International Journal of Epidemiology, 2020, 1730–1732
doi: 10.1093/ije/dyaa139
Advance Access Publication Date: 23 August 2020

Letters to the Editor

Age-and sex-adjustment and the COVID-19 pandemic – transformative example from Italy

Valentina Gallo [1,2,3]* Paolo Chiodini,[4] Dario Bruzzese [5] and Raj Bhopal[6]

[1]Campus Fryslân, University of Groningen, Leeuwarden, The Netherlands, [2]Institute of Population Health Science, Queen Mary University of London, London, UK, [3]Department of Medical Statistics, London School of Hygiene and Tropical Medicine, London, UK, [4]Medical Statistics, University of Campania "L. Vanvitelli", Naples, Italy, [5]Medical Statistics, University of Naples "Federico II", Naples, Italy and [6]Usher Institute, University of Edinburgh, Edinburgh, UK

*Corresponding author. University of Groningen, Fryslan, Wirdumerdijk 34, 8911 CE Leeuwarden, the Netherlands. E-mail: v.gallo@rug.nl

Accepted 7 July 2020

The COVID-19 pandemic is causing hundreds of thousands of deaths worldwide.[1] Monitoring the pandemic to compare countries and regions is of paramount importance to understand the infection dynamics and to prepare health care systems to face its consequences. To date, it has been impossible to compare data coming from different countries and regions partly because of a failure to apply basic epidemiological principles (e.g. adjustment for age), with emphasis on the numbers of cases.[2] Interpreting numbers of cases (and the rates derived from them, e.g. case-fatality ratio) is problematic given that these are heavily dependent on variable policies about testing for COVID-19 at population level, leading to potential underreporting, especially of people showing few or no symptoms. Mortality, on the other hand, does not suffer from difference in testing and case finding; however it is potentially subject to misclassification too, whenever its definition differs from that recommended by WHO: deaths for which the immediate or underlying cause of death can be reasonably ascribed to COVID-19.[3] China[4] first reported that mortality from COVID19 is strongly associated with age and steeply increases with age, with higher rates in males than females. Therefore, not adjusting for age and sex undermines meaningful comparison between populations, especially when the age structure of populations differs markedly, such as for comparisons between low- and middle-income countries with high-income countries.

To illustrate the importance of this principle, data on age and sex distribution of the first 4993 COVID-19 deaths in Italy, recorded until 23 March 2020,[5] were used to calculate age- and sex-standardized figures in each Italian region. Assuming that the age- and sex-mortality rates remain constant over time, each data point can be interpreted as a standardized mortality trend ratio (SMTR), i.e. the ratio between observed deaths in a region on a specific day, over the expected deaths if that region had the same mortality as the Italian average on 23 March 2020 x 100. In Figure 1, the cumulative number of deaths by region is reported in panel A, and the daily SMTRs calculated on the cumulative deaths relative to the same period are reported in panel B.

Lombardy is the region rhat experienced the highest death toll by far, reaching 16 112 death by the end of May 2020. Emilia Romagna and Piedmont reached only about 4000 deaths (4114 and 3864, respectively), followed by the other regions all below 2000 deaths. However, once the underlying age- and sex-structure of the population was accounted for, the picture changed. Lombardy remained the region experiencing the greatest excess mortality with SMTRs almost 20 times higher (SMTR = 1968) than the national average (on 23 March); Valle d'Aosta (SMTR = 1323) was the second region for mortality followed by Emilia Romagna (SMTR = 1034) and Trentino-Alto Adige (SMTR = 924).

At the beginning of April, Marche experienced almost double the SMTR compared with Piedmont, but by the beginning of May the relative mortality between the two regions reversed. Veneto, among the morthern regions, was comparatively less affected with the SMTR only four times higher than the national average. Also, it emerged more clearly which regions were most successful in 'flattening the curve' (e.g. Valle D'Aosta, Trentino-Alto Adige, Marche) as opposed to those regions which were still experiencing COVID-19-related mortality, although at a lower rate of increase (e.g. Lombardy, Piedmont, Liguria).

Age- and sex-standardization is essential for monitoring the pandemic in space and over time. Our method has the limitations of assuming that the age- and sex-specific mortality rates remain constant over time (which we are addressing in ongoing work), and that COVID-19 related mortality is coded consistently across regions. However, if every country provided the WHO with the simple data required for calculating the SMTRs, the monitoring of trends across regions and over time

© The Author(s) 2020. Published by Oxford University Press on behalf of the International Epidemiological Association.
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.

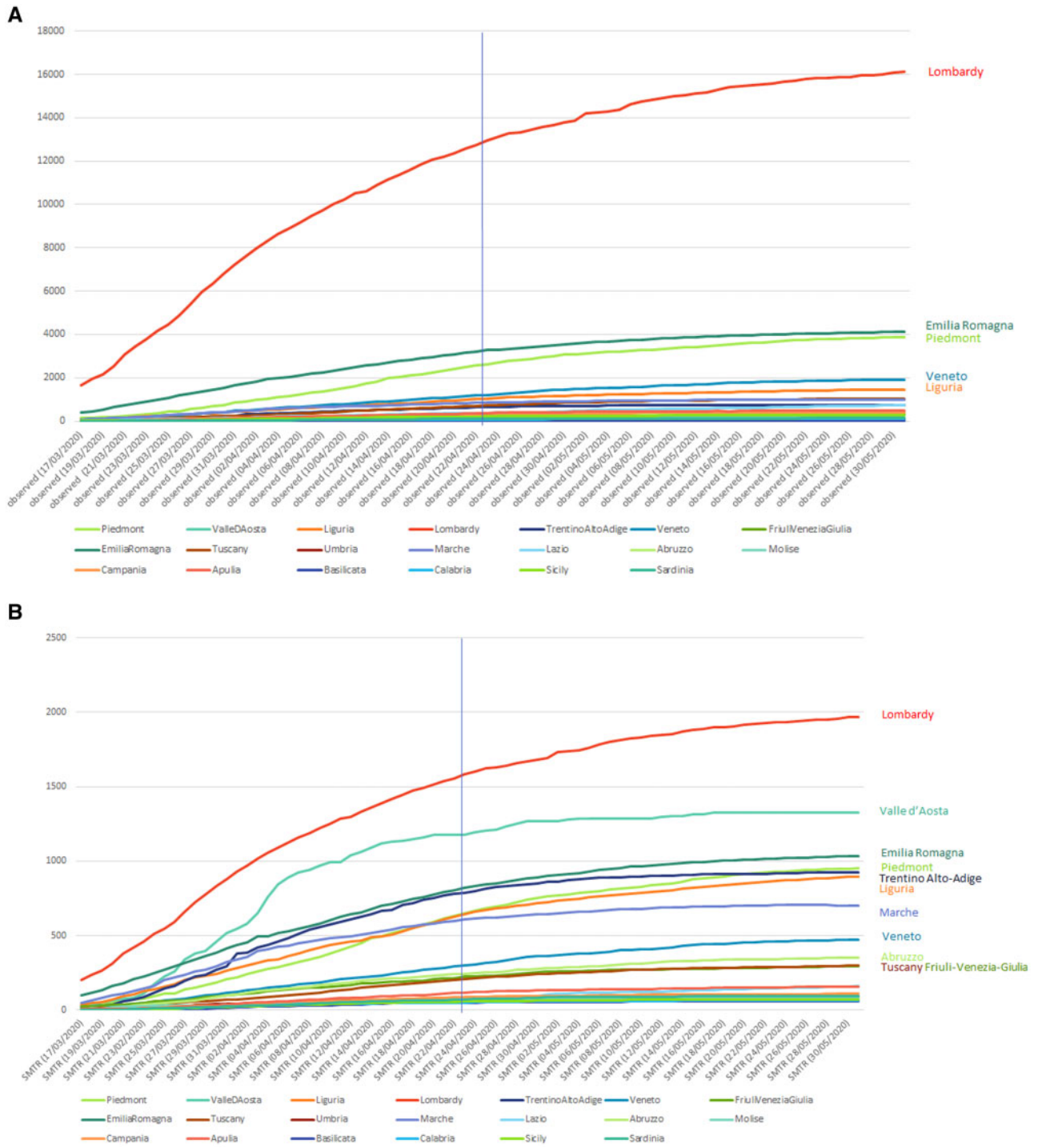

Figure 1 Absolute number of deaths by region (panel A) and Standardized Mortality Trend Ratios (SMTR) comparing observed vs. expected cases based on the age and sex distribution of the first 5019 Italian cases on 23 March 2020, and the age and sex structure (panel B) by region from 17 March to 3 May 2020 (vertical full line: 23 March 2020, the data for which were used for standardization)

would convey realistic approximations with minimal requirement for data, once age- and sex-specific COVID-19 mortality data from adequately representative populations were available.

Conflict of interest

None declared.

References

1. Zhang X. Epidemiology of COVID-19. *N Engl J Med* 2020;**382**:1869.
2. Bhopal R. COVID-19 worldwide: we need precise data by age group and sex urgently. *BMJ* 2020;**369**:m1366.

3. WHO. *International Guidelines for Certification and Classification (Coding) of COVID-19 as Cause of Death*. Geneva: WHO, 2020.
4. Verity R, Okell LC, Dorigatti I *et al*. Estimates of the severity of coronavirus disease 2019: a model-based analysis. *Lancet Infect Dis* 2020;**20:**669–77.
5. Italian National Institute of Health . Epicentro. *Epidemia COVID19 Aggiornamento Nazionale 23 Marzo 2020 [Epicentro. COVID-19 pandemic National update 23 March 2020]*.https://www.epicentro.iss.it/coronavirus/bollettino/Bollettino-sorveglianza-integrata-COVID-19_23-marzo%202020.pdf (9 April 2020, date last accessed).

Can the implementation of electronic surveys with quick response (QR) codes be useful in the COVID-19 era?

International Journal of Epidemiology, 2020, 1732–1733
doi: 10.1093/ije/dyaa170
Advance Access Publication Date: 23 October 2020

Andrea Faggiano [1]* and Stefano Carugo[2]

[1]Medical Student, School of Medicine, University of Milan, Milan, Italy and [2]Heart and Lung Department, San Paolo Hospital, ASST Santi Paolo and Carlo, University of Milan, Italy

Corresponding author. University of Milan, Via della Pace, 7, Brescia, Milan 25122, Italy. E-mail: andreafaggiano95@gmail.com

The world is facing a health crisis with the outbreak of a novel coronavirus-caused respiratory disease (COVID-19). Strong measures (e.g. lockdown) and restrictions to limit the spread of infection have been adopted worldwide. Hand washing, maintaining physical distance (1–2 m) and using protective masks are the main measures recommended by the World Health Organization (WHO)[1] and seem to be effective,[2] but they cannot be maintained forever.

Self-administered electronic surveys are an important data collection tool in clinical practice and epidemiology. Being less resource-intensive than other data collection methods, they are ideal for achieving wide geographical population coverage and for dealing with sensitive topics. Electronic surveys can be administered in various ways. E-mail-based surveys have existed since 1986[3] and website-based surveys since the early 1990s,[4] but both have limitations and low response rates. Email-based surveys require users to have an email address, and users may ignore e-mails flagged as spam or be reluctant to complete surveys received via e-mail. For website-based surveys, people may have trouble finding the correct website and be unlikely to remember and correctly enter a long web address.

In recent years, technology advances have allowed electronic surveys to be implemented using mobile apps on smartphones or tablets. However, to use these tools, people must remember the name of the app and be familiar with using the app store.

Quick response (QR) codes can also be used to implement electronic surveys and may prove useful in the COVID-19 era. A QR code is a two-dimensional barcode that can be read by the camera of smartphones or tablets to connect instantly to websites, including surveys[5] (see Supplementary material, available as Supplementary data at *IJE* online). QR codes solve the challenges related to app/website/e-mail surveys by directing the person to the correct electronic survey without any need for URL entry, app store/web searching or mental recollection.

Creating a QR code survey is simple. The finalized online questionnaire is associated with a link that is convertible into a QR code through a free online application. Quick access to the online survey is then granted to the user by scanning the QR code with a smartphone or tablet camera. Although many other machine-readable codes (e.g. barcodes) exist, QR codes are more appropriate in health care settings because people can use them without needing to download specific scanning apps or to purchase a barcode scanner.

QR code technology is not yet widespread in the medical world, but it is gaining attention. Mira *et al.* showed that an app able to transform the QR codes on medication packaging into verbal instructions can improve elderly patients' compliance with pharmacological therapy.[6]

It is crucial to distinguish between 'open' electronic surveys, which are open to anyone to complete, and 'targeted' surveys, which are issued to specific people and automatically linked to each person's identity. Targeted surveys are sometimes conducted by giving the user a unique number or text code; another element that must be remembered and entered correctly. This problem can be solved by QR code technology, as the QR code can either direct everyone to an open survey or be unique to a specific user for a targeted survey.

During the COVID-19 pandemic, we believe that QR code-based surveys could be especially helpful to conduct large medical cross-sectional studies and to simplify clinical practice. Following are three potential applications of this technology in the COVID-19 era.

To limit physical contact and interaction time between doctor and patient

During this pandemic, all health care workers must wear personal protective equipment, which complicates interactions with patients. Collecting patients' information and medical history requires a longer time and use of tools (i.e. pen and paper) that could facilitate infection. As already experienced at the Hospital Universitario Gonzalez (Mexico),[7] the use of a survey accessible via QR code could reduce doctor–patient interaction time. Posters containing a QR code linked to a survey that collects patients' data (e.g. symptoms, risk factors and medical history) can be placed in the waiting rooms of emergency services and general practitioners' clinics. This would

© The Author(s) 2020; all rights reserved. Published by Oxford University Press on behalf of the International Epidemiological Association