A CONCEPTUAL FRAMEWORK TO APPLY DISCRETE-EVENT SIMULATION TO ESTIMATE THE RESOURCES NEEDED TO PERFORM A POPULATION-BASED CANCER SCREENING PROGRAM

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BACKGROUND

Some type of cancers meet the criteria needed to recommend population-based screening programs. However, implementing this type of health policy needs a high level of resource use which implies a high cost for the national health service. In a context of scarcity of resources, evidence about the long-term impact of initiating a population-based cancer screening program is needed. Moreover, changes in screening strategies and ageing of population will affect the volume of need for resources to perform the screening programs in the future and, thus, its budgetary impact.

OBJECTIVE

To establish a conceptual framework to build a simulation model to estimate the resources needed to start a population-based cancer screening program and to estimate its long-term impact in terms of benefit and resource use.

METHODS

A conceptual model was defined according to discrete-event simulation methodology. The conceptual model included, on one hand, the stages of a screening program (figure 1) and, on the other hand, the natural history of the disease (figure 2). The stages of a screening program included: invitation of the target population, participation and screening test, confirmation test(s) after a positive screening result, cancer diagnosis and cancer treatment. The natural history of the disease includes the following states: free of cancer, pre-clinical cancer phase, clinical (or symptomatic) cancer phase and cancer cured, including recurrences and death. The natural history of the disease will be modeled as time until a change of state, and this health states will be managed as attributes of the simulated subjects. Then, the health state will be taken into account through the process of screening to choose which sensitivities and specificities of the screening and confirmatory tests should be applied and what is the result of the screening (true positive, true negative, false positive, false negative). It will also be used to detect interval cancers, which is one of the adverse effects of a screening program.

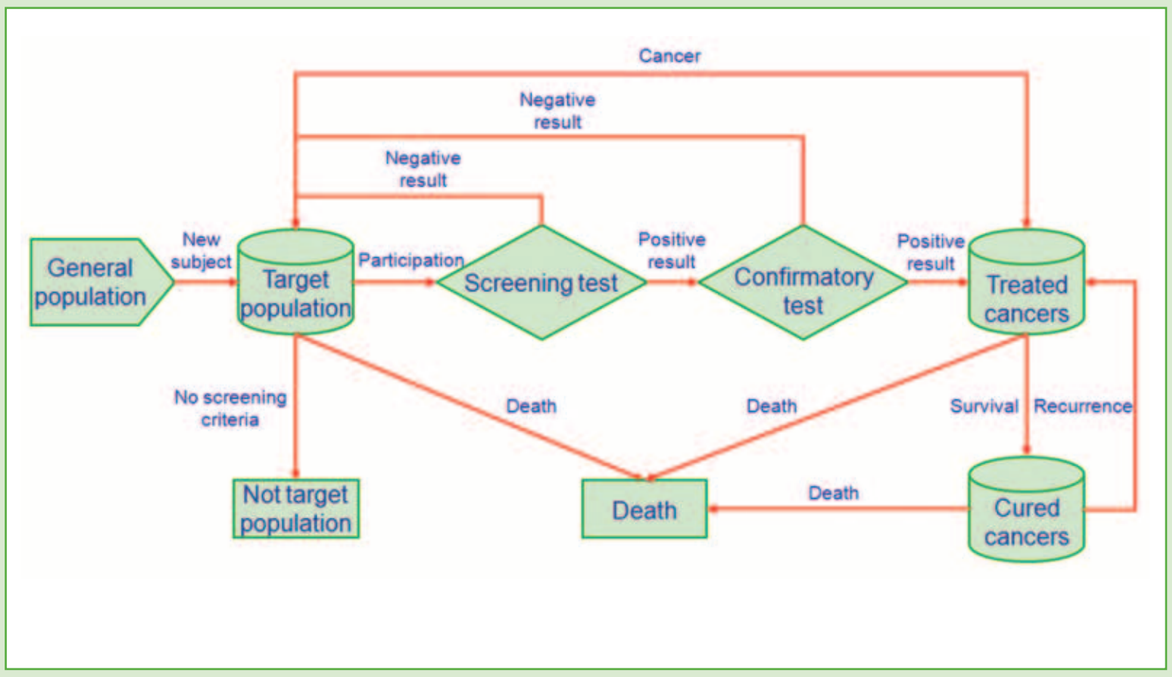

Figure 1: Generic conceptual model for a cancer screening program.

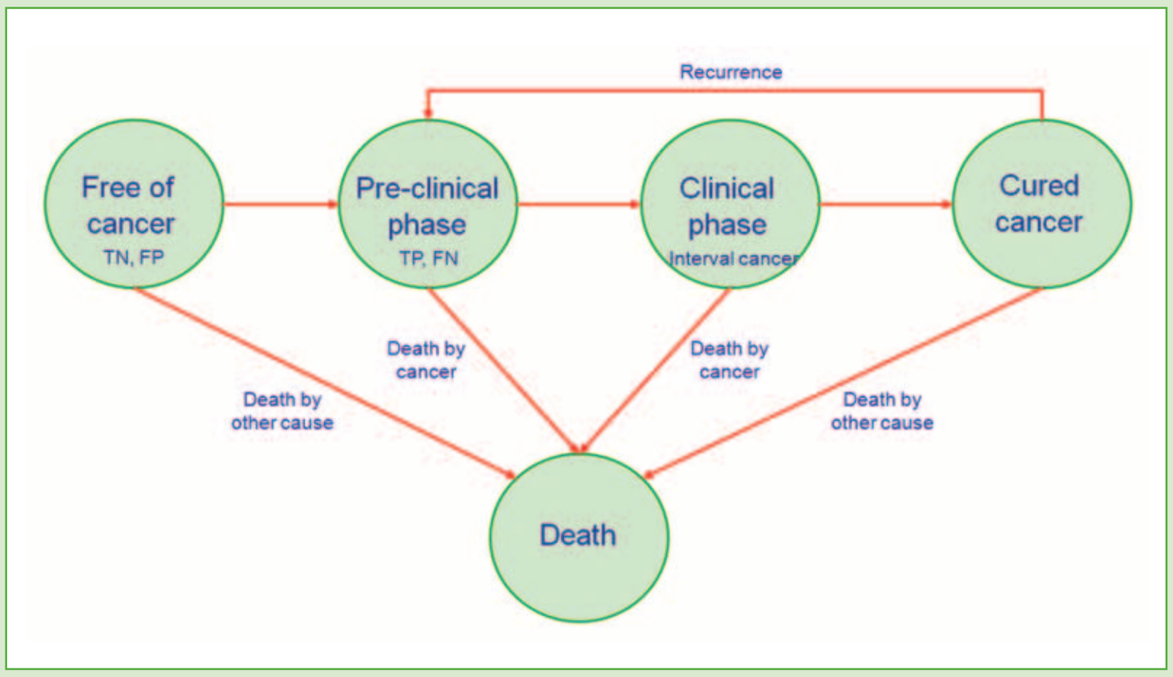

Figure 2: Conceptual model for the natural history of cancer.

IMPLICATIONS

Using a simulation model to reproduce a population-based cancer screening program will allow estimating the amount of resources needed to implement the program. This will be applicable to cancers for which screening is recommended, such as colorectal, cervical or prostate cancer, but also to explore changes in the screening strategy such as widening the age range for breast cancer screening or the impact of digital mammography.

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