Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Study of critically ill patients with COVID-19 in New York City

Cummings and colleagues[1] reported the epidemiology, clinical course, and outcomes of 257 critically ill adults with laboratory-confirmed COVID-19 admitted to two hospitals in New York City. The primary outcome was the rate of in-hospital death, and each patient had at least 28 days of observation. The authors report that, as of April 28, 2020, 101 (39%) of 257 patients had died, 94 (37%) remained hospitalised, four (2%) were transferred to another hospital, and 58 (23%) were discharged alive. Surprisingly, the authors show in figure 1 of their Article[1] a cumulative incidence of in-hospital death of approximately 45% at 28 days. Given the numbers of patients at risk reported below the figure, we have identified that this result is not correct. Apparently, the authors censored the patients discharged alive (n=58) at the day of discharge. This methodological error has led to overestimation of the cumulative incidence of death, and distorted the results of the Cox proportional hazards regression. A fundamental assumption in survival analysis is that censoring should be non-informative—ie, that patients censored have the same survival prospects as those who continue to be followed up.[2] Patients discharged alive should not have been censored; their status should be considered as event-free (ie, alive) throughout the study observation period. This methodological error in the COVID-19 literature is common yet serious.[3] We kindly ask the authors to reanalyse the data, and correctly report the cumulative incidence, and the risk factors of in-hospital mortality, considering the above aspects.

We declare no competing interests.

*Daniele Piovani, *Stefanos Bonovas*
stefanos.bonovas@hunimed.eu

Department of Biomedical Sciences, Humanitas University, Pieve Emanuele, Milan 20090, Italy; and Humanitas Clinical and Research Center, IRCCS, Rozzano, Milan, Italy

1 Cummings MJ, Baldwin MR, Abrams D, et al. Epidemiology, clinical course, and outcomes of critically ill adults with COVID-19 in New York City: a prospective cohort study. *Lancet* 2020; **395:** 1763–70.
2 Bland JM, Altman DG. Survival probabilities (the Kaplan–Meier method). *BMJ* 1998; **317:** 1572.
3 Bonovas S, Piovani D. Compassionate use of remdesivir in Covid-19. *N Engl J Med* 2020; **382:** e101.

Authors' reply

We agree with Daniele Piovani and Stephanos Bonovas that informative censoring, if present, could represent a potential source of bias in the survival analyses in our Article.[1] However, sensitivity analysis suggests that any such bias is likely to be minimal.

To evaluate the effect of assigning different observation times on our regression estimates, we reconstructed our primary Cox model with patients discharged from hospital alive considered event-free throughout the study period, as suggested by Piovani and Bonovas. The generated hazard ratios were consistent with those we previously reported, with older age (adjusted hazard ratio 1·31 [95% CI 1·10–1·56] per 10-year increase), chronic cardiac disease (1·71 [1·05–2·78]), chronic pulmonary disease (3·12 [1·58–6·19]), and higher concentrations of interleukin-6 (1·13 [1·04–1·23] per decile increase), and D-dimer (1·10 [1·01–1·20] per decile increase) associated with mortality in the multivariable model. Regarding the cumulative incidence of hospital mortality at 28 days, reconstruction of this function yielded an estimate of approximately 40%.

In addition, more definitive in-hospital outcomes for the patients included in our cohort are now available. As of July 2, 2020, by which time all patients had at least 90 days of observation, a final in-hospital outcome was known for 250 (97%) of 257 patients. 113 (44%) patients had died (including 96 [47%] of 203 patients who received invasive mechanical ventilation), 133 (52%) patients were discharged alive, four (2%) were transferred to another hospital, and seven (3%) remained hospitalised.

MJC and MRO'D participated as investigators for completed and ongoing clinical trials evaluating the efficacy and safety of remdesivir (sponsored by Gilead Sciences) and convalescent plasma (sponsored by Amazon), respectively, in hospitalised patients with COVID-19. Support for this work is paid to Columbia University.

*Matthew J Cummings, *Max R O'Donnell*
mo2130@columbia.edu

Division of Pulmonary, Allergy, and Critical Care Medicine, Department of Medicine, Irving Medical Center (MJC, MRO'D) and Department of Epidemiology, Mailman School of Public Health (MRO'D), Columbia University, New York, NY 10032, USA; and New York-Presbyterian Hospital, New York, NY, USA (MJC, MRO'D)

1 Cummings MJ, Baldwin MR, Abrams D, et al. Epidemiology, clinical course, and outcomes of critically ill adults with COVID-19 in New York City: a prospective cohort study. *Lancet* 2020; **395:** 1763–70.

Undermining breastfeeding will not alleviate the COVID-19 pandemic

Breastfeeding offers numerous immunological, developmental, and psychological advantages to the infant–mother dyad. The risks posed to infant and maternal health through any loss of support for breastfeeding mean that public health messaging during the COVID-19 pandemic should be careful. As academic leads of human milk banks, we are acutely aware of the importance of understanding the risks posed by novel infectious pathogens in human milk and the mitigation of risk to susceptible infants.

It is therefore essential that published data related to COVID-19 are valid beyond question. In their Correspondence, Rüdiger Groß and colleagues[1] describe the detection of viral particles in human breastmilk, but no cell culture to measure viral viability was done. Furthermore, the likelihood of severe acute respiratory syndrome

Submissions should be made via our electronic submission system at http://ees.elsevier.com/thelancet/

coronavirus 2 (SARS-CoV-2) being introduced into milk samples from the infant saliva via retrograde milk flow was not considered.[2,3] Personal communication with Groß and colleagues confirmed that the infant was fed just before sample collections. SARS-CoV-2 is present in saliva during the first week of signs,[4,5] and the baby showed signs of infection that coincided precisely with the period in which positive milk samplings were collected.

The haste to publish has created possible false narratives associated with major harm (two of the four cited articles in the aforementioned Correspondence[1] were non-peer-reviewed preprints). Since the Correspondence by Groß and colleagues[1] was published, results of larger studies have shown no viable infectious virus in breastmilk and that breastfeeding is probably not a mode of SARS-CoV-2 transmission.[6] Mothers should be supported to establish and continue breastfeeding if they are positive for COVID-19.[7] Epidemiological evidence suggests the harms of breastfeeding cessation disproportionately outweigh the risk of COVID-19 transmission.

NSS declares funding from UK Research and Innovation as a Future Leaders Fellow at Imperial College London; and is a cofounder and non-remunerated trustee of the Human Milk Foundation. All other authors declare no competing interests.

*Natalie S Shenker, Aleksandra Wesolowska, Johannes B van Goudoever, Sushma Nangia, Daniel Klotz
natalie.shenker09@imperial.ac.uk

Department of Surgery and Cancer, Imperial College London, London W12 0HS, UK (NSS); Human Milk Foundation, Rothamsted Institute, Hertfordshire, UK (NSS); Human Milk Bank Foundation, Warsaw, Poland (AW); Regional Human Milk Bank, Holy Family Hospital, Department of Medical Biology, Medical University of Warsaw, Warsaw, Poland (AW); National Human Milk Bank, Amsterdam, Netherlands (JBvG); Universitair Medische Centra, Emma Children's Hospital, University of Amsterdam, Amsterdam, Netherlands (JBvG); National Human Milk Bank, Department of Neonatology, Lady Hardinge Medical College and Kalawati Saran Children's Hospital, New Delhi, India (SN); and Centre for Pediatrics, Division of Neonatology and Paediatric Intensive Care Medicine, Medical Centre and Faculty of Medicine, University of Freiburg, Freiburg, Germany (DK)

1 Groß R, Conzelmann C, Müller JA, et al. Detection of SARS-CoV-2 in human breastmilk. *Lancet* 2020; **395:** 1757–58.
2 Ramsay DT, Kent JC, Owens RA, Hartmann PE. Ultrasound imaging of milk ejection in the breast of lactating women. *Pediatrics* 2003; **113:** 361–67.
3 Hassiotou F, Hepworth AR, Metzger P, et al. Maternal and infant infections stimulate a rapid leukocyte response in breastmilk. *Clin Transl Immunology* 2013; **2:** e3.
4 To KK-W, Tsang OT-Y, Leung W-S, et al. Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: an observational cohort study. *Lancet Infect Dis* 2020; **20:** 565–74.
5 To KK-W, Tsang OT-Y, Yip CC-Y, et al. Consistent detection of 2019 novel coronavirus in saliva. *Clin Infect Dis* 2020; **71:** 841–43.
6 Chambers C, Krogstad P, Bertrand K, et al. Evaluation for SARS-CoV-2 in breastmilk from 18 infected women. *medRxiv* 2020; published online June 16. https://doi.org/10.1101/2020.06.12.20127944 (preprint).
7 WHO. Breastfeeding and COVID-19 for health care workers. May 12, 2020. https://www.who.int/docs/default-source/maternal-health/faqs-breastfeeding-and-covid-19.pdf?sfvrsn=d839e6c0_5 (accessed May 28, 2020).

Authors' reply

In the ongoing COVID-19 pandemic, questions regarding possible methods of virus transmission, including the safety of breastfeeding by mothers who are infected, are of great importance. We reported[1] the detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA (not viral particles, as incorrectly stated by Natalie Shenker and colleagues) in consecutive milk samples from an infected mother and interpreted our findings with the greatest caution. In particular, we did not claim that SARS-CoV-2 is transmitted via contaminated breastmilk or that breastfeeding should be discontinued by mothers with the infection. Instead, we emphasised that more research is required.

At the time of writing, there are eight other reports of SARS-CoV-2 RNA detection in milk samples,[2] in several cases at multiple timepoints during the course of the infection.Consequently, the now-published review articles that we cited in our Correspondence,[2] which summarised the peer-reviewed publications at the time of submission, are already outdated. In most of these studies, care was taken to avoid environmental contamination (eg, by breast disinfection or washing if feeding occurred before sampling), as also indicated in our Correspondence.

Shenker and colleagues suggest that the detection of SARS-CoV-2 RNA in breastmilk might be the result of retrograde milk flow of infant saliva containing the virus. We feel that this is unlikely; there is no experimental evidence that any virus might be transferred by this route in humans. On the contrary, SARS-CoV-2 contamination from the infant has been excluded in three studies[3–5] reporting viral RNA in milk from mothers, where the infant was either continually COVID-19-negative or separated from the mother, or both. Generally, there are examples of viruses (eg, HIV and human cytomegalovirus) that are shed into breastmilk and might lead to an infection of the neonate, whereas other viruses are shed but typically pose no risk for vertical transmission.[6] Establishing whether either process is relevant for a novel human pathogen requires careful examination.

So far, no cases of SARS-CoV-2 transmission via breastfeeding have been reported, and it has not been established if the virus in this body fluid is infectious. Thus, WHO suggests continuing breastfeeding upon maternal SARS-CoV-2 infection. We agree with this recommendation but feel that further research on this topic to protect neonates and to reassure nursing mothers is highly warranted.


Nastasic/Getty Images

RG declares funding via a scholarship from the International Graduate School in Molecular Medicine of Ulm University (Ulm, Germany). JAM declares funding from the German Research Foundation; and grants from the Ministry of Science, Research, and the Arts of the State of Baden-Württemberg. FK declares funding from the German Federal Ministry of Education and Research for the project Restrict SARS-CoV-2 and the German Research Foundation for the project CRC1279; and grants from the Ministry of Science, Research, and the Arts of the State of Baden-Württemberg. JM declares funding for the EU 2020 Horizon project Fight-nCoV and the German Research Foundation for the project CRC1279; and by grants from the Ministry of Science, Research, and the Arts of the State of Baden-Württemberg. FR and CC declare no competing interests.