

Chapter 1

Introduction



Abstract In this chapter we describe in general terms what we mean by the equivalent terms multilevel analysis (MLA) or multilevel modelling. We place MLA in the context of public health and health services research. Most of our readers will be working in this field, and this book is specifically written for them. As public health and health services research is an applied research, it is strongly oriented towards solving practical problems in health, healthcare and health policy. Therefore we will also discuss the relationships between research on the one hand and policy and practice on the other. We end with some conclusions on the relevance of MLA for public health and health services research.

Keywords Multilevel analysis · Public health research · Health services research · Health policy · Health system organisation · Inequalities in health

The fact that we are willing to consider ‘Health in context’ means that people’s health depends on the context in which they live. This is a basic credo of social medicine and public health (Rosen 1993). Not only health and well-being but also health behaviour and healthcare utilisation depend partly on people’s personal resources and partly on shared resources and circumstances—in other words, their context. People’s personal resources can be their personal stock of health—their health capital in other words—as well as other more tangible resources. So if we talk about health, we are implicitly talking about two distinct levels: people and their context.

MLA makes it possible to handle this reality of health operating at different levels. Although MLA is a statistical method, it would be too narrow to restrict the teaching of multilevel modelling to statistical methods courses. Statistics is a tool to solve problems, so the methods should not be seen to be isolated from the problems themselves. In other words, if we want to understand MLA, we should also pay attention to the substantive fields of public health and health services research and to the origins of their research problems. Moreover, in sociology, a lot of attention has been paid to the relationships between different levels, from the micro level of individual people, via intermediate levels of families, schools and work

organisations, to the macro social levels of cities or countries. Social science helps us to conceptualise these different levels and to decide which levels are relevant for certain research problems. Therefore, it is not only statistics that we will be dealing with in this book; theoretical considerations about levels and about human behaviour in context are equally important. We should add a third pillar to this book: study design and methodology. Between theory and statistics stand the study design and methodology—the way we design our research and collect data to test our theoretical ideas.

Importance of MLA for Research in Health and Care

MLA is important for research in the fields of public health and healthcare for two reasons. The first is substantive: many of the problems studied involve different levels or contexts. To analyse such problems with state-of-the-art methods, MLA is the most appropriate statistical tool. Secondly, research in the fields of public health and healthcare increasingly uses MLA. It is therefore important that even if you do not apply MLA yourself, you are able to understand research that uses MLA. Nowadays it is nearly impossible to understand, appreciate and critically appraise published articles in our field of research if you are not acquainted with MLA.

The pioneering development of MLA methodology has been in education where researchers have been interested in studies examining how pupil outcomes (such as examination scores) are related to both the characteristics of the pupils themselves and those of the schools (Aitken and Longford 1986; Snijders and Bosker 2012). The use of MLA has since been widespread in the overlapping fields of health services research, epidemiology and public health (Diez-Roux 2000; Leyland and Groenewegen 2003; Merlo et al. 2005a, b, c, 2006; Rice and Leyland 1996; Subramanian et al. 2003), assisted by the development of specialist multilevel software and the addition of multilevel capabilities to common statistical packages (de Leeuw and Kreft 2001). The educational example may be transferred to a public health context in several ways. For example, when studying outcomes in hospitalised patients, interest focuses on the roles played by both hospitals *and* patients. The individual *and* the workplace may both influence absence from work due to sickness. Regional differences in incidence of heart disease may reflect differences in the composition of populations *and* in the success of local health promotion programmes.

The Scope of Public Health and Health Services Research

The intended readership of this book consists of researchers with an interest in public health and health services research. We will now briefly discuss the scope of these two areas of research and will show that they are often related. Public health research studies the conditions in which populations can be healthy. Health at group or population level is the focal point of interest. According to the Lalonde model

Fig. 1.1 Influences on population health

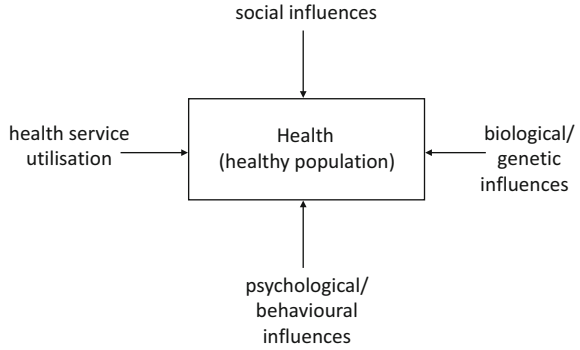
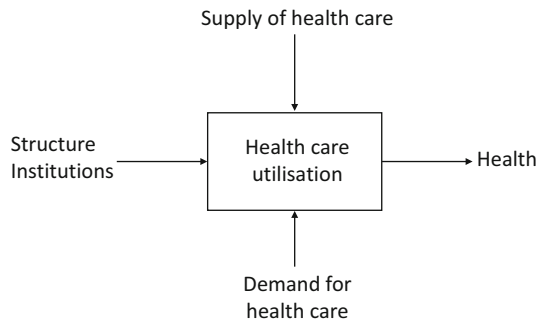


Fig. 1.2 Influences on healthcare utilisation (and health)



(1974), the health of the population is influenced by social, psychological, biological and healthcare determinants (see Fig. 1.1). In some form, this model has been at the root of public health policy in numerous countries. Health and health inequality at a group or population level are based on some aggregation or transformation of the health status of the people who form the group or population. The determinants of health can be both individual level and group or population level. Psychological determinants of health are typically individual characteristics. However, in the form of shared ideas and common psychological traits, they could build a collective characteristic, such as a group mentality. Biological characteristics can be individual, but they can also be shared characteristics of larger populations of genetically related individuals or those exposed to the same environmental hazard. Healthcare determinants are typically group or population-level characteristics determined by the administration or government, whether this is at the local (e.g. municipality) or national level. Social influences will also often operate through various higher (population) levels such as family, peer group or neighbourhood.

Compared to public health research, the scope of health services research places more emphasis on healthcare and healthcare utilisation than on health per se (Fig. 1.2). Health services research focuses on the relationships between demand for care and supply of care, as influenced by the structure and institutions of the healthcare system. It is a multidisciplinary field of scientific investigation that studies

how social factors, financing systems, organisational structures and processes, health technologies and personal behaviours affect access to healthcare, the quality and cost of healthcare and ultimately our health and well-being. Its research domains are individuals, families, organisations, institutions, communities and populations (AcademyHealth 2005). Quality of care is an important research area, and this can be defined in relation to structures, processes and outcomes in the provision of health services (Donabedian 2003).

Healthcare utilisation is traditionally the centre of attention in health services research. It is influenced by the *demand* for healthcare. The demand for healthcare is partly based on health—people with health problems tend to use health services—but not completely. There are also social and psychological influences on healthcare utilisation. People differ individually in the way they cope with ill health, and the threshold at which they will visit a healthcare professional also differs. There are also social influences, such as family or group norms as to when to invoke the help of others. The supply of healthcare also influences healthcare utilisation. The availability of hospital facilities, for example, influences their utilisation. And the organisation of healthcare facilities also affects utilisation; supply of and demand for healthcare exert their influence within an institutional context. This is the way in which the system is organised and funded. Whether or not general practitioners (GPs) have a gatekeeping role influences the utilisation, not only of the services that GPs provide but also of specialist services. Financial accessibility, in terms of organisation in systems of insurance or other funding of healthcare, also influences utilisation. Again we can say that these influences can be individual characteristics but often they are group- or population-level characteristics. Countries differ regarding the structure of their healthcare system, regions differ in the supply and mix of services, and social groups differ in how quickly they invoke healthcare.

Figures 1.1 and 1.2 also show the relationship between public health research and health services research. In public health research, the utilisation of health services is one of the determinants of health whilst in health services research one of the influences on healthcare utilisation is ill-health, and one of the outcomes of health service utilisation is the creation of health. Both public health research that does not take healthcare into account as an input and health services research that does not take health into account as an outcome can exist.

This brief discussion of the scope of public health and health services research has drawn our attention to different influences. Researchers with different educational backgrounds can study each of these influences on their own. Public health and health services research is populated by researchers who studied medicine, health sciences, epidemiology, psychology, sociology, statistics, human geography, economics, political science, etc. (and we must still have forgotten some). This diversity is the reason why we discuss rather broad substantive and theoretical issues in the first two chapters of this book. This ensures that we have a common understanding of the kind of research we are doing before proceeding to the statistical approach.

Research and Policy

Although researchers in the health and healthcare realm come from different disciplinary backgrounds, they typically do not derive their research problems from their original disciplines. Public health and health services research derives the problems from the healthcare sector. They are applied fields of research, in the sense that researchers in these areas apply their skills to problems that have their base in the healthcare sector and in the sense that they try to produce insights that can be used to solve problems in that same sector. The issues we study are rooted in the problems that practitioners and policymakers encounter in the healthcare sector. In the standard theoretical–empirical cycle of research within a specific discipline, the problems for research are generated within the discipline and are usually based on earlier research. This refers to the right-hand side of Fig. 1.3, where the conclusions of previous research typically feed back to new research questions. However, in public health and health services research, the problems we study are very strongly influenced by the current practical and policy problems in the healthcare sector (Bensing et al. 2003). Our research is part of a broader cycle that also involves the application of our results in health policy and practice.

To get a better feeling for this extended policy and research cycle and to illustrate the importance of different levels in studying problems in policy and practice of healthcare, we will spend some time on a very broad grouping of policy problems.

Governments have a responsibility for the health of their subjects. In the Netherlands, for example this responsibility for protecting and improving population health is part of the Constitution. Governments take this responsibility by designing and implementing policies. Some of these policies are directly related to health, whereas others are intended to improve healthcare. As the history of public health shows, policies directed towards standards for housing quality and public services in areas such as waste disposal and clean water supply have been very important. Often

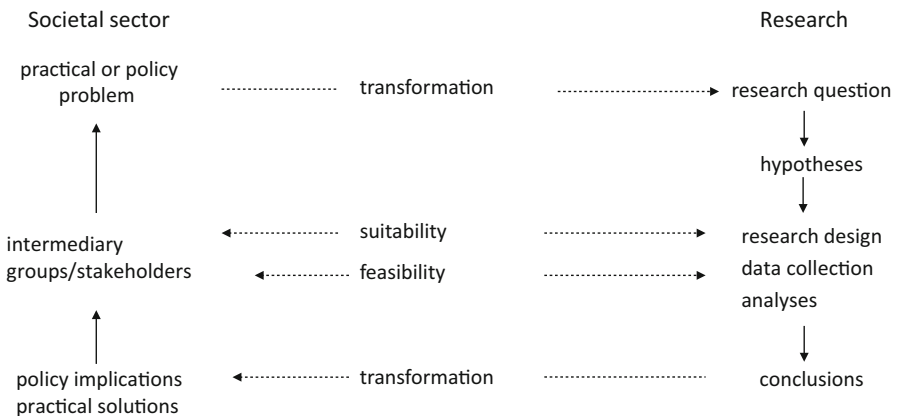


Fig. 1.3 Relationships between the societal sector of healthcare and health (services) research

these are policies that originate outside the direct jurisdiction of ministries of health. They require crosscutting policies and analysis of the health impacts of sector-specific policies (Puska 2007).

The central aim of health (care) policy is to improve population health. This aim is very general. It can be approached through policies in several important fields, and we can see these as being instrumental in reaching the overarching aim. As an example, the Dutch Ministry of Health published a document in 2009 with the title ‘Societal challenges for public health and health care’ (Ministry of Health 2009). According to this document, the big societal challenges were living longer in good health, anticipating changing care demands, quality of care and patient safety, dealing with limits to care and governance of the system. Here we can distinguish three instrumental aims:

- Increasing the coherence and responsiveness of the system
- Diminishing inequalities in health and in access to healthcare
- Increasing the efficiency of the system (stewardship)

We use these three aims because, basically, most social systems are concerned with problems of coherence and responsiveness, inequalities and efficiency in one way or another, and healthcare is no exception. For example, a country’s educational system can be seen as trying to cope with these three basic problems: the way different types of school are tuned in to different educational needs, geographical and social inequalities in access to schooling and the efficiency of teachers and educational programmes. Therefore, we might get our inspiration to develop research in the healthcare field by looking at experiences in other sectors of society. We might also look at more general theories of how societal systems are organised or about the causes of inequalities. So we might use this insight in a horizontal way—looking at other sectors—or in a vertical way—looking at more general theories. An example of a book that does both is ‘The spirit level: why more equal societies almost always do better’ (Wilkinson and Pickett 2009).

Going back to healthcare, the emphasis that is placed on each of these three instrumental aims may vary over time or differ between countries (Tenbensen et al. 2012). If we look at the past few decades, we could say that in the 1970s the emphasis was on structuring the healthcare system, by strengthening primary care and by using planning as an instrument (Saltman and Von Otter 1992). In contrast, efficiency and stimulation of evidence-based healthcare were much more at the centre of policy attention during the 1990s (Sackett et al. 1996). The performance movement in healthcare is also intended to increase the efficiency of the system but performance indicators of healthcare in themselves, such as those developed by the World Health Organization (WHO) for the World Health Report 2000 (WHO 2000), try to incorporate indicators of inequality and responsiveness. Inequalities in access to healthcare are central to a model, developed in the early 1970s in the USA, called the Andersen–Newman model (Aday and Andersen 1974). This model looks at and subsequently analyses the influence of the need for healthcare; predisposing variables, such as attitudes about health and healthcare; and enabling variables, such as income or insurance status, and is still often used. Inequalities in health have featured prominently on the political agenda over the past decades from the Black report

(Department of Health and Social Security 1980) to more recent reviews of the state and extent of inequalities (Commission on Social Determinants of Health 2008; Marmot Review 2010).

These aims of health policy give us a basic classification to enable us to position our own research problems. We can think of examples of a research problem addressing one of these central aims of health policy. In doing so, we will see that again different levels are involved. The central aims can be used to introduce the relationships between macro, intermediate and micro levels, and the idea is that more than one level is usually involved when you analyse a problem. We will briefly go through each of the three instrumental aims.

Our research problem might concern the reasons why some people receive the care that they need, whilst others do not get the care that they require or are given care that they do not need. This is a well-known problem in areas such as home care where some people, who just need some help with shopping, receive help cleaning their house, or where people who need specialised nursing attendance receive home help. Some of the explanation for such discrepancies might be at the intermediate level, which could be the level of the organisation that supplies home care. Home care might not cooperate effectively with the hospitals that discharge patients with certain needs or with GPs who have a clear view of the exact nature of a person’s needs. So the way the actions of different healthcare providers are tuned in to each other might influence the outcome for individual users of home care. The extent of cooperation with other service providers might vary between home care organisations. As a consequence, badly tuned care might be more prevalent among the clients of some organisations than among clients of other organisations. In other words, to some extent the outcome of whether a patient receives the appropriate care is clustered within home care organisations. The extent of cooperation between health and home care providers might vary between regions or health care systems. We then come to the macro level where health system organisation may influence cooperation at the intermediate level, for example in terms of an emphasis on planning or the market, or in the public/private mix (Fig. 1.4).

Problems of inequality might be defined in terms of health, determinants of health, access to healthcare or healthcare utilisation. In this example we consider

Fig. 1.4 Problems of coherence and responsiveness

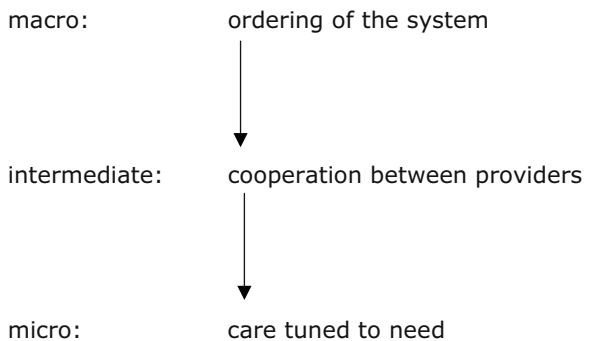
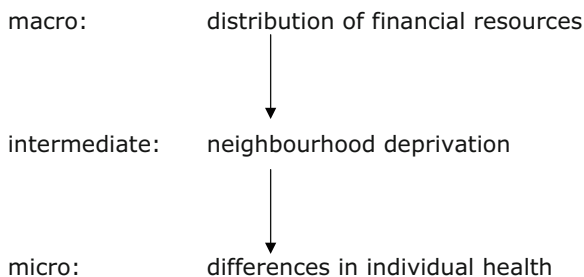


Fig. 1.5 Problems of inequality

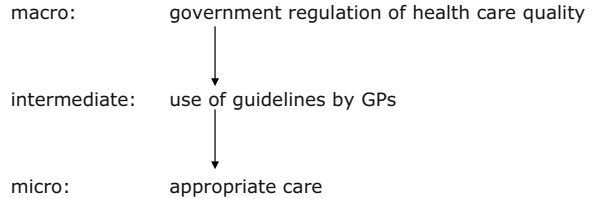


health. We might want to explain the relationship between neighbourhood deprivation, individual socioeconomic resources and health behaviour and some measures of health. Variation in health (which is an indication of health inequalities) might be greater in some neighbourhoods and smaller in others. This might be partly related to individual people's resources (such as whether or not they are unemployed) and health behaviours (e.g. smoking). However, some of the variations might persist and indicate differences between neighbourhoods. These might be related to neighbourhood (as distinct from individual) deprivation. At the macro level, we could look at the cities where these neighbourhoods are located. We could, for example, relate the financial or social policies of different cities to neighbourhood deprivation. Again we see that we can subsume a specific research question under the umbrella of problems of inequality. And we can specify different levels that contribute to the explanation of health inequalities (Fig. 1.5).

The third example relates to problems of efficiency. As we mentioned before, one of the manifestations of a healthcare policy that is oriented to increasing the efficiency of healthcare is evidence-based medicine. We might define appropriate care at the micro level as being whether or not a patient receives care according to current guidelines. Some patients might receive appropriate care and others not. Some of the reasons for that might have to do with individual circumstances, such as the existence of a co-morbidity which can be a reason to deviate from single morbidity guidelines. Part of the explanation might be that the patient is treated by a GP who is not in favour of this particular guideline or of guidelines in general, or who is just too busy to take the time and effort to work according to the guideline. Consequently, some of the variation in whether a patient receives appropriate care is generated at this intermediate level of GPs. Groups of GPs might be organised within larger practices or primary care groups or trusts. These larger groups then form a macro context that may influence the behaviour of individual GPs by agreeing on the use of guidelines or sanctioning their non-use (Fig. 1.6).

In these examples, we have used three different levels and named the higher two intermediate and macro. It is important to realise that there is no 'law of three levels'. The number of levels in any study depends on a combination of theoretical analysis and practical considerations of data collection or availability. What is micro or macro depends on your point of view. Although the micro level is often the level of individuals, we will see in Chap. 4 that the micro level or lowest level in a multilevel analysis can also be a number of repeated observations on the same person. The

Fig. 1.6 Problems of efficiency



lowest level can also be a small area, for example when we do not have access to individual health data for reasons of data confidentiality. In such a case we might obtain small area data and analyse them within a higher level of regions or countries. The macro level is also relative. In some research problems, this level might be formed by countries, but in others by GP practices.

Conclusion

The issues we have raised in this introductory chapter relate directly to the philosophy behind the book. Firstly, we feel that it is important to try to integrate substantive issues, methodology and statistics. Secondly, these substantive issues relate to the field in which we are working and our approach: application, policy and practice oriented. Thirdly, MLA has a close correspondence with the substantive issues; health and healthcare are context dependent. And, finally, we have to learn to think in multilevel concepts: to develop hypotheses, conceptualise contexts and define levels.

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