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Commentary

In the past few months, there has been a huge amount of research around COVID-19 pandemic. This research is usually fast and often based on data sources whose quality has not been assessed properly, and, in some cases, they even suffer from a poor statistical quality. In addition, technologies are used in various ways to address important research questions. Certainly, the urgency to deal with the pandemic requires timely statistical analysis to inform policy-makers. However, we strongly believe that statistical quality of all the estimates and analysis should not be neglected.

We would like to thank the authors of the article titled "Critical Limitations of Digital Epidemiology: Why COVID-19 Apps Are Useless" for their interesting and well-articulated contribution on the problems of Digital Epidemiology in the COVID-19 pandemic. This article generates an important debate that must be considered by policy-makers and in particular by national health systems in the fight of COVID-19.

The authors criticise the use of devices, such as smartphone contact apps, fitness trackers, and apps for voluntary reporting to monitor or limit the spread of COVID-19. This crucial topic is evaluated from a survey statistics as well as official statistics point of view. In particular, the article adopts the Total Survey Error (TSE) framework to investigate the problems arising from those techniques.

The article begins with a very good introduction on the recognition of the important issues related to devices in survey statistics and methodology that are studied in the literature. Then, the use of Digital Epidemiology in the context of COVID-19 is discussed. Specifically, the authors treat the issues of missing data, coverage of the target population, selectivity, and more broadly, the possibility to carry out statistical inference. Regarding the use of fitness trackers, the authors also point out another important problem that should be investigated i.e. measurements problems arising from this data collection mechanism.

Furthermore, the authors discuss in detail the limitations of digital epidemiology with a particular attention to COVID-19 in Germany. First, the problem of coverage is highlighted. The authors focus mainly on age groups and socioeconomic status. We remember here the problem of care homes that have been particularly vulnerable in this pandemic. Moreover, we believe that a further coverage problem might be related to ethnic groups. Information on ethnic minorities would be very helpful for policy-makers, indeed in the UK and the US ethnic minority populations seem to be disproportionately affected by COVID-19 (Khunti, Singh, Pareek, & Hanif, 2020). We want also to stress that ethical issues connected with the use of digital epidemiology might influence the coverage of these tools as well. Some people might be reluctant to share their information for privacy reasons, and some people may voluntarily hide some movements by simply turning off their Bluetooth.

The authors also discuss some possible alternatives for COVID-19 population research in Germany. Interestingly, they stress important recommendations from survey method-

ology literature in the COVID-19 data collection problem. The authors mention excellent points regarding the necessity of randomly selected samples. Indeed, some European countries have already started to select random samples representative for the national population. Good examples of these strategies are the Italian Statistical Institute and the Office for National Statistics (UK) which launched some sample surveys based on probabilistic experiments. Moreover, Understanding Society in the UK is conducting an interesting survey on the participants' experience during COVID-19. We are not totally convinced that "a small population survey" could be adequate "to describe changes in attitudes and reported behaviour due to COVID-19", as the authors stated in Section 5. Indeed, this survey would require a complex survey design with representativeness of the sample at subnational levels. Therefore, the sample should not be small to avoid extremely large variances in the estimates for sub- national areas. Indeed, COVID-19 has an important geographic distribution component in its aspects.

A crucial recommendation highlighted at the end of the article is the following: "This survey should not be implemented as a web survey to avoid bias due to health, age, and education". The literature has widely discussed this issue and we want to stress again that ethnic groups as well as characteristics related to economic well-being may affect web surveys.

The numerous issues arising from data collected via the technologies mentioned in this article may be approached in different ways. The paper correctly discusses Bethlehem and Biffignandi (2012) model, and thus the TSE framework. We agree with the authors that Digital Epidemiology has important limitations in the COVID-19 pandemic analysis. However, can some information collected by those be included and integrated with data coming from probabilistic experiments? For example, the issue of data integration of non-probability samples with probability samples has been studied in the literature. Also, can survey calibration using auxiliary information help in this context? In addition, how can measurement error issues be tackled?

We really hope that this article will be read by policy-makers that diffuse information on COVID-19 every day and especially by those governments that are planning to adopt apps to investigate aspect of COVID-19. To contrast this pandemic, we need organised data collection plans to provide accurate and precise estimates related to the multiple aspects of the phenomena.

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