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Short report

Cost-effectiveness analysis of human resources policy interventions to address the shortage of nurses in rural South Africa

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ABSTRACT

Recent policy recommendations have called for increased research efforts to inform the design of cost-effective interventions to address the shortage of health workers in rural areas. This paper takes forward the recent use of Discrete Choice Experiments to assess the effects of potential incentives to attract nurses to rural areas. The analysis relies on data collected in South Africa between August and November 2008. Effectiveness measures derived from Discrete Choice Experiments are combined in a Markov model to derive the long-term effects of policies, and costs are evaluated with secondary data. Measures involving the selection of more nursing students who are more likely to accept positions in rural areas are shown to be the most cost-effective interventions. If such policies could not be implemented, the next best options are to offer preferential access to specialist training to nurses willing to work in rural areas.

Background

The role of human resources in the provision of health services has been highlighted by ecological evidence (Anand & Barnighausen, 2004). In South Africa, concern over human resources has been a prominent theme in the transformation of the country's health system, and it remains a critical constraint to providing good quality care to all (Health Systems Trust, 2008). In particular, redressing the unbalanced distribution of staff between rural and urban areas is a public health priority for South African authorities (Department of Health, 2006).

Since providing adequate human resources for health (HRH) requires first training and then hiring health workers, HRH policies can be divided into "upstream" and "downstream" interventions. Upstream interventions relate to the selection and training of future health professionals: they seek to select individuals who are more likely to like rural jobs (Brooks, Walsh, Mardon, Lewis, & Clawson, 2002) or try to influence individuals' tastes during their training (e.g. exposing students to rural settings). Downstream interventions improve working conditions to attract or retain staff in under-served areas. Four main downstream interventions have been implemented by developed and developing countries: financial incentives, provision of education opportunities, interventions supporting the work of health professionals and regulatory mechanisms, such as compulsory services in under-served areas (Grobler et al., 2009).

Two critical questions are unanswered for policy-makers wishing to redress the geographical imbalance of health care providers. First, whilst they need to know which incentives, either alone or combined, would be effective, there is a lack of rigorous evidence on the effects of the available interventions, as underlined by a recent Cochrane review (Grobler et al., 2009). Second, they need to know the relative cost-effectiveness of different interventions. Indeed, salary increases might be effective measures, but the recurring costs induced probably make them extremely costly. Unfortunately, there is hardly any evidence on the costs or cost-effectiveness of HRH interventions (Zurn et al., 2011).

In the absence of experimental or quasi-experimental evidence measuring the effect of HRH policies, it is both possible and desirable to use modelling techniques to inform their design (WHO, 2010). Discrete choice experiments (DCEs) have been used increasingly to investigate to what extent certain hypothetical policies, not currently offered to heath care workers, would attract staff to rural areas (Lagarde & Blaauw, 2009). This paper takes this literature forward by building on DCEs to evaluate the cost-effectiveness of various measures that could be implemented in South Africa to increase the number of nurses in rural areas.

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Methods

General outline of the analysis

The analysis takes the government perspective and assumes that its main objective is to increase the number of nurses in rural areas, where they are critically missing (hence the marginal value of a rural nurse is greater than its (current) cost). The assumption adopted here is that any loss of welfare for urban patients in attracting urban nurses to rural posts will be less than the gain to rural patients.

The study assesses the cost-effectiveness of three series of measures: downstream, upstream and mixed.

Seven potential single downstream measures are evaluated: three different salary increases (10%, 20% or 30%); a car allowance worth ZAR500 every month; better housing conditions (a two-bedroom house instead of the shared flat currently provided to rural nurses); guaranteed access to study leave after two years in post; more rapid promotion to the next grade, after one year instead of two. These single incentives are also combined to create 14 additional packages of downstream measures (see Appendix A).

Then, two upstream measures are included, mimicking the effects of two hypothetical policies where quotas would be introduced to ensure that 75% and 100% of individuals are recruited from rural areas.

Finally, the analysis includes mixed measures, evaluating all downstream measures for the two hypothetical nursing populations (75% and 100% of rural recruits).

The baseline scenario for comparison represents the conditions currently prevalent in the public sector: a starting annual salary of ZAR120,000 (ZAR1 = USD0.12) followed by a normal promotion schedule, no car allowance, a basic subsided housing (shared flat), and guaranteed study leave after six years of service.

Effectiveness measures

To assess the cost-effectiveness of HRH interventions, it is necessary to model their long-term impact on nurses' career choices, as incentives that have positive effects in the short-run may generate adverse effects in the long run. For example, rural nurses who have access to study leave to specialise might take up (private) urban jobs after their speciality training. The effectiveness measures therefore rely on the combination of three data sources to simulate long-term dynamics:

- A DCE that mimics the prevailing conditions in the labour market in South Africa (Lagarde, Blaauw, & Cairns, submitted for publication);
- A second DCE that simulates the effects of policy interventions designed to attract nurses to rural areas (Blaauw et al., 2010);
- A Markov model that takes the results of the two DCEs as inputs, and simulates, for the different scenarios, the distribution of nurses in the labour market over time (Lagarde & Cairns, 2012).

A brief presentation of each study is given below, but more details can be found in the publications referenced and in the Appendix A. Data collection for the two DCEs took place in the North-West and Gauteng provinces in South Africa, between August and November 2009.

In the absence of revealed preference data on nurses' careers and their distribution in the labour market in South Africa, the distribution of nurses between the public sector (rural and urban) and the other main job opportunities (overseas and private jobs) in the South African labour market is obtained using the predictions of a DCE administered to 377 final year nursing students (Lagarde et al., submitted for publication). The DCE was designed to replicate the conditions prevailing in the labour market and asked respondents to rank four job descriptions: a job in the private sector, one overseas, a public urban job and a public rural one. Based on the preferences estimated in the analysis, the distribution of nurses between these four jobs under the current conditions was simulated for this economic analysis. Similar simulations were performed with two modified samples (composed of 75% and 100% of rural students). All results are reported in the Appendix A.

To simulate the effects of potential policies to attract nurses to rural areas, a second DCE was designed and administered to the same nursing students. Respondents had to choose between a public urban job (similar to prevailing labour market conditions), and one in a rural area whose characteristics reflected the possible incentives described in 2.1. The data were analysed specifically for this economic analysis to simulate the immediate uptake of rural posts under the different policy scenarios described above, with the original sample and for two modified samples (composed of 75% and 100% of rural students). All the results of these simulations are reported in the Appendix A.

Finally, to account for long-term effects of incentives, a Markov model was developed that forecasts the distribution of a cohort of 2000 nurses[1] across the four main job opportunities for South African nurses, from their entry until their retirement 40 years later. The model takes as inputs the simulations of the two DCEs, as well as a number of assumptions on the transition rates across the different jobs over time. A detailed presentation of the model can be found elsewhere (Lagarde & Cairns, 2012). The Markov model computes the distribution of nurses in the labour market as 40 successive cohorts of nurses are trained and enter the labour market with the same job opportunities and policy incentives offered. Based on the outputs of the model, a single measure of effectiveness for each policy is computed for the sole purpose of this economic analysis: the number of rural nurse-years, obtained by adding the number of nurses in public rural posts over the 40-year horizon.

Cost estimations

The annual total cost of an intervention is obtained by multiplying the number of rural nurses by their unit costs. Since administrative costs for policy implementation and the cost of building additional health facilities or training institutions are deemed irrelevant and/or negligible compared to all the other costs of the interventions, the calculation of the unit cost of a rural nurse in a given year relies on three elements:

- the salary earned by a rural nurse (with or without rural allowance, with or without a fast-tracked promotion path);
- the direct and indirect costs of receiving post-basic training;
- the other financial benefits (housing and car allowances).

Accounting for salaries accurately is particularly important as they represent the vast majority of the costs. Whilst data on salary scales are available, there is no information on nurses' typical career paths, or the distribution of the nursing workforce across the different salary grades. Therefore to estimate the average annual cost of a nurse's base salary for a given year, an 'average' nursing career was constructed. Estimates of the salary costs accounted for indirect charges (pension, etc.), and, when necessary, for the different policy interventions simulated (e.g. a 30% rural allowance

[1] Approximately the annual production of nurses in South Africa.