Outbreak, Surveillance, Investigation & Response (OSIR) Journal
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Epidemiological Workforce for Current and Future Pandemic Control

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Abstract

Epidemiology is the frontline combatant discipline against COVID-19. Human's knowledge and technology evolve in parallel with the emergence of this and other coming pandemics. Modern epidemiologists must have a glimpse at various relevant scientific fields and employ them to tackle the problems. In order to shape up such competence for the new generation epidemiologists, the educational institutes must critically review the training curricula.

Introduction

Interacting with the current coronavirus disease 2019 or COVID-19 has been continuingly giving us new lessons all the time. The highly contagious agent, SARS-CoV-2 virus keeps on spreading as well as evolving. Human beings, the target host, keep on gathering data, developing new technology and doing large-scale experiments. While the host cannot evolve quickly enough to escape the catastrophe, the complex immune system would have change susceptibility level to the infection.

Epidemiology is the frontier discipline to get information about the pandemic, gain insight in transmission patterns, identifying risk factors for infection, severe illness and death. Finally, the discipline evaluates all the measures to contain, control and get rid of the problems through vaccination, therapeutics and non-pharmacologic interventions. In response to the unprecedented swiftly rising and large scale of damage to the global population, we need a larger number and better (new) quality of epidemiologists to tackle the problems.

Rapidity of the Spreading

The frightening characteristics of COVID-19 include its highly effective air-borne-cum-droplet transmission, and high case-fatality rate. It also has short latency period of only a few days.[1] With current rate of transportation, the disease has become pandemic in a short period and started killing all walks of lives just a few weeks after. Learning from SARS outbreak, the only effective main measure in the early phase was social distancing, or 'lockdown' on a larger scale. This solution has however disrupted the global economy and livelihood. The rapid increase of burden has also paralyzed health services in many countries, causing massive excess deaths among those who were sick from non-COVID diseases. SARS-CoV-2 is extra virulence for the elderly and those with chronic non-communicable diseases. The pandemic thus seems to target the global weaknesses resulted from demographic and epidemiological transition.

HIV/AIDS–the Unnoticed and Unfinished Pandemic

HIV is another on-going pandemic. It has been indirectly de-emphasized by the emergence of COVID-19. HIV has been less alarming because of the fact that its transmission is not airborne, which is somewhat avoidable by the upper class. However, the incubation period of HIV is much longer making it impossible for the transmission to be controlled by quarantine or isolation. For the past four decades, HIV/AIDS has killed over 36 million people (nearly seven times of that from COVID-19). A slightly higher number of people (37.7 million) are living with HIV.[2] The damage from HIV is longer lasting than that from COVID-19, which has killed five some million.[3] Another worse part of HIV/AIDS is that there has no effective vaccine and therapeutic cure is still limited.

Opportunity for Improvement of Prevention and Control Measures

Sciences and technology in the COVID-19 period have been developed very far from that in 1918, the period of the Spanish flu. From the turning of this century, bio-technology on '-omics', such as genomics,

transcriptomics, microbiomics has made advancement in an exponential speed. During the SARS (much smaller) pandemic in 2002, it took weeks for scientists to identify the causative agent and months to get the coronavirus genetic sequence. For the COVID-19, it took only a few days to get the whole genetic sequence of this SARS-CoV-2 openly published.[4] Within a few days after, the diagnostic tests were developed. Having the proper diagnostic tools has helped the health system to identify and stop the infected persons who, otherwise, would be spreading the disease.

Knowledge on genetic sequence also led to quick designs on nucleic acid vaccine, which was later shown to be effective within around one year after the first case was diagnosed.

The other promising technology that helps contact tracing, a routine epidemiological work, is the advanced data science. A number of East Asian countries such as South Korea, Singapore, Taiwan of China have employed this technology to trace and track suspects who were potentially infected.[5-7] This linked with notification to the person and the systems, which could stop further disease spread. However, the evolution of the coronavirus is smarter than the development of this technology. The new variant (delta) spread too fast for the intelligent system to stop them. Detection of the cases was always some steps behind the successful spread of infection, especially among the majority asymptomatic and pre-symptomatic persons.

What have We Learned from COVID-19 Pandemic regarding Human Resources for Disease Control

This pandemic has been telling us that we need multi-disciplines to help tackling the problems. To coordinate the team, epidemiologists, the core members of the control team, must be equipped with broader knowledge than before. They must have some good ideas about how the experts in other disciplines can contribute in the disease control. While people from other disciplines must get acquainted with epidemiological concepts and jargons, the epidemiologists must reciprocally counter-learn from them.

Revision of Existing Curriculum and Designing a Refresher Course

COVID-19 pandemic has taught us a lot of lessons. When the level of burden has decreased to some extent, we need a mindful retreat to reflect what we have learned and how we should go further. This will help us to handle the current and the future pandemic more properly.

Based on the results of the retreat to come, a training program or a training institution should do at least two related things: revision of the training course for the trainees and create a refresher course for the practitioner of epidemiology. One of them is Data Sciences.

Suggested Contents on Data Sciences to be Included

Data Sciences is a part of computational sciences, which make use of robust quantitative reasoning, analysis and development. It grows steadily both in theory and in technological development. Many theories are testable only when suitable Big Data and computing power are available.

In the past, field epidemiological data are mainly from a survey or an outbreak investigation. Currently, epidemiological data are routinely generated by registration and follow up of the mass population under the control measures. As mentioned above, contact tracing can be enhanced by the information technology that can trace and track individuals' activities. In Thailand, in the active vaccination period, there are at least one hundred thousand vaccinations entered into the vaccination data set per day. The same individuals need to be re-immunized or booster with the same or different kinds of vaccines. They need to be followed up and linked to the registry of case records to evaluate vaccine protective effectiveness.

Epidemiologists who are involved with these data, which are just small examples, are playing the role of data stewards. Their duties include to ensure that the data are properly designed and collected in an analyzable fashion. Then, another or the same group of epidemiologists must be involved in data analytics. Epidemiological researchers should direct the objectives of the analysis, interpret the results and present and discuss with the policy makers. On the way, they should grasp the principle of data visualization, which is important in design of dashboard to the policy makers and people to follow up the situation of the subgroups of interest. Basic epidemiological training that they already have, should enable them to be aware of the limitation of the results either from bias or confounding and etc.

Modern epidemiologist should also have a glimpse at the other fashionable part of data sciences such as the '-omics', machine learning and artificial intelligence. Unlike the above mentioned parts on epidemiological Big Data, it is not essential to dip most of the new batch of epidemiologists profoundly into these trendy subsets of data sciences. It is however essential to know when to employ these technologies under what conditions.

Conclusion

COVID-19 has taught us a lot of lessons. The way to learn the lessons together is to have a retreat at a proper point of time. New generations of epidemiologists need novel ideas and state-of-the art sciences and technology to support their work to tackle new problems. This must be organized by the training institutions.

Suggested Citation

Chongsuvivatwong V. Epidemiological workforce for current and future pandemic control. OSIR. 2021 Dec;14(4):149–51.

References

1. Xin H, Li Y, Wu P, Li Z, Lau EHY, Qin Y, et al. Estimating the latent period of coronavirus disease 2019 (COVID-19). Clin Infect Dis. 2021 Aug 28:ciab746. doi: 10.1093/cid/ciab746
2. The Joint United Nations Programme on HIV/AIDS. Global HIV & AIDS statistics—Fact sheet [Internet]. Gevena: The Joint United Nations Programme on HIV/AIDS; 2021 [cited 2021 Dec 10]. <https://www.unaids.org/en/resources/fact-sheet#:~:text=680%20000%20%5B480%20000%E2%80%931.0,the%20start%20of%20the%20epidemic>.
3. Worldmeter. Reported cases and deaths by country or territory [Internet]. [place unknown]: Worldmeters; [cited 2021 Dec 10]. <https://www.worldometers.info/coronavirus/#countries>
4. Wang H, Li X, Li T, Zhang S, Wang L, Wu X, et al. The genetic sequence, origin, and diagnosis of SARS-CoV-2. Eur J Clin Microbiol Infect Dis. 2020 Apr 24;39:1629-35. doi: 10.1007/s10096-020-03899-4
5. Kang SJ, Kim S, Park KH, Junmg SI, Shin MH, Kweon SS, et al, Successful control of COVID-19 outbreak through tracing, testing, and isolation: Lessons learned from the outbreak control efforts made in a metropolitan city of South Korea. J Infect Public Health. 2021 Sep 21;14(9):1151-4. doi: 10.1016/j.jiph.2021.07.003
6. Government Technology Agency. TraceTogether [Internet]. Singapore: Government of Singapore; c2020 [updated 2021 Mar 11, cited 2021 Dec 10] <https://www.tracetogether.gov.sg/>
7. Jian SW, Cheng HY, Huang XT, Liu DP. Contact tracing with digital assistance in Taiwan's COVID-19 outbreak response. Int J Infect Dis. 2020 Dec;101:348-52. doi: 10.1016/j.ijid.2020.09.1483