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Original Research

Carbon mitigation, patient choice and cost reduction – triple bottom line optimisation for health care planning

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ABSTRACT

Objectives: Health services must provide safe, affordable clinical care whilst meeting efficiency, environmental and social targets. These targets include achieving reduced greenhouse gas emissions. A care pathway approach based on a decision-support tool can simultaneously reconfigure health services, improve productivity and reduce carbon emissions.

Study design: Probabilistic modelling using secondary data analysis.

Methods: Estimates of carbon emitted by a health service drew on a previous carbon accounting study which integrated bottom–up assessment of carbon emissions with top–down analysis of indirect emissions by Duane et al. (2012).[1]

Using human resource information, estimates were applied in a decision-support model to measure the carbon footprint and service provision of theoretical scenarios. Using this model, sites with less than 60% utilisation were theoretically reconfigured to reduce carbon emissions and improve service provision.

Results: Clinic utilisation rates improved from 50% to 78%. Human resource savings were identified which could be re-directed towards improving patient care. Patient travel for health care was halved resulting in significant savings in carbon emissions.

Conclusions: The proposed model is an effective health care service analysis tool, ensuring optimal utilisation of health care sites and human resources with the lowest carbon footprint.

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Introduction

The provision of safe, cost effective and responsive clinical care whilst meeting productivity, efficiency, environmental and social targets presents significant challenges in the health care system.

The 'triple bottom line', coined by John Elkington, requires the balancing of financial, social and environmental objectives.[2] The need for thinking of this 'triple bottom line' in the health sector is clear,[3] but systematic attempts to model the competing objectives are scarce.

In terms of the environment, climate change is a global health threat requiring concerted and integrated health system adaptation and mitigation efforts.[4,5] Particular effort is needed at sectoral level to ensure climate change mainstreaming – with particular attention to potential synergies or conflicts between adaptation and mitigation – realising the complexity of decision-making in this context, with significant uncertainties.[6]

In England, 3% of greenhouse gas (GHG) emissions are attributable to health care.[7]

In Scotland, the National Health Service (NHS) must undertake carbon accounting,[8,9] to meet energy and GHG reduction targets.[10] Balancing these demands against pressures to appropriately locate services for local need and improve efficiency and productivity within finite financial and environmental resources, requires robust information and complex planning systems.[11]

The Pollard model is a decision-support tool, employable as a bottom–up framework for testing service reconfiguration and associated resource consequences.[12] As with all such models, a number of simplifying assumptions must be made. The Pollard model, which uses a care pathway approach, has been shown to capture planning scenarios in a robust manner.[9]

Methods

The model has been applied to the Community Dental Service (CDS) in Fife and its output analysed in gauging whether patient choice and service provision were jeopardised in reducing operating costs and carbon emissions.

Estimates of carbon emitted by CDS drew on a carbon accounting study which integrated detailed bottom–up assessment of direct emissions (e.g. from energy, waste, water and patient transport) with a top–down analysis of indirect emissions (e.g. procurement).[1] Within this carbon audit, energy and water consumption were based on meter readings; waste-related emissions from collection contracts and travel from staff and patient questionnaires.

These estimates were applied in the Pollard model to measure the operational carbon footprint and optimise service provision. Fig. 1 gives an illustration of the use of the Pollard model to derive indicators of the triple bottom line in the case of dentistry.

The model used a four step process as follows:

1. Demand for services at each location was derived from postcode data, incidence rates, and the presumption that treatment was carried out at the site closest to the patient's home postcode.
2. Each site's available capacity was calculated using the numbers of patients that could attend at each dental surgery and standard managerial knowledge of how many staff are needed for each size of dental surgery. Capacity included the number of sites, equipment type and staff needed (e.g. dental professionals, reception staff, cleaners etc.).
3. Demand, aggregated for services at each site, was converted into total treatment time for each of 28 types of dental care (e.g. examination, extraction etc.). Table 1 illustrates the process to calculate energy consumption for four care categories.
4. Capacity required at each site was compared against capacity available. Any shortfall was addressed by varying the assumptions leading to a 'best-fit' solution to enhance indicators for carbon reduction, patient travel, resource utilisation and costs.

To simulate the provision of the CDS, five scenarios were compared:

1. Baseline A: assuming existing energy use, patient travel and resource deployment;
2. Baseline B: assuming patients travel to their closest site;
3. Scenario 1: over-utilised sites reconfigured (thus retaining all sites);
4. Scenario 2: sites with less than 40% utilisation in Scenario 1 closed and remaining sites reconfigured; and

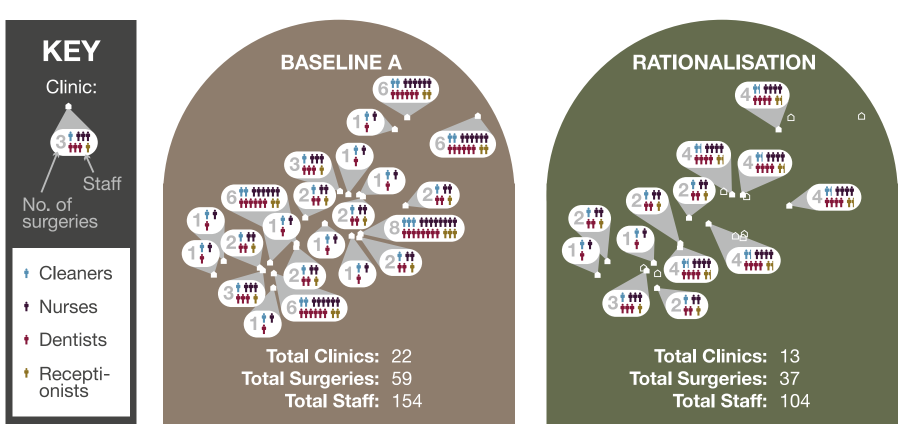

Fig. 1 – Pollard model overview.