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A microsimulation model to assess the impact of SARS-CoV-2 on cancer outcomes, healthcare organization and economic burden

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Background

SARS-CoV-2 pandemic has deeply modified healthcare seeking and services in Europe since February 2020 with delays in treatment delivery and changes in the standards of care. The organization of cancer centers (CC) has been transformed to minimize virus exposure in cancer patients (pts). Real-time assessment of the impact on cancer outcomes can optimize decision-making for future epidemic episodes.

Methods

A discrete-event simulation (DES) model was developed to model individual pt pathways during the pandemic in a context of constrained medical resources. Cancer pt care is modeled based on pandemic-adapted guidelines for medical practice. Pt flow is derived from medico-administrative databases using time series methods to estimate the proportion of punctual / late visits and associated delay and to extrapolate future flows. Finally, the impact of modified care on survival is estimated using literature data.

Results

From March to December 2020, based on data from Gustave Roussy CC in France (n= 4877 included pts), estimated overall treatment delay is ≤ 7 days in 86,6% of pts and 5,2% of pts have a delay higher than 2 months. More than 94% of this duration is delay in pt request for care, causing 99 pts to suffer a major prognosis change upon arrival. Delayed pt flows result in a highly time-variable use of medical resources, with important queues forecast for surgery care and chemotherapy. The handling of such queues will require intensified healthcare professionals effort. Projections show that, in the best-case scenario, ie without a 2nd pandemic wave, treatment delays and modifications will result in around 49 additional 5-year cancer-specific deaths (+ 2,25% of 5-year deaths), mainly in liver, sarcomas and head and neck cancer pts.

Conclusions

In a resource-constrained context, optimization of the benefit-risk ratio between COVID-19 and cancer care is key. Simulations of individual projections from actual hospital data, show a 2.25% increase of the 5-year risk of death and that pandemic-related cancer burden is mainly due to patient-induced lateness in seeking care. Defining optimal strategies in terms of screening, monitoring and prioritization for care could minimize the impact of future pandemic episodes.

Legal entity responsible for the study

The authors.

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Disclosure

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