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Letter

COVID-19 provides an opportunity to transform cancer research

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Recent advances in preclinical and clinical research have enabled remarkable progress in cancer prevention and treatment, and this has translated into a 29% decline in the cancer death rate from 1991 to 2017 (Sung et al., 2021). Nevertheless, the goal of eliminating cancer as a major health concern is still far from being reached (Sung et al., 2021). As a consequence, continued investment in research is imperative in order to reduce the overall cancer burden. The direct and indirect consequences of the COVID-19 pandemic have disrupted the cancer research ecosystem worldwide and are challenging its future sustainability. Although it is difficult to objectively quantify, there is an inestimable negative impact on scientific endeavor, patients, and society.

The pandemic resulted in suspension, early termination, and reduced recruitment rates in cancer clinical trials (Upadhaya et al., 2021). Compared to the pre-pandemic period, new studies dropped 60% (Lamont et al., 2021). Despite the adoption of policies to protect clinical investigation during the health emergency, an estimated 99,940 patients were not enrolled in trials that were stopped, and nearly 1,200 patients in trials that were terminated (Upadhaya et al., 2021). In addition to the direct impact on patients, who were deprived of the opportunity to access the most innovative treatments or optimized standard-of-care (particularly in low- and middle-income countries), this significant detrimental effect raises concerns regarding the longer-term impact on the development of new cancer therapies, which will ultimately result in increased population morbidity and mortality through lack of advancement (Colbert et al., 2020).

The disruption of discovery science and of the bench-to-bedside translational workflow is even more concerning because it undermines the fundamentals of cancer research, essential for clinical advancement. The shutdown of laboratories, forced turnover of staff, reduction of patient samples, and delays in laboratory materials due to national lockdown restrictions and re-prioritization of health systems resources have halted all kinds of *in vitro* and *in vivo* experimentation (Colbert et al., 2020). The consequences of this detriment are poised to persist for years. In addition, the interruption of education and laboratory training for graduates and PhD students; challenges in mobility, networking, and productivity; and career uncertainties—particularly for junior scientists and women, who have been disparately penalized during the COVID-19 outbreak, creating the prospect of a lost generation of cancer researchers (Levine and Rathmell, 2020; Zon et al., 2020)—will jeopardize the scientific community as a whole and the innovation that emanates from these activities.

Financial challenges are probably the most critical threat that the cancer research ecosystem is facing. The pandemic-associated economic breakdown of funding agencies, governments, charities, and universities, along with the reorientation of the public's donations and investments toward COVID-19 related studies, are depleting cancer research funding. Philanthropic cancer-focused organizations, which fund up to half of research projects worldwide, have been particularly affected by this global financial crisis. The American Cancer Society, Cancer Research UK (CRUK), and the Canadian Institutes of Health Research have lost an estimated

\$200 million each during 2020. This is limiting their ability to normally fund grants for preclinical projects and clinical trials (Burki, 2021).

These data indicate that the future viability of cancer research is at serious risk. If no action is taken, the obvious sequelae would be a massive setback that will lead to excess deaths in the years to come—deaths beyond those directly caused by COVID-19. To avoid this scenario, the development of collaborative strategies and transdisciplinary policies aimed at resuming every affected link of the cancer research chain is critical and essential. The imperative now is not only to adapt, but to reshape the future cancer research paradigm by capitalizing on the changes made during this unprecedented crisis.

Clinical trials should be reformed by considering many of the temporary pandemic-related adaptations for permanent implementation to address recognized structural barriers to trial participation and to accelerate clinical drug development. Some of the positive changes to take forward include: remote monitoring of clinical sites, electronic signatures and documentation, telehealth visits, delivery of research-related care at peripheral clinical sites, and increased flexibility in administrative procedures (de Paula et al., 2020). The American Society of Clinical Oncology (ASCO) provided guidance for clinical research to implement lessons learned from the COVID-19 experience by identifying five goals that sponsors, investigators, and health systems should pursue in order to craft more equitable, accessible, and efficient clinical research that ensures patient safety and scientific integrity (Figure S1) (Pennell et al., 2021). The streamlining of administrative procedures and acceleration of traditional regulatory



timelines, which sped up clinical development and approval of novel treatments and vaccines for the COVID-19 infection in an unprecedented manner, would boost cancer research significantly.

Basic science also needs to be renovated. In addition to the temporary measures that were implemented to support research and researchers during the acute phase of the health emergency, long-term holistic policies are necessary in order to build solid foundations for future innovation and progress (Figure S1). In particular, it is time to rethink the way cancer research is funded. The pandemic made us realize that in some countries—particularly in Europe—a relevant proportion of research funding is provided by charities and philanthropic organizations. For instance, CRUK is responsible for roughly half of all publicly funded cancer research in the UK (Burki, 2021). Although this mechanism of “collective self-reliance” is of outstanding significance, the major responsibility of funding research cannot be delegated to the generosity of individuals. The introduction of administrative fiscal relief measures has undoubtedly helped mitigate the acute impact of the pandemic-associated bankruptcy on the scientific community. However, the persistence of the health emergency and the consequent pervasive economic downturn—which is expected to endure—imply that longer-term thinking

and action are required (Figure S1). Governments must increase funding addressed to cancer research in recovery plans, and they should consider fixed investments to foster scientific progress. It is also crucial to finance stimulus measures for cancer-focused organizations to support them in the medium and long term.

In conclusion, the COVID-19 pandemic, while disruptive, has revealed strategies for improving preclinical research, bench-to-bedside translation, and patient access to high-quality care and research. Policymakers, universities, and industry must now consider implementing long-term, multi-level interventions for resuming research networks as a public health priority (Figure S1). This is a unique opportunity for profound transformation to cancer research.

SUPPLEMENTAL INFORMATION

Supplemental information can be found online at <https://doi.org/10.1016/j.ccell.2021.07.018>.

DECLARATION OF INTERESTS

The authors declare no competing interests.

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