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Magnetic resonance imaging and linear accelerators: are they complement or substitute for computed tomography and cobalt units?

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Abstract

Background

Medical technology diffusion generally follows the classic "S" shaped curve in which a technology enters its final phases of diffusion as it becomes obsolescent or is substituted by a newer technology. Obsolescence and substitution effects are harder to recognize in health care systems than in other industries. Previous studies have reported an increasing number of computed tomography scanners (CTs) and magnetic resonance scanners (MRIs) in some countries, together with an increasing number of linear accelerators (LAs) and a decreasing number of cobalt units (CUs). To explore the substitution or complement effect of alternate technologies, we studied the cases of MRI vs. CT, and of LA vs. CU among the 24 countries of the Organization for Economic Cooperation and Development (OECD).

Methods

Data on the number of MRIs, CTs, LAs and CUs installed in OECD countries at the end of 1985 and 1990 were collected from the multinational industry, national institutions, and the literature. Population and health care expenditure per capita (HCE pc) were obtained from OECD publications. For diagnostic imaging technologies, we carried out linear regression analysis considering the number of MRIs per million population (pmp) as the dependent variable, and CTs pmp and HCE pc as the independent variables. Analogously for radiation therapy, LAs pmp was the dependent variable, while CUs pmp and HCE pc were the independent variables.

Results

The regressions equations show that CTs pmp and HCE pc can help explain 73% of the variance for MRIs pmp in the OECD countries, and CUs pmp and HCE pc explain 69% of the variance for LAs pmp. HCE pc has a positive effect on both MRIs pmp and LAs pmp. However, while CTs and MRIs are positive associated, there is a negative association between LAs and CUs.

Conclusions

These findings suggest that magnetic resonance complements computed tomography for diagnostic imaging, while linear accelerators tend to replace cobalt units for radiation therapy.

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