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## Health mobility: implications for efficiency and equity in priority setting

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## Abstract

Health mobility is a statistical measure of inter-temporal fluctuations in health of a group of individuals. Increased availability of panel data has led to a number of studies which analyse and compare health mobility across subgroups. Mobility can differ systematically across patient subgroups, even if prevalence measured at one point in time is the same. There is a lack of discussion regarding whether health mobility is a relevant concept for resource allocation decisions. In this think piece, we explore whether and how health mobility is incorporated in cost-effectiveness analysis (CEA).

CEA takes health mobility into account where it matters in terms of efficiency and – depending on treatment programs- either favours groups with low mobility or gives equal priority to groups of differing levels of mobility. However, CEA fails to take into account the equity dimension of mobility. There is qualitative research to suggest that some members of the public find that patient groups with low health mobility should be given priority even if some efficiency was sacrificed. Results also indicate that this may depend on the nature of the condition, the actual lengths involved and the magnitude of the efficiency sacrifice.

Health mobility may also have political implications which affect resource allocation decisions, possibly in opposing directions. Further research is required to investigate the extent to which the public is concerned with health mobility, to determine conditions for which health mobility matters most, and to explore ways of how the equity dimension of health mobility can be incorporated into CEA.

## *Introduction*

Every health system aspires to implement health policies which can achieve the best possible health and wellbeing for the population. This requires decisions on how to allocate scarce resources among competing subgroups. Such decisions are complicated by the fact that the health of individuals can change over time. There is evidence that the extent of intertemporal changes, or ‘mobility’, in health states can differ systematically across individuals or subgroups, even if prevalence measured at one point in time is the same. The increased availability of panel data has led to a number of studies which analyse and compare health mobility for different subgroups (Buckley, Denton, Robb, & Spencer, 2004; Contoyannis, Jones, & Rice, 2004a, b; Hauck & Rice, 2004; Hernandez-Quevedo, Jones, Lopez-Nicolas, & Rice, 2006; Jones & Lopez-Nicolas, 2004; Kerkhofs & Lindeboom, 1997; Pascual & Cantarero, 2009; Salas, 2002). There is a lack of discussion, however, regarding whether health mobility is a relevant concept for resource allocation decision. In this note, we explore the concept of ‘health mobility’, and whether and how it is reflected in cost-effectiveness analysis (CEA). We find that, while economic evaluation does take health mobility into account where it matters in terms of efficiency, it fails to take into account the equity dimension of mobility.

## *Health mobility*

Cross sectional studies on population health are used to determine prevalence rates and to explain differences in these across subgroups, at a certain point in time. For example, a study on the mental health of young Australians finds that 27% of 18-24 year olds suffer from a mental health disorder (ABS, 1998). This might be due to each individual having a 27% chance of suffering ill health, in any given year, or 27% suffering from ill health all the time (and 73% never) or - most realistically - something in between, so that of the 27%, (say) 10% will experience ill health in repeated time periods, and the rest (17%) are ill for one time period only. The first scenario is characterized by high, the second by none, and the third by some intermediate level of health mobility (some use the term *health*

*dynamics*). Cross sectional data are not sufficient to inform on this intertemporal aspect of health. Panel data need to be used to test the extent of health mobility, because it allows tracking individuals over time (Hsiao, 2003).

As incidence and prevalence, health mobility is essentially a population concept, based on the aggregate health experiences of a number of individuals over several time periods. As with incidence and prevalence, health mobility is determined by the proportion of healthy individuals becoming ill. As with prevalence, but unlike incidence, health mobility is determined by the proportion of ill individuals who become healthy. Unlike incidence or prevalence, health mobility reflects the number of consecutive periods individuals remain in one health state or the other. In addition, unlike incidence or prevalence, health mobility can be used with two or more discrete levels of health states or with continuous health measures to reflect the magnitude of change in health states.

A measure of mobility can collapse changes in health states over several time periods and over several individuals into a single summary measure, which allows comparison of mobility across different subgroups over time. Measures based on discrete health outcomes usually rely on estimated transition probabilities, i.e. probabilities of moving from one health state to the other over time (Buckley et al., 2004; Contoyannis et al., 2004a; Hernandez-Quevedo et al., 2006; Pascual & Cantarero, 2009). High/low transition probabilities are indicative of high/low mobility. Measures of mobility derived from continuous health measures can be based on the extent of correlation in health states of individuals over time, with strong/weak correlation indicative of low/high mobility (Hauck & Rice, 2004). Alternatively, mobility measures can be derived from the estimated influence of previous health on current health status, with a small/large influence of previous health indicative of high/low mobility. This requires specification of a dynamic panel data model with one or several variables for previous health status as regressors (Contoyannis et al., 2004a, b; Hauck & Rice, 2004; Kerkhofs & Lindeboom, 1997; Salas, 2002).

Jones et al. (2006) review dynamic models and discuss the factors which influence health mobility. To some extent health mobility may reflect the chronic nature of some illnesses. Also a cumulative history of a range of health problems may have a direct influence on current health. These effects can be thought of as pure dynamics, often termed state dependence. In addition, individuals may have certain characteristics (such as education, material deprivation, childhood nutrition or environmental factors) that predispose them to poorer health and that persist over time. Some of these factors may be observable, but others – such as genetic predisposition, time preference and risk aversion – are generally difficult to measure.

### *Health mobility and cost effectiveness*

Analysis of mental health in the UK shows that low income groups (LIG) and minority ethnic groups (MEG) experience similar levels of mental illness at a point in time (Hauck & Rice, 2004). However, LIG experience persistence in their illness, thus have lower health mobility, whereas individuals from MEG experience greater fluctuations in their mental health and thus have higher health mobility. Suppose a policy maker wants to implement preventive and curative mental health programs, targeted at both LIG and MEG. How should resources be allocated between the two groups? Although the language of health mobility may not be established in the economic evaluation literature, clinical trial studies are in effect based on data from panel or cohort studies, and therefore the information on health mobility is already available. If so, how is health mobility reflected in conventional CEA? In what follows, we use LIG and MEG as shorthands for two equally-sized population subgroups that suffer from a given non-fatal disease, but also demonstrate distinct levels of health mobility in and out of this disease.

Suppose we are analysing the cost effectiveness of a program which *cures* all who are ill at  $t = 0$ . We assume that costs are the same regardless of how long patients have had the condition for, or how long patients would have the condition for without treatment. We also assume that marginal utility for surviving in a given health state is constant. Both LIG

and MEG have the same level of prevalence at any point in time, but seen over several time periods, incidence, and therefore health mobility, are higher among the MEG. This implies that the net benefit to the MEG will be lower than the benefit to the LIG. While the number of patients at  $t = 0$  are the same across the two groups, the patients from MEG would have recovered sooner without treatment than the patients from LIG, thus the average patient from MEG has a lower net benefit of treatment than the average LIG patient. CEA gives higher priority to the LIG, thus reflecting the difference in mobility between these two groups.

Now, suppose we are analysing the cost-effectiveness of a *prevention* program, to be implemented at  $t = 0$ , which reduces the incidence over the next  $n$  time periods to zero. The MEG has a higher level of incidence per period; however, each averted case would have lasted for a shorter duration. Therefore, equal prevalence at any point in time means that at the end of the  $n$  time periods, benefits for the two groups will be the same. Thus, the relative results of the CEAs will depend on the cost side. If the prevention program is a complete public good so that the costs cannot be attributed to individual beneficiaries (e.g. air quality control to prevent respiratory conditions), then the overall CEA results are the same for LIG and MEG, and difference in health mobility does not affect cost effectiveness. However, if the prevention program is entirely a private good (e.g. a drug to prevent hypertension), then the costs are a function of the number of people treated. MEG has a higher incidence, and therefore, to the extent that this means a larger number of people need to receive the intervention in order to eliminate incidence over the target period, MEG will be associated with a higher cost of achieving the same health benefit as LIG.

In summary, we can conclude that CEA incorporates health mobility on both the benefit and the cost side. Given equal prevalence, curative programs favour groups with lower health mobility, because benefits are greater. For prevention programs where implementation costs are not a function of the number of persons treated, CEA gives equal priority to groups with high and low mobility. However, for prevention programs where

implementation costs are a function of the number of persons treated, CEA favours groups with lower health mobility because costs are lower. We conclude that CEA does not give higher priority to groups with higher mobility, at least not for the scenarios considered above.

### *Health mobility and equity*

What we have not considered so far is that fluctuations in health may have associated societal values, over and above disutility generated by ill-health experienced by individual patients. In the following section, we will consider under which conditions the equity aspect of health mobility should be reflected in resource allocation decisions. Should fluctuations in health states be taken into consideration? In particular, how can judgements be made on the question which group is worse off: the one with high or low health mobility? We argue that both of these questions are matters of social value judgement. If policy decisions are to reflect the efficiency aspect of mobility only, then current practice of economic evaluation is fine. However, if this is not the case, then the level of health mobility for the health problem in question and the extent to which it should count in the decision making process need to be established and incorporated into the analysis to achieve not only efficient but also equitable resource allocation.

Let's assume for the following discussion that the general public should decide on whether or not the equity aspect of health mobility is to be considered in CEA. If total disease burden is fixed, then high mobility is associated with shorter spells of illness for a larger group of people, and low mobility with longer spells of illness for a smaller group of people. If the public is only interested in the level of total ill health and not how it is distributed, valuations for high and low health mobility would be the same. This implies that differences in health mobility should have no impact on resource allocation decisions over and above the impact it has through standard CEA.

Now, let's assume that the public is not only interested in the level of total ill health, but also in how it is distributed over time across subgroups of the population. In addition, we assume a situation where people can be either healthy or ill (and there are no births or deaths). One possibility is that the public would regard lower health mobility of a subgroup as something that should be given higher priority to, when prevalence is the same. In other words, if a given level of disease prevalence is distributed across a defined group through time, the public may prefer it to be dispersed widely so that more people suffer a short duration each (high mobility) than to be concentrated so that a smaller number of people suffer a long duration each (low mobility). At any given point in time, low mobility implies a lower probability of recovery to full health in the next time period than if health mobility were high. Thus, the public may feel that patient groups experiencing low health mobility should receive greater compensation for their lower probability of leaving the ill state in the next time period. For our example, this would imply that improving the health of LIG should receive a higher weight relative to improving the health of MEG, considering that those in LIG suffer more persistence in their mental illness than MEG. This will be in addition to the advantage LIG may have based on the efficiency implications of health mobility.

There is evidence to suggest that economic inequality across subgroups in society impacts on individual well-being, over and above the adverse effects of low income itself. It has been found that individuals have a lower tendency to report themselves happy when income inequality is high, controlling for individual income, a large set of personal characteristics, and year and country (or, in the case of the US, state) dummies (Alesina, Di Tella, & MacCulloch, 2004). The authors point out that the impact is stronger in Europe than in the US, and they discuss the extent to which this may be explained in terms of perceived social mobility. In what follows, we will briefly report some findings from two small-scale exploratory studies conducted as preparatory work for the "NICE Social QALY Project" (Dolan, et al., 2008). This project aimed at capturing and quantifying societal preferences for the relative value of health depending on the beneficiary.



In the exploratory studies, members of the general public were introduced to two hypothetical equally-sized groups of patients (Group A and Group B) with different characteristics, one of which was ‘length of time with condition’. Scenarios were set up so that in each case, if respondents support a simple health maximisation principle then they would give priority to Group A, but if respondents regard the characteristic to be a relevant concern then they may sacrifice health maximisation and choose to give priority to Group B. The objective of the first study was to find out why respondents supported deviation from simple health maximisation, if they do. The objective of the second study was to identify the threshold at which each characteristic becomes a relevant concern (i.e. ‘how much time’ the patient lived with certain condition).

In the first study, Group A consisted of ‘patients who have had the condition for 2 years’ and was expected to achieve a larger health gain, whereas Group B consisted of ‘patients who have had the condition for 10 years’ and was expected to achieve a smaller health gain. Sixteen individuals were recruited in Sheffield City Centre, and participated in four separate focus group sessions. Given the small sample size and non-representativeness of the respondents, only qualitative results are reported here. One view that was repeatedly expressed by several participants was that those who have had the condition for longer should be given priority even if this did not maximise health benefits because “they've waited that long [...] they shouldn't have to wait any longer”. However, there were also participants who felt that those who have had the condition for longer would have learned to live with it so that “you can live with it a bit longer, can't you”, and therefore did not need the treatment as much. Although the scenarios used in the exercise did not give the specifics of the illness involved, some participants pointed out that the answer will have “quite a lot to do with the nature of the illness that we're dealing with”.

In the second study, Group A consisted of ‘patients who got the condition recently’ and was expected to achieve a larger health gain, whereas Group B consisted of ‘patients who have had the condition for 6 months’ and was expected to achieve a smaller health gain. For those respondents who chose Group A, the length of time those in Group B had the

condition for was increased to 1 year, whereas for those respondents who chose Group B, this length of time was decreased to 3 months, and so on. There were three such path-dependent sub-questions. The distribution of respondents in terms of how long the wait needs to be for patients in Group B to be given priority over those in Group A was identified, and the results were reported in terms of the quantitative trade off made by the median respondent.

Forty-two individuals were recruited in Sheffield City Centre separately from the first study, and participated in four different focus group sessions. Given the non-representativeness of the sample, the results should not be generalised. The results were found to be sensitive to the size of the sacrifice in efficiency. When the health gain for Group B was set at 90% of the health gain for Group A, one in seven respondents chose Group A (i.e. to maximise health gain), whereas the median respondent, alongside the majority of respondents, chose to prioritise patients who have had the condition for longer even if it was by one month. However, when the health gain for Group B was set at 50% of the health gain for Group A, a third of respondents chose to maximise health, while the median respondent chose to prioritise patients that had had the condition for one year or longer.

Thus, the two studies have found evidence to suggest that depending on the context, at least some members of the public think that patient groups with low health mobility should be given priority even if this meant that some efficiency was sacrificed. At the same time, the results also indicated that this may depend on the nature of the condition, on whether patients had learned to live with the condition, on the actual lengths involved, and on the magnitude of the efficiency sacrifice. (For further details on these exploratory studies, Dolan et al, 2008, should be consulted.) In summary, we find that it is possible that the public is concerned with fairness in the distribution of health with respect to the length of time with illness so that the group with low mobility would receive greater priority than the group with high mobility, even where cost-effectiveness ratios are the same (as we have shown to be the case for some prevention programs). These tentative results suggest that

the efficiency implication of health mobility on CEA (where they do exist) and the equity implication of health mobility on CEA (if they are to exist) both go in the same direction.

### *Political implications of health mobility*

In the real world, resource allocation decisions by policy makers are influenced by many factors and not only the outcomes of CEAs. Health mobility can have political implications, which in turn may affect resource allocation decisions. If health mobility for a particular illness (e.g. mental illness) among a subgroup such as MEG is high, this implies that - over several time periods - a comparably larger proportion of people in this subgroup is or will be affected by the illness than if health mobility were low. A policy maker (possibly concerned about re-election) may want to allocate larger amounts of resources to this subgroup than to another where mobility is lower. This is because, over several time periods, a greater number of voters will be affected in the subgroup with high mobility. This implies that the subgroup with high mobility may attract a larger amount of resources even if prevalence at one point in time is the same as in a subgroup with lower mobility. On the other hand, an illness or a subgroup affected by an illness which is characterized by low health mobility may be more conducive to the formation of patient organizations which require time and a relatively stable member base to become politically influential (Patient organization movements, 2006). It has been shown that patient organizations and other non-state actors and networks can have a considerable influence on resource allocation decisions (Rabeharisoa, 2003; Tantivess & Walt, 2008). This implies that the subgroup with low mobility would manage to attract a larger amount of resources even if cost-effectiveness ratios are the same as another subgroup with higher mobility.

In summary, there may well be political implications of health mobility which influence resource allocation decisions, possibly in opposing directions. They may make it difficult to implement the recommendations generated by CEA, especially if differences in health mobility between subgroups are large.

## *Conclusions*

In this note, we explore the concept of ‘health mobility’, and whether it is relevant for resource allocation decisions. We discuss whether and how health mobility is incorporated in cost-effectiveness analysis (CEA). Obvious limitations of this initial discussion are that we focus on simplified treatment programs, we assume equal costs for the curative program, we distinguish only high and low health mobility (where it can be measured over several categories, and even continuously), and we can only present exploratory qualitative research on public preferences regarding the trade-off between health mobility and efficiency. Still, we can derive some conclusions. CEA does reflect health mobility in terms of efficiency. Depending on the type of intervention, CEA either favours groups with lower health mobility or gives equal priority to groups with different levels of mobility. However, CEA does not take into account the equity dimension of health mobility. Qualitative research indicates that the public may be concerned with health mobility: some members of the public are willing to sacrifice health in order to give greater priority to patients who have had the condition for longer, i.e. those with lower health mobility. If this is the case, health mobility needs to be incorporated into CEA to reflect the public’s value judgements. Further research is required to investigate the extent to which health mobility is a concern for the public, the conditions for which health mobility matters most, and to find ways of how the equity dimension of health mobility can be incorporated into CEA.

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