Scale optimisation is important in hospital initiatives in South Africa

As national and international attention shifts towards improving health system performance, efficiencies must be maximised wherever possible. There will be increasing focus on escalating public and private sector health care costs in South Africa with the proposed introduction of national health insurance (NHI) and other health system strengthening initiatives.[1] Furthermore, the intended benefits of NHI will not materialise unless there are significant improvements in health system performance. While previous initiatives to enhance efficiency have addressed important issues such as health worker motivation, remuneration and referral systems, one underutilised mechanism is ensuring that facilities are of optimum size. A common misperception is that a larger hospital is invariably more efficient as it reaps economies of scale by having, for example, sufficient numbers of patients to fully utilise a computed tomography scanner or other large equipment. We reviewed the evidence about optimal hospital size and discuss here its implications for the planned reconstruction of major hospitals, including the Chris Hani Baragwanath Public-Private Partnership and the rebuilding of King Edward VIII Hospital in Durban.[2]

Classic economics holds that, in a competitive industry, the motive of profit and the effects of competition ensure that businesses (hospitals in this case) become optimised by using 'best practice' technology; choosing the combination of inputs that minimises costs (e.g. task shifting to mid-level providers); and producing their outputs at an efficient scale.[3] In the health sector, competition is less than perfect, the profit motive is often absent and sometimes scorned, and all governments intervene in one way or another with varying frequency and intensity of intervention.[4] From an economic and indeed social perspective, the performance of health systems should be critically appraised in terms of efficiency.[5] Whether hospitals are publicly owned or run by private organisations, the most efficient 'mix' of hospital types and sizes must be sought, and might consist of, for example, a few large general hospitals; a higher number of smaller, more specialised hospitals; and several medium-sized general facilities.

Hospital cost studies determine the extent of **economies of scale** (e.g. reductions in the average cost of a hospital bed as the number of beds increases) and **economies of scope** (reductions in average costs as the range of services increases).[6] The diversity of patients and the challenges in measuring costs and outputs, compared with some other industries, make it more difficult to determine optimal hospital size. Consequently, there is much variation between estimates of the most efficient types and sizes of hospital in different settings. In Britain, Posnett found that bigger is not better; he concluded that there is no reason to believe that a further concentration of services within hospitals will lead to any automatic gains in efficiency or patient outcomes.[7] In contrast, Canadian investigators examining economies of scale and scope in the years preceding a major restructuring of hospitals, had little doubt that such economies were possible in larger hospitals.[8] These might result from repetition of tasks (which improves quality and reduces time per unit output); improved purchasing power (bargaining power achieved through a larger volume of purchases); and other advantages achieved through operational and financial synergies. Many classic reasons for economies of scale seem to apply to hospitals, especially as capital outlays on building construction and medical equipment are so substantive. Furthermore, larger hospitals tend to attract better-trained administrators, which may lead to better policies and procedures, in turn enhancing efficiency.

Despite the complexities of hospital cost studies, we can draw conclusions about how available resources might best be configured to maximise the services provided. While the reasons above suggest that a larger hospital may be more efficient, several factors negate this. There is consensus among researchers that small (less than 100 bed) and large (over 1 000 bed) hospitals are more costly. This suggests a bell-shaped curve, with expensive 'tails of the curve', i.e. small and large hospitals. A study of 30 hospitals in Zambia found that about 40% of the hospitals assessed were uneconomically large and a similar proportion were inefficiently small; for the latter, an increase in bed number would be an efficient spend.[9] Clearly, beyond a certain size, diseconomies of scale occur in the health sector, with costs per bed rising with increasing size of a facility. Several factors account for this trend. Larger hospitals become more complex, requiring numerous formal organisational mechanisms. This hinders strategic planning and makes communication protracted, leading to slower response times and duplication of operational efforts. Furthermore, the typical bureaucratic changes that follow increasing size can distance decision-makers from the coalface. Consequent efforts to standardise systems across large organisations introduces rigidity and a disjuncture between strategic goals and implementation.[9] Also, having few large hospitals implicitly means geographically distant hospitals, with higher patient transport costs and travel time. Furthermore, it is not by accident that the profit-maximising private sector in South Africa selects a hospital size that is considerably smaller than the less efficiency-conscious public sector. Useful lessons can also be learnt from the efficiency challenges encountered by the large tertiary academic institutions that emerged following the merging of smaller universities or technical colleges in South Africa – efficiency did not follow size!

A study in 3 provinces of South Africa found that only 13% of the public sector hospitals studied operated at an efficient size.[10] Similar to the Zambian findings,[9] there were possible performance gains in expanding level I hospitals, while levels II and III facilities were seemingly too large and had bed redundancies. Though understanding the potential role of size optimisation is important in planning for NHI, its significance is brought to the fore by the present hospital upgrading initiatives in South Africa. Smaller and more specialised hospitals, such as the planned Nelson Mandela Paediatric Hospital consisting of 200 - 300 beds in Johannesburg, also allow for a narrower and more focused scope of activities (economies of scope). Here, patient need can be closely aligned with hospital staffing whereas, in larger facilities, these are often poorly matched; for example, a highly skilled specialist might treat a child with uncomplicated pneumonia whose outcome would be comparable with care received from a nurse following an Integrated Management of Childhood Illness (IMCI) algorithm.

Several conclusions can be drawn and might inform the planned hospital revamping. Firstly, the normal mechanisms which produce efficiency seldom operate within public sector hospitals, necessitating government intervention and careful strategic planning before embarking on large projects. However, as far as possible, these projects must be based on the current best evidence regarding hospital size and efficiency. Secondly, size does matter, with decreasing returns to scale after a certain size. The specific size required to optimise efficiency is context-specific, but is highly likely to be well below 1 000 beds. Particularly in level II and III facilities, where diseconomies of scale presently occur, bed closures – often politically difficult – could be considered, with re-allocation of budgets and resources towards other health care services and smaller facilities that exhibit increasing returns to scale. Thirdly, substitution between the inputs into hospitals (such as doctor hours, beds, and nurse hours), can lead to a more efficient mix of inputs and, ultimately, outputs.[11]

Finally, size optimisation cannot be a short-term phenomenon; it requires careful strategic planning, not only initially during construction (or revitalisation), but also iteratively, aiming to ensure maximum efficiency by adapting to ongoing changes in patient mix. Size optimisation should also aim to take advantage of emerging opportunities to substitute inputs and ultimately to be brave enough to change size if required.

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SOUTH AFRICAN MEDICAL RECORD.

Notes on a Case of Perforative Appendicitis caused by Round Worms.

By H. J. WILLIAMS, M.D., F.R.C.S.

Female child, aged 5 years, first seen June 20th. Mother said she had sent for me because the child had worms—had passed two worms by bowel and had vomited one; also because child was restless at night, and had complained of discomfort in the stomach.

On examination (which was at evening, the child having gone to bed at that time, but had been running about all day) I found a fairly well-nourished and quite healthy-appearing child; abdomen slightly distended and also slight general tenderness, such as one often finds in children suffering from *Ascaris lumbricoides*.

The pulse, temperature, and respiration were, as far as I could judge, quite normal, and the child seemed quite happy otherwise.

I prescribed two powders, each containing two grains of santonin, one half grain calomel and three grains of pulv. rhei, to be taken on alternate mornings before breakfast, with instructions that no food be given until three hours after the administration of the powders.

The following evening I was informed that the child had been playing about that day until four o'clock when she complained of sudden pain in the stomach, went to bed, and died about seven o'clock.

I called and did a post-mortem at eight o'clock the same evening.

On opening the abdomen, the first thing I noticed was a number of very large live worms crawling about among the intestines. I collected in all nineteen such worms free in the peritoneal cavity. I began to search for the opening by which these intestinal parasites gained access to the abdominal cavity. Beginning at the stomach, I examined the canal carefully until I reached the cæcum, and just at the junction of the appendix and cæcum I found a large worm slowly making its way through a small perforation at this point. As far as I could judge without a microscopical examination of the mounted tissue, I found no evidence of inflammation of the appendix other than that associated with the rapid acute general peritonitis from which the child evidently lost her life. All the other organs were quite healthy.