

## Chapter 2

# Health in Context



**Abstract** With multilevel analysis, we can model the relationship between the context in which people live or act and an outcome at the individual level. In this chapter we discuss the relationship between the context or macro level and the individual or micro level. Sociologists have developed ways of analysing these relationships that may help our understanding of MLA. At the micro level, it is important to have a theory of human behaviour that takes context into account. But what contexts are relevant? That depends on the research question, and the phenomenon we are studying.

**Keywords** Multilevel analysis · Social production function theory · Health behaviour · Healthcare providers · Social context · League tables

Multilevel analysis enables us to analyse individual-level outcomes in relation to independent variables at the same level and independent variables at a higher level. This higher level is what we usually call the context or the macro level. In this chapter we give a theoretical analysis of the relationships between individual- or micro-level outcomes and contexts. However, the relationship between macro and micro levels has two dimensions. Not only does the context, such as the availability of health services in an area, influence behaviour (e.g. health service utilisation), there is also an influence the other way around: from micro to macro level. Continuing this example, the health service utilisation of many individuals will result in a high level of healthcare expenditure in an area. Often we are interested in both directions. MLA is especially suited for analysis in one direction, from macro to micro level, and less so the other way around. However, when we are analysing ‘league tables’ of hospital performance at the end of this chapter, we can use MLA to arrive at estimates of hospital effects, taking differences in the composition of the patient populations (case-mix differences) into account.

We start this chapter examining the relationship between macro-level context and individual, micro-level outcomes. The other dimension, from micro level to macro level, will be addressed at the end of this chapter. At that stage we will also briefly introduce league tables. In between we discuss theories about behaviour (the micro level) and the relevance of different contexts.

## Relationships Between the Macro and Micro Levels

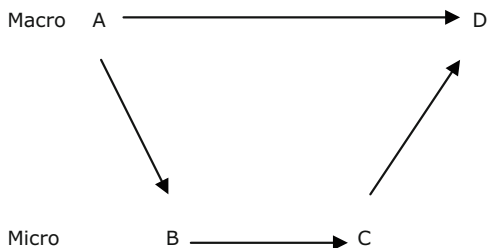
Social context influences what people do, their behaviour and interactions, and what people do leads to certain outcomes in which we are interested such as their health or the decision to consult a healthcare provider. These outcomes are the results of decisions people make. To clarify this statement, people usually do not choose to be unhealthy, but this outcome is partly the consequence of their behavioural choices and partly the outcome of circumstances that influence either their choices or the outcomes directly. We will discuss three heuristic models of the relationships between macro and micro levels that maybe helpful in conceptualising your own research (Raub et al. 2011). Heuristic means that these models are not conceived as descriptions of reality, but as a means of helping you to understand phenomena, to conceptualise your own research, and arrive at hypotheses (Groenewegen 1997).

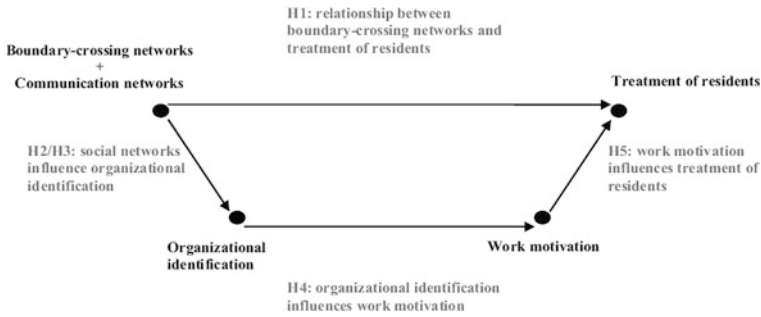
The first heuristic approach brings the relationship between two phenomena at the macro level to centre stage. For example, consider the relationship between mean income level and income inequality on the one hand and the standardised mortality rate of states on the other hand. The explanation of a relationship like this requires the specification of a mechanism that connects the macro contexts (mean income and income inequality) with individuals at the micro level (Hedström and Swedberg 1998). The outcome at the micro level is whether individuals of a specified age and sex die. The mechanism might be partly behavioural, such as health damaging habits, partly social, such as comparison to other people, and partly biological, such as the effect of exposure to dangerous substances. Based on the individual deaths at the micro level and additional information about the populations involved, standardised mortality ratios can be calculated. Figure 2.1 shows the basic scheme as developed by (Coleman 1986, 1990).

Van Beek et al. (2013) applied Coleman's diagram to establish and explain a relationship between social networks of staff in nursing home wards (A) and treatment of residents by ward staff (D). The explanation runs via organisational identification (B) and motivation (C) of nursing staff. Figure 2.2 illustrates this.

In ecological analyses, we only analyse the relationships at the macro level (the arrow from A to D). We run the danger of attributing these macro relationships to relations at the individual level (a phenomenon known as the ecological fallacy, described in Chap. 3). In behavioural research, we analyse the relationship at the micro level (the arrow from B to C). We then run the opposite risk to the ecological

**Fig. 2.1** Coleman's diagram of relations between macro and micro level





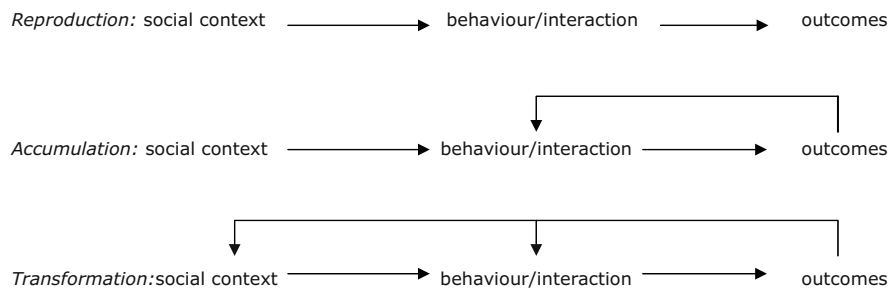
**Fig. 2.2** Application of Coleman’s diagram to explain the relationship between social networks of nursing staff and treatment of residents. (Reproduced with permission from Elsevier, Social Networks)

fallacy—that of the atomistic fallacy. In instances of an atomistic fallacy, the analysis is carried out at the micro (individual) level, but inference is made at the macro (group) level (Diez-Roux 1998).

Sometimes the relationship at the micro level is analysed, using information about the context as a distributed variable at the individual level. That is, every single individual in the same context is assigned the same value for a contextual variable. In this case we would run into a statistical problem. The observations on individuals that share the same context or macro variable are not independent. This violates an important assumption in standard regression analysis. Moreover, standard statistical techniques would misestimate the precision of the coefficients of the distributed variables. They would not distinguish between the (usually much smaller) number of contexts and the number of individual observations. However, when using MLA we are able to analyse macro and micro levels—the contexts and the individuals—in a statistically appropriate way. In Chap. 3 we will elaborate on this further.

Figure 2.1 shows that ecological research and behavioural research are not mutually exclusive approaches. The two complement each other, and there is a clear relationship between them; to explain an ecological relationship, you need to go into the micro-level mechanisms. MLA helps us to analyse part of the diagram: the arrows from A to B to C. In other words, MLA provides us with the tools to examine how aspects of the context in which people live (A), together with their personal characteristics and resources (B), influence some outcomes at the individual level (C).

Coleman’s heuristic shows the basic structure of the explanation of macro-level relations. It is, however, more easily applied to static situations than to problems involving social change. Boudon (1979) explicitly designed a heuristic to analyse processes of social change. He distinguishes between the *Environment*, which includes the social and institutional structure, the *Interaction System*, which includes the relevant actors and the choices they make, and the *Outcomes*, which form a distribution of the choices of many actors, such as the percentage of people who choose to behave in a certain way. These elements correspond to Coleman’s A, B



**Fig. 2.3** Boudon's diagram of social change

and C, and D, respectively: 'environment' influences 'interaction system', which produces certain collective 'outcomes'. However, Boudon's next step makes the system a dynamic one. 'Outcomes' might feed back to the processes in the 'interaction system' or to the 'environment'.

Boudon distinguishes three processes of social change (see Fig. 2.3). In the first, called reproduction, there is no feedback and outcomes stay the same. In the second, there is feedback from outcomes to the interaction system, causing a process of accumulation or the gradual change of a distribution. Finally, if there is also feedback to the environment, then a process of transformation occurs.

As an example of these processes of social change, one could look at the system of care around childbirth (Schuller 1995). As outcomes we are interested in the changing distribution of the place where women give birth to their children. By the end of the nineteenth century and the beginning of the twentieth century in Western countries, most children were born at home with the assistance of a midwife. With the single exception of the Netherlands, where, at the beginning of this century, approximately 30% of children were stillborn at home, in Western countries childbirth had become a hospital affair. How did this change come about? The interaction system consists of childbearing women and their direct social relations, midwives and physicians. The environment consists of the broader healthcare and hospital system, both in the structural sense of accessibility and supply and in the institutional sense of the regulation of the professions involved, and developments in medicine and medical technology.

Until the early twentieth century, the system was in equilibrium and could be characterised as a reproduction process: there was not much choice, and nearly all women delivered their babies at home, attended by a midwife. However, with the development of the modern hospital, improved hygiene and new medical technology, the outcome of hospital deliveries in terms of the health of child and mother became as good and under some conditions better than the outcome of home deliveries. From that time on there was a choice, and physicians developed an interest in hospital obstetrics, the safety arguments appealed to expectant mothers, and midwives were not in a position to counteract.

These good and sometimes better results of hospital births fed back to the interaction system and influenced the decision-making process regarding the place

of birth, especially in the case of a first child or following an earlier difficult delivery. The decrease of family size during the twentieth century resulted in a higher proportion of births being first children. Combined with the changing decision regarding place of birth, this resulted in a rapid increase of the share of hospital births—a process of accumulation. In most European countries, at some point in the 1960s, the number of home births reached such a low point that the possibility of a home delivery virtually disappeared as an alternative. Market shares became too low for self-employed community midwives, and physicians undertaking home deliveries would be scandalised within their profession. So eventually even the environment was affected, and again there was no choice whatsoever; hospital birth became not just the norm but the rule. Among Western industrialised countries, the Netherlands was the only exception to this process, probably due among other reasons to a stronger position of midwives in terms of their legal position, the reimbursement rules of public insurance and their professional education (De Vries 2005).

Generally, in this heuristic the interaction system is the micro-level process. The environment is the macro-level and determines the range of options available to the actors within the interaction system, and the outcome is the macro-level result of interaction. Again, using MLA we can statistically analyse the relationships between the environment, the micro-level conditions of the actors that influence the choices of pregnant women, and the choice of women to have a home or hospital birth as the dependent variable. The macro-level outcomes (the percentage of home deliveries) and the feedback steps are best explored using approaches beyond the scope of this book, such as complex systems theory (Diez-Roux 2011) and specific techniques, e.g. structural equation modelling (Bentler and Stein 1992).

The third heuristic that we will briefly discuss relates to the transformation of individual behaviour to macro-level outcomes. Often these outcomes are the unintended consequences of individual behaviour. Students flock to studies that educate them for occupational fields with high-income potential due to current shortages, only to find out that so many did the same that the shortage turns into over-supply and decreasing wages.

Unintended consequences are part and parcel of processes of social change. For example, as we have seen, decreasing family size has the unintended consequence of speeding up the accumulation process of the share of hospital deliveries. Such unintended consequences of behaviour are of primary interest to many social scientists (Boudon 1982; Popper 1963; Wippler 1981). If, as a first approximation, human behaviour is seen as being goal-directed, the question arises as to why people do not always achieve their goals. Part of the answer is in the transformation from micro to macro level. Two important sources of unintended consequences are the interdependencies of individual behaviour and incorrect anticipation of the reactions of others. An example of interdependencies leading to unintended consequences can be found in what has been called fee inflation. This occurs when there is a macro budget for specialist care, for example, and when individual specialists are paid on a fee-for-service basis. If they bill for too many services, the budget is exceeded and fees are adapted downwards. If individual physicians want to maintain their income, then they have to increase the number of services they undertake, and, since all other

physicians are doing the same, the unintended consequence is that they all have to work harder to achieve the same income (Delnoij 1994).

Health policy struggles with unintended consequences due to the incorrect anticipation of the reactions of policy subjects. One example is of the reaction of health insurers within the field of healthcare to the announcement of the basic ideas for health system reform in the Netherlands in the second half of the 1980s. The aim of the intended reforms was to improve the performance of the system by introducing market elements and competition in healthcare. Health insurance organisations anticipated this policy by undertaking a huge chain of mergers. This in its turn made it very difficult to realise the original aims of the policy when competition was actually introduced because of the reduced number of competitors (Groenewegen 1994).

We have briefly discussed three heuristics that connect the micro and macro levels. Macro-level structures and institutions influence individual behaviour and the interaction between individuals, and individual behaviours form macro-level outcomes, both intended and unintended. In the following sections, we will first discuss some aspects of behavioural theory at the micro level. Following this we will discuss the transformations from macro to micro level and vice versa.

## Micro Level: Behaviour of Patients and Providers

An important element in the analysis of macro-level phenomena is a behavioural theory at the micro level. The point of departure is that people act in a goal-directed manner and are sensitive to incentives. They act rationally in a restricted sense, set against the background of their knowledge and ideas about goals and their means to reach them (Boudon 1979). The extent to which people achieve their goals will be determined by the constraints imposed upon them as well as by the resources at their disposal. In as far as constraints and resources are structurally or institutionally determined, they are the way to bridge the gap between the macro and micro levels (Wippler and Lindenberg 1987).

If we apply the theory of goal-oriented behaviour as part of the explanation, we need to know the background against which people weigh up their alternatives—in other words, what their goals are. A systematic approach to this is given in social production function theory (Lindenberg 1996). The assumption here is that people have a limited number of ultimate goals, namely physical and social well-being. The theory proposes that people produce their physical and social well-being through their activities and use of resources (Fig. 2.4).

How and through which activities people achieve their ultimate goals depend on individual circumstances and resources and on macro-level social, structural and institutional conditions. This theory has been successfully applied to explain the loss of quality of life among the elderly (Gerritsen 2004; Ormel et al. 1997). It was also the basis of the empirical material we use in the tutorial on multilevel logistic regression in Chap. 12.

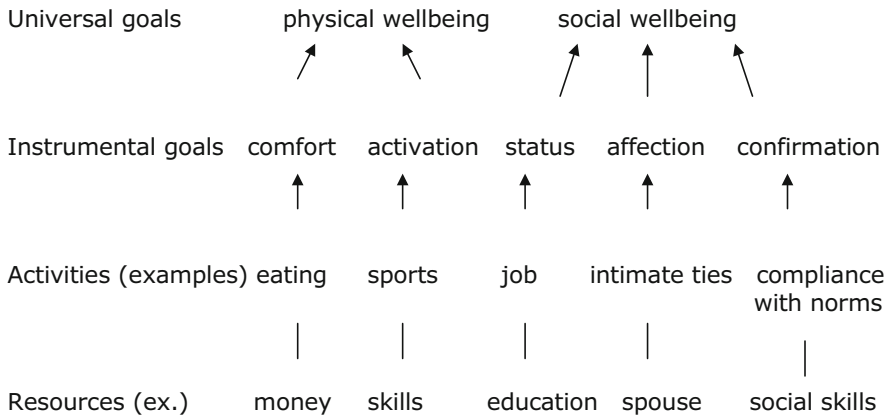


Fig. 2.4 Outline of the social production function theory. (Adapted from Ormel et al. (1997))

### ***The Behaviour of Healthcare Providers***

We assume that healthcare providers strive to achieve the same general goals of physical and social well-being as everyone else. An important instrumental goal for producing social well-being specific to health workers is the promotion of the health of their patients or clients. The importance of this goal is firmly established through a long period of socialisation in medical school and internships and during postgraduate specialisation. The patient’s health is usually the first and dominant element in determining the physician’s definition of a decision situation. This also underlines the mutual dependence of health workers’ and patients’ goals.

The fact that health workers also have other instrumental goals makes it understandable that they are not necessarily perfect agents for their patients (Domenighetti et al. 1993; Mooney and Ryan 1993). Their actions towards the improvement of their patients’ health have consequences for their other goals; they take time, generate income, and obtain approval or disapproval from colleagues. Structural conditions, at the system level, for example, might influence the ability to achieve an optimal mix of income and leisure time. Fee-for-service payment makes it attractive to perform more services, because that increases income, as was hypothesised by Westert (1992). Physicians that work in single-handed practices depend more on their patients to gain social approval, whilst those in group practices have a greater dependency on their colleagues to achieve the same goal (Freidson 1970, 1975).

### ***The Behaviour of Patients***

Models of patients’ behaviour have been elaborated mainly from a social psychological point of view. A common model is the Health Belief Model (Janz and Becker

1984) based on attitude theory. A more sociologically oriented model is the so-called Andersen–Newman model (Andersen and Newman 1973; Andersen 1995) that evaluates healthcare utilisation from three groups of influences: predisposing variables (attitudes, patterned by age and gender); enabling variables (or constraints), such as insurance status or the availability of health services; and needs variables, such as the experience of symptoms of ill health. These models lack a theory of preferences, such as social production function theory. They either take the goals of patients for granted (as in the Anderson–Newman model) or just ask people for their preferences (as in the Health Belief Model). Within health economics, the Grossman model (Grossman 1972; Van Doorslaer 1987) assumes that healthcare utilisation is one of several instrumental goals that people use to create health. The basic idea is that people invest in maintaining their ‘stock of health capital’ by their lifestyle, preventive actions and use of healthcare. Apart from maintaining or regaining health, people also have other instrumental goals such as reducing anxiety or uncertainty (Ben Sira 1986) or have quick or slow solutions to their problems (depending on sickness benefits, for example).

### ***Patient–Provider Interaction***

Utilisation of health services, the meeting point of supply and demand, is determined in the interaction between healthcare providers and patients—usually the consultation. A typical feature of this interaction is its asymmetry. Firstly, asymmetry exists in the importance of the consultation. For a particular patient, there is only one problem and that is his or her problem, whilst for the health worker there are many patients with many problems (Gillon 1988). Secondly, there is asymmetry in information. Providers have information that patients do not have, and the former use that information to reach a diagnosis or to advise therapy. Finally, healthcare providers sometimes govern access to scarce resources, such as drugs that are only available on prescription or sickness certificates that entitle the patients to certain benefits (Stone 1979).

Given these asymmetries, one would hypothesise that the expectations of health workers and providers would often diverge from those of patients (Persoon 1975). In addition, both parties have instrumental goals other than regaining or maintaining health. In situations in which expectations diverge, patients have different alternative courses of action, for example:

- To negotiate or enter into conflict with the health worker: the alternative of the knowledgeable patient
- To find another healthcare provider: the alternative of ‘doctor shopping’ or consulting complementary healers
- To act as if they accept the situation, but neglect the advice dispensed: the alternative of non-compliance.

Both the occurrence of diverging expectations and the alternatives that are subsequently chosen depend on constraints and resources.

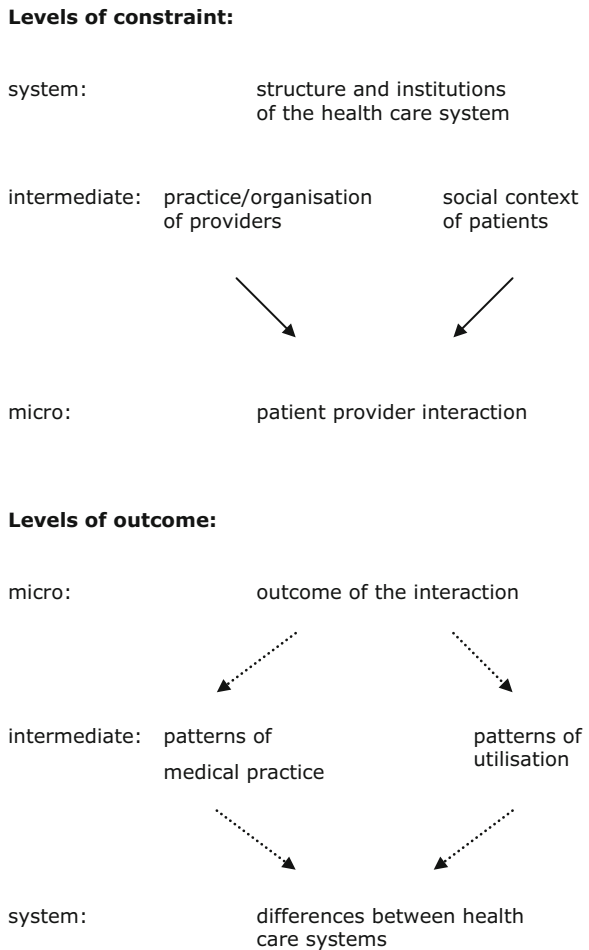


## From Macro to Micro Level

The gap between macro and micro levels is bridged by assumptions about structural and institutional constraints that influence the way people can realise their goals. These constraints are located at different levels. Basically, the organisation of the phenomenon under study determines what the relevant levels are and where they are located. In the case of health services research, three levels might be relevant: the level of the healthcare system, the level of the practice or organisation (hospital) in which providers work or the social context of the patient and the level of the actual consultation between provider and patient. The upper half of Fig. 2.5 shows these levels.

The structure and institutions of the healthcare system influence both healthcare providers and patients. The result of the interaction between patient and provider, in

**Fig. 2.5** Context at different levels and outcomes at different levels



terms of alternative modes of action distinguished above, is influenced at the system level by the extent to which consultations are embedded in an existing patient–provider relationship. This is notably the case when patients are on the list of a specific healthcare provider. In such circumstances, what happens in the current consultation may be influenced both by the common past of the patient and the provider and by the expectation of a common future. Moreover, in some systems, it is more difficult to change your doctor than in others (Thomas et al. 1995). If providers are paid on a fee-for-service basis, patients and providers are usually not institutionally tied to each other or, if they are, then this tends to be only for a restricted time period. In such a case, one would expect patients to negotiate when expectations diverge. If providers are paid on a capitation basis, patients and providers are tied to each other and usually there are administrative barriers to changing your doctor. The reaction to diverging expectations in this case is more likely to be non-compliance. If providers are in salaried service, patients are usually tied to a group of providers but not to an individual doctor. In this case, we would expect to find a higher incidence of doctor shopping.

The second, intermediate level at which constraints operate is at the level of the practice or organisation of the provider and the social context of the patient. Doctors in single-handed practices are more dependent on their patients to gain social approval, whilst doctors who work in larger practices depend more on each other to gain this good (Freidson 1970). As a consequence, the former might be more willing to negotiate with their patients. From the viewpoint of patients, the tendency to negotiate might be influenced by their ability to communicate their goals to healthcare providers, which is probably related to their educational level, and by the need to communicate their goals (such as the time or money costs of the proposed treatment), which may be related to their economic position (Westert et al. 1991).

Finally, there are constraints at the level of the consultation. The more urgent that a healthcare problem is, the less important any alternative goals of the patient will be and the greater the inclination of patients will be to follow professional advice. If the health problem is less urgent, goals will coincide to a lesser extent. If, in such a case, the freedom of the doctor to make an individual decision has been reduced as a consequence of professional guidelines or protocols, patients might be more inclined to go doctor shopping, for example by seeking a second opinion.

## **What Contexts Are Relevant?**

Contexts are important because they define the action space of individuals and the alternatives they have. Many problems in health and healthcare are related to people’s behaviour. People behave within the social and institutional context of their community or workplace, for example. These contexts influence the resources and the range of options (opportunities and constraints) that actors have.

The question ‘Which contexts are relevant?’ is answered by analysing the research problem and asking: ‘What kind of opportunities and constraints determine

people's behaviour, and across which units are these opportunities and constraints patterned?' This abstract notion can be illustrated with an example as follows.

If you are trying to explain neighbourhood differences in health, different contexts might be relevant, each related to a different mechanism. And each of these contexts has different requirements regarding the kind of geographical unit you would prefer to use.

1. People live in social units, and these offer opportunities and constraints that influence their health and health behaviour. Neighbourhoods differ in terms of how close the relationships between people are within those neighbourhoods and the availability of support networks. Social integration and social support are known to influence people's health. A relevant context would comprise small-scale, socially homogeneous units. The relevance of small homogeneous areas has been discussed from a theoretical and methodological point of view in criminology by Oberwittler and Wikström (2009) in their chapter 'Why small is better'.
2. People also live in administrative and planning areas which are used to plan and organise healthcare facilities, including community health centres and hospitals, and to organise public health activities, such as the delivery of smoking cessation services or vaccination campaigns. Here the opportunities and constraints are more institutional. A relevant context would be administrative areas.
3. People's health is also influenced by exposure to the physical environment. Areas differ in exposure to factors including noise and air pollution. When analysing such physical influences, sometimes very small units are used, especially in urban areas.

Different constraints related to several higher levels could influence health at the same time, either separately or jointly. Different levels may work in conjunction; for example, municipalities may have certain policies, and the effectiveness of these policies may depend on the characteristics of neighbourhoods (such as deprivation, remoteness or rurality) within these municipalities.

In conclusion, examples of higher level units relevant in public health and health services research are administrative areas, such as municipalities; social units, such as groups of neighbours or peers; service areas of healthcare institutions, such as hospitals; places of work, such as schools or different departments of a large enterprise; and exposure areas to physical agents.

Ideally, the choice of higher level units should not depend on what routinely collected administrative data are available but on a substantive analysis of the research problem. However, for practical reasons, one often has to compromise and use data based on administrative units, even though the preference might be for data based on small areas with different levels of exposure. In such suboptimal cases, it is important, when interpreting results, to be aware that the units of interest may not coincide exactly with those that have been analysed.

## From Micro to Macro Level

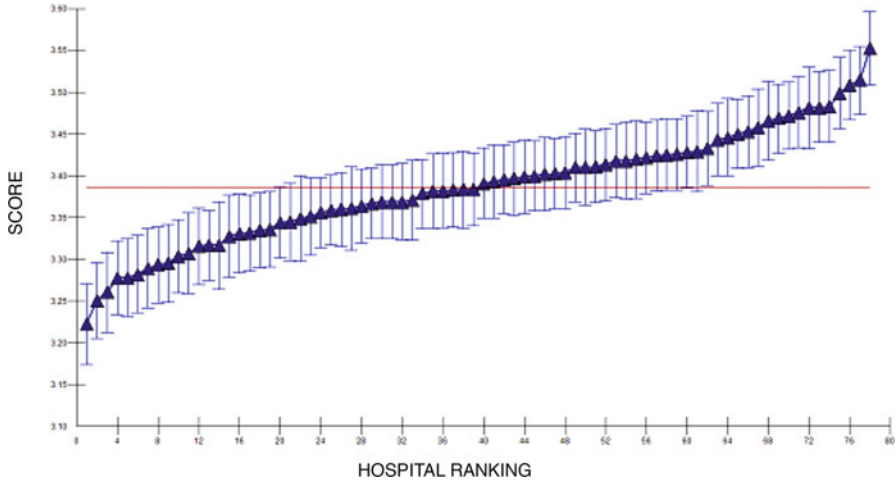
Usually the aim of health services research is not to explain the individual choices made by healthcare providers or patients. From the viewpoint of the providers, the main focus is on patterns of medical practice rather than the individual choice of a therapy. In the same way, from the patient's viewpoint, the main interest is in patterns of healthcare utilisation. The behaviour of individual providers and patients, therefore, has to be transformed to higher levels (see the lower half of Fig. 2.5). Just as we distinguished different levels at which constraints operate, we can also distinguish different levels of results: from the results of the interaction of provider and patient in particular consultations to intermediate-level results in terms of practice patterns and utilisation patterns, to differences between health systems at a system level.

The transformation of micro level to macro level can have a number of different forms. We can distinguish four such forms.

- **Aggregation:** in this case, individual behaviour is transformed through the application of a mathematical function. An example is the rate of Caesarean sections in a region, which is the count of the individual decisions by gynaecologists to perform a section divided by the total number of births in certain time period.
- **Partial definition (or definition by convention):** when the incidence of an individual outcome reaches a certain level, a collective outcome is supposed to exist by definition. An example is the existence of an epidemic. One might use the partial definition that if a certain percentage of the population at risk is infected, it is called an epidemic.
- **The application of institutional rules:** in this case the transformation is not made through a more or less arbitrary definition, but is based on an institutional rule. An example is the process of creating consensus statements or protocols for medical treatment. In a process like this, implicitly or explicitly, a majority rule is used as a necessary step in transforming individual expert opinion into a consensus document.
- **Game theory and simulation:** the analogy of a game can be used to predict the collective outcomes of joint individual actions. Game theory can, for example, be applied to the analysis of fee inflation. When formal, mathematical solutions cannot be reached, simulation can be used to transform individual effects to collective outcomes.

## The Use of “League Tables”

In the wake of the performance indicator movement, governments increasingly want to monitor the success of public and semi-public organisations, such as hospitals. Moreover, knowledgeable healthcare consumers want information on which to base their choice of healthcare provider. League tables order organisations from high to low performing on a given criterion. The English NHS, for example, publishes league tables for GP practices, based on the Quality and Outcomes Framework, on its website.



**Fig. 2.6** Hospital performance scores (and confidence intervals) on the patients’ experience of their room and stay (78 hospitals; 22,000 patients). (Source: Sixma et al. (2009))

Such performance indicators are usually aggregated from individual outcomes. Examples include patient deaths, complications, and readmissions within a given time period, and patient satisfaction. A big problem with league tables is how we can make a fair comparison between organisations that may have very different patient populations. Specialised hospitals differ from general hospitals in the composition of the patient population in terms of severity of conditions, and this in turn might affect outcomes that are used to construct league tables (Jacobson et al. 2003; Leyland and Boddy 1998). MLA can be used to adjust the differences in outcomes between organisations for case-mix differences. Importantly, however, it also ensures that adjustments are made based on the assumption that there may be an institutional effect (Goldstein and Spiegelhalter 1996).

Organisations also differ in size and, as a consequence, the confidence intervals for estimates of the average outcomes differ. With MLA we can estimate these confidence intervals. A further discussion of this and related issues will follow in Chaps. 5 and 8. Figure 2.6 gives an example from a comparison of 78 hospitals in the Netherlands. The measured effect shown here relates to people’s experience of how clean sanitary facilities were.

## Conclusion

In this chapter we have put health and healthcare in a micro to macro context. This provides the readers with heuristic tools to analyse their own research problems. Characteristics of macro-level contexts define people’s action space and thus influence their behaviour. The outcome of people’s individual behaviour aggregates to collective outcomes, and these in turn might influence future behaviour. Different

heuristics and models of (health) behaviour may be helpful when defining your own research and when developing hypotheses. The individual research problem determines which contexts are relevant. We come back to this in the next chapter when we ask the question: ‘What is a level in multilevel research?’

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