accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments, with a waiver of informed consent for chart review.

Data availability

The data in this study will be shared upon request and approval will be designated by a data access committee. The data access committee comprises four authors and there is no restriction to data access. ❒

Editorial note: This article has been peer-reviewed.

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Author contributions

E.C. and L.J. contributed to the study design and data interpretation and writing of manuscript; M.D. contributed to statistical analysis; E.S., L.W. and R.B.-C. contributed to data-collection analysis; A.A., D.H., S.B., M.S, D.S.P. and L.A.C. contributed to critical revisions to the manuscript; and all authors reviewed and approved the final version of the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

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Check for updates

Possible consequences of the COVID-19 pandemic on the use of biospecimens from cancer biobanks for research in academia and bioindustry

To the Editor —The COVID-19 pandemic highlights the risks associated with the collection and processing of human biospecimens with an unknown status for the coronavirus SARS-CoV-2, whether for diagnostic, therapeutic or research purposes. Biosamples from patients with cancer, which continue to be collected and stored in biobanks during the pandemic, are likely to be infected with SARS-CoV-2. Apart from urine, all types of biospecimens (tissues, biofluids and swabs) and organs are potentially affected[1–6]. SARS-CoV-2 is likely to be inactivated in formalin-fixed, paraffin-embedded samples heated to 56 °C (133 °F)[7]. However, as SARS-CoV-2 survives on various types of surfaces, it is unclear whether this could also apply to cassettes containing formalin-fixed, paraffin-embedded samples[8]. For this reason, and because SARS-CoV-2 is highly infective, it is essential to prepare, store, handle and ship human samples to ensure that the people exposed to the biospecimens not only are familiar with the appropriate safety procedures for handling potentially infectious fluids or tissue samples but also are able and willing to implement them.

Image credit: Christopher Furlong/Getty Images News.

Universal precautions remain the best practice for the control of potential infection from human samples. Therefore, SARS-CoV-2-positive samples should not be marked accordingly, since these precautions apply to all biospecimens (as in the COVID-19 Biospecimen Guidelines of the University of California, San Francisco: https://research.ucsf.edu/covid-19-biospecimen-guidelines). It is mandatory to work at biosafety level 2 (BSL-2) and to use class II biosafety workbenches (https://www.cdc.gov/coronavirus/2019-ncov/lab/lab-biosafety-guidelines.html). Reproductive work (e.g., viral culture, isolation or neutralization tests) should be carried out in laboratories with inward-directed airflow (BSL-3) (https://www.who.int/publications-detail/laboratory-biosafety-guidance-related-to-coronavirus-disease-2019-(covid-19)).

Many cancer biobanks, but also researchers, do not have access to the security facilities mentioned above. Introducing them would be costly, not only for biobanks but also for researchers from academia and biotech/biopharmaceutical companies requesting these samples and the associated clinical data. Under what conditions should biomaterials be collected from patients with cancer during and after the current COVID-19 pandemic? The relevant ethical and legal consequences of the tests must also be clarified. There is a need to specify which COVID-19-related symptoms, such as dry cough or fever, should be recorded, as well as who should record these data and until when. For avoidance of possible cross-contamination, an immediate and

applicable recommendation would be to store separately in biobanks all human samples collected during the COVID-19 outbreak.

Biobanks can identify whether they have an appropriate quality-assurance system in place and demonstrate to end users that this system is being applied, together with standard security guarantees. The quality-assurance system also enables the transparent traceability of the samples requested from academia and from bioindustry. Traceability ultimately allows assessment of the quality of the samples and associated data. However, this comes with financial investment. The present crisis represents a new, critical and urgent challenge in the field of biobanking for cancer research. ❐

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Competing interests

The authors declare no competing interests.

Check for updates

'Test, re-test, re-test': using inaccurate tests to greatly increase the accuracy of COVID-19 testing

To the Editor — Commenting recently on rapid point-of-care tests, US COVID-19 coordinator Deborah Birx said, "We are very quality-oriented. We don't want false positives."[1]

"If they are incredibly accurate, we will work out the quickest way to release them. If they are not accurate, we will not release any of them." echoed UK Chief Medical Officer Chris Whitty[2].

Given the need for testing[3], the end goal is a quick, accurate and cheap test. With scientific innovation, we will, in time, attain this goal. But the best is becoming the enemy of the good. Meanwhile, avoidable infections are growing.

The 'gold standard' RT-PCR test for COVID-19 is highly accurate and reproducible, but is costly (US$125 per test kit, and over $15,000 to set up a processing lab) and slow (4–6 hours of processing time, and a turnaround of 2–4 days, including shipping)[4].

At the other extreme, a Bangladeshi lab has reportedly developed a $3 rapid test kit that gives a result in under 15 minutes (ref. [4]). But the accuracy of such point-of-care tests is questionable.

Smart tactics can help break this tradeoff between cost and quality.

First, consider two quick, cheap and inaccurate tests, each developed by a different lab, and based on detection of a different antibody — or of the same antibody, but via a different method. Suppose each test has a false-negative rate of 30%, and, for simplicity, zero false-positive results. What if both tests were administered to the same person? If the results of the two tests are independent, the chances of obtaining two false-negative results drops to 9% (and to less than 3% if a third independent test with similar characteristics is administered). Figure 1 illustrates this logic, which also applies to false-positive results, for a test with a 50% false-negative rate. (Reports suggest that the tests being considered for large-scale procurement in the UK are in this range[4,5]). As a comparison, since 2017, rapid influenza diagnostic tests cleared by the US Food and Drug Administration have been required to achieve false-negative rates and false-positive rates of below 20% and 5%, respectively, compared with RT-PCR[6].

Second, this recommendation to test and re-test can apply elsewhere too. Consider a test that displays the same false-negative and false-positive rates as the tests above — and is also unreproducible. If a patient is tested twice in succession with this test, the results could vary. Counterintuitively, this lack of reproducibility may be advantageous.

Flipping independent fair coins	Probability of event	Testing a patient repeatedly with independent tests, each with a 50% false-negative rate	Probability of event
Heads		False negative	
Heads, heads		False negative, false negative	
Heads, heads, heads		False negative, false negative, false negative	

Fig. 1 | Why re-testing increases testing accuracy.