


















# Charting the path forward in Southeast Asia: Learning from the COVID-19 vaccination challenges in six ASEAN countries

Jolene Yin Ling Fu<sup>1</sup> , Muhammad Harith Pukhari<sup>1</sup>, Kristine Alvarado-Dela Cruz<sup>2</sup> , Amin Soebandrio<sup>3</sup> , Le Van Tan<sup>4</sup> , Watsamon Jantarabekjukul<sup>5</sup> , Anak Agung Sagung Sawitri<sup>6</sup> , Napaporn Chantasrisawad<sup>5</sup> , Sidney Yee<sup>7</sup>, Ruifen Weng<sup>7</sup> , Raghav Sundar<sup>8,9</sup> , Chee Wah Tan<sup>10</sup> , Lin-Fa Wang<sup>10</sup> , I-Ching Sam<sup>1</sup> , Barnaby Young<sup>11,12,13</sup> , I Nyoman Sutarsa<sup>6,14</sup> , Yoke Fun Chan<sup>1</sup> ; on behalf of the Association of Southeast Asian Nations (ASEAN) Sero-Surveillance Study on COVID-19 vaccines (ASSeSS) Working Group

<sup>1</sup>Department of Medical Microbiology, Faculty of Medicine, Universiti Malaya, Kuala Lumpur, Malaysia

<sup>2</sup>Microbiology Department, Laboratory Research Division of the Research Institute for Tropical Medicine, Muntinlupa City, Philippines

<sup>3</sup>Department of Microbiology, Faculty of Medicine, University of Indonesia, Jakarta, Indonesia

<sup>4</sup>Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam

<sup>5</sup>Thai Red Cross Emerging Infectious Diseases Clinical Centre, King Chulalongkorn Memorial Hospital, Bangkok, Thailand

<sup>6</sup>Department of Public Health and Preventative Medicine, Faculty of Medicine, Udayana University, Bali, Indonesia

<sup>7</sup>Diagnostics Development (DxD) Hub, Agency for Science, Technology and Research (A\*STAR), Singapore

<sup>8</sup>Department of Haematology-Oncology, National University Cancer Institute, Singapore

<sup>9</sup>Yong Loo Lin School of Medicine, National University of Singapore, Singapore

<sup>10</sup>Duke-NUS Medical School, Programme in Emerging Infectious Diseases, Singapore

<sup>11</sup>Singapore Infectious Diseases Clinical Research Network (SCRN), National Centre for Infectious Diseases, Singapore

<sup>12</sup>Department of Infectious Diseases, Tan Tock Seng Hospital, Singapore

<sup>13</sup>Lee Kong Chian School of Medicine, Nanyang Technological University Singapore, Singapore

<sup>14</sup>School of Medicine and Psychology, College of Health and Medicine, The Australian National University, Canberra, Australia

**W**ith a population exceeding 630 million (8% of the global population), the ten member states of the Association of Southeast Asian Nations (ASEAN) accounted for approximately 61 million (7.9%) of global COVID-19 cases and 808 166 (11.6%) of deaths, with case fatality rate (CFR) of 1.3% by the end of 2023 [1]. The actual figures are certain to be at least several-fold higher, with estimates suggesting

The global response to the COVID-19 pandemic has highlighted the importance of the 3P's – people, partnership, and policy within ASEAN.

an excess mortality of 1.2 million in the first two years of the pandemic. Despite the World Health Organization's (WHO) 4 May 2023 declaration that coronavirus disease 2019 (COVID-19) is no longer a public health emergency, it remains a global threat. The global response to the COVID-19 pandemic has highlighted the importance of collaborative networks within ASEAN, particularly in scientific information, technology and research exchange, resource mobilisation, and capacity building. While individual ASEAN country implemented responses with varying degrees of success, a unified and cohesive regional approach is crucial for

early variant detection, efficient resource allocation, and evidence-based public health policies. Without collaborative efforts, the collective regional response weakens, jeopardising the region's preparedness for future health crises.

In response to COVID-19, ASEAN launched several initiatives, including the ASEAN Comprehensive Recovery Framework (ACRF) [2], the ASEAN Travel Corridor Arrangement Framework, the ASEAN COVID-19 Response Fund, and the activation of the ASEAN Coordinate Council Working Group on Public Health Emergencies (ACCWG PHE) [3]. Although these initiatives contributed to mitigating the health, social, and economic impacts of the pandemic, the absence of a scientific network for COVID-19 serology surveillance in the ASEAN region hindered a thorough understanding of population susceptibility and the effectiveness of COVID-19 vaccination in the region. In May 2021, the ASEAN Committee of Science, Technology, and Innovation (COSTI) endorsed the establishment of the ASEAN Sero-Surveillance Study on COVID-19 vaccines (ASSeSS) Working Group, involving researchers from six ASEAN countries: Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam. The ASSeSS Working Group focused on evaluating vaccine efficacy, specifically monitoring antibody responses and immunoglobulin G avidity maturation over time. The local scientific data on the effectiveness of the various COVID-19 vaccines used in the region would serve as a guide in planning public health strategies in ASEAN. This article explores gaps in ASEAN's scientific collaboration during the COVID-19 pandemic and highlight the importance of regional research networks such as ASSeSS for pandemic preparedness.

At the beginning of the COVID-19 pandemic, all member countries of the ASSeSS Working Group were spared from the explosive outbreaks observed in Western countries due to the timely implementation of strict public health and social measures, social distancing, border closure, and movement restrictions [4]. Experiences with previous outbreaks such as SARS-CoV in 2003 and bird flu (H5N1) in 2004, and a generally high level of trust in governments facilitated implementation and compliance with these preventative measures [5]. These strategies became less effective due to the emergence of highly transmissible variants of concern with relatively high rates of severe illness which threatened to overwhelm health care systems [6]. The strategies in ASEAN subsequently needed to pivot from containment measures to a large-scale vaccination programme.

The ASEAN Sero-Surveillance Study on COVID-19 vaccines (ASSeSS) Working Group will champion pandemic preparedness by building basic research to translational research during peacetime.

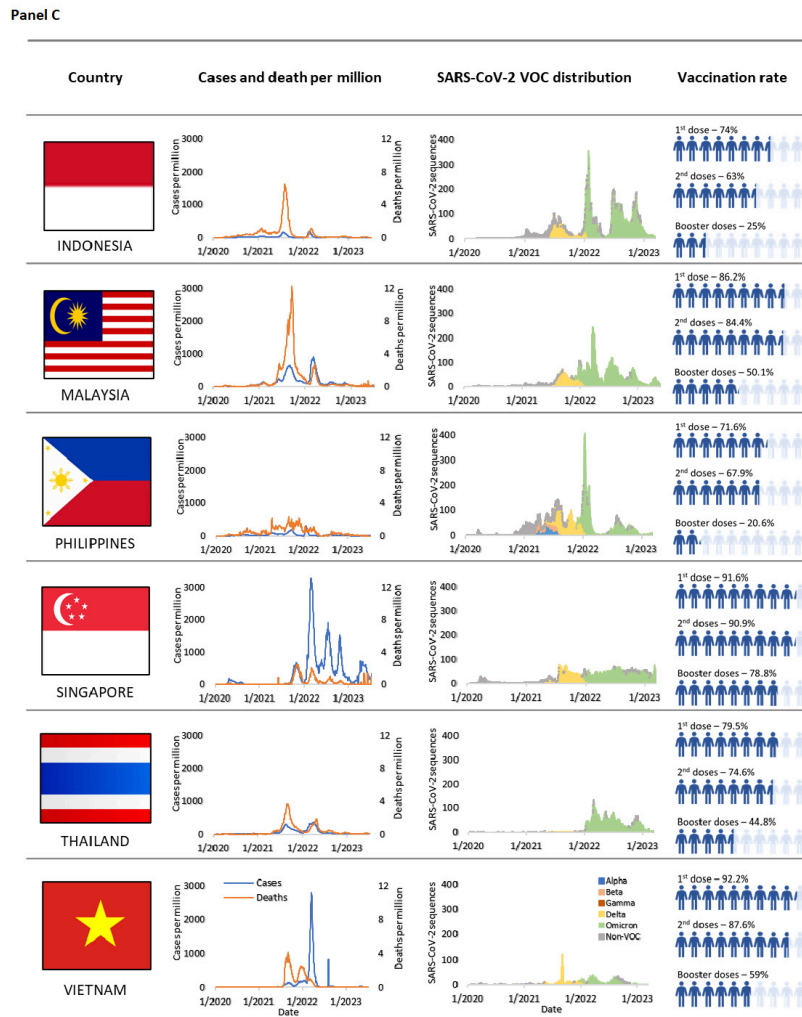
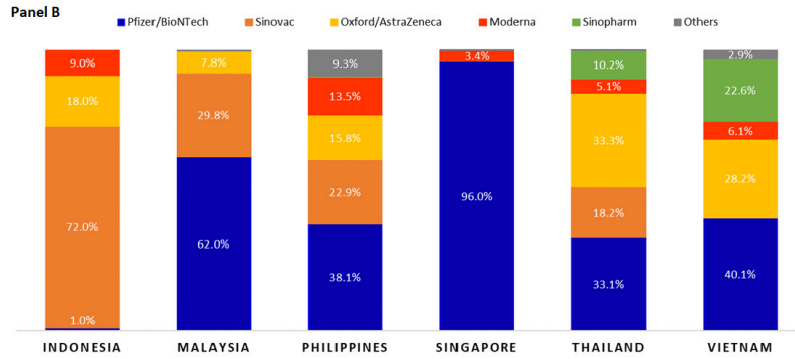
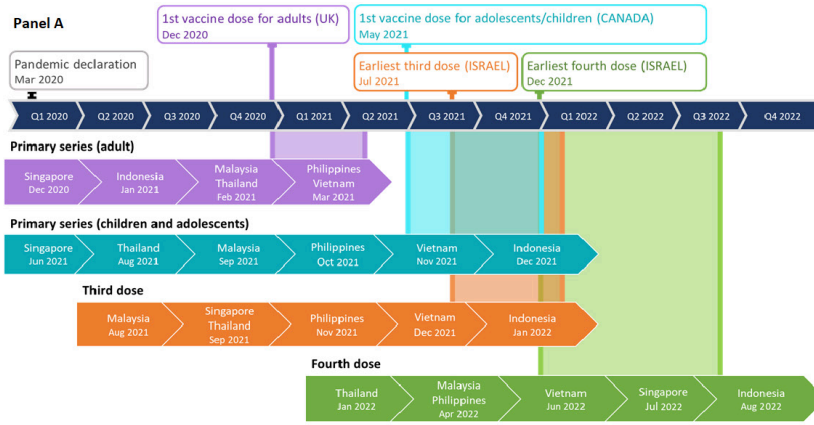
Due to limited or non-existent local vaccine production, ASEAN heavily relies on vaccine imports from the global marketplace, restricting choices of vaccines. In contrast, Western countries like the European Union pooled resources, shared risks, and coordinated efforts for a collective and equitable vaccination response, displaying a more unified approach than the initially independent ASEAN efforts. ASEAN strategies included direct purchase from suppliers (e.g. Singapore and Malaysia with Comirnaty Pfizer/BioNtech), bilateral donation (e.g. Vietnam and Indonesia; China donating and supplying Indonesia with CoronaVac (Sinovac) since December 2020), regional initiatives (e.g. Quad Vaccine Partnership mainly for Indonesia), and multilateral platforms (e.g. the COVID-19 Vaccines Advance Market Commitment (COVAX AMC) initiative

donating vaccines to Cambodia, Indonesia, Laos, Myanmar, the Philippines, and Vietnam) [7]. Only recently some countries have begun increasing their local production capacity, for example, Indonesia with its 'Merah Putih' vaccine development. Despite the limitations, ASSeSS member countries have managed to procure vaccines at a competitive timeline compared to countries from other regions (Figure 1, panel A).

Logistical and infrastructural challenges related to vaccine distribution, storage, and transportation posed a great challenge to ASEAN at the beginning of the vaccination campaign. In the first six months of 2021, less than 5% of the ASEAN population was vaccinated. In addition, geographical, political and socioeconomic disparities contributed to an inequitable distribution of the vaccine in the region. These issues were especially prominent in ASEAN countries with lower Logistics Performance Index (LPI) scores, a benchmarking tool that measures the efficiency and effectiveness of logistic systems in different countries [9].

Regional cooperation and partnerships with international organisations, such as the WHO and Global Alliance for Vaccines and Immunization (GAVI) subsequently helped to improve vaccine access and distribution across ASEAN. Further, all member countries adopted a unique, vaccine-plus strategy, utilising a combination of COVID-19 vaccines to increase vaccination coverage (Figure 1, panel B). Mass vaccination efforts were carried out to increase vaccination coverage, either via large-scale vaccination centres, small-scale community-based vaccination drives, or mobile vaccination centres to reach rural regions.

To address challenges with vaccine hesitancy, ASEAN member countries adopted collaborative approaches that sought to engage all sectors of society. This included providing resources and funding needed for imple-



**Figure 1. Panel A.** Coronavirus disease 2019 (COVID-19) vaccination timelines and distribution including primary series in adults, children and adolescents, third doses and fourth doses, in six member countries of the ASseS Working Group (Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam). **Panel B.** Distribution of COVID-19 vaccines. We took the data from available public COVID-19 vaccine dashboards as of July 5, 2023. **Panel C.** Overview of COVID-19 situations including total cases and deaths per million, and SARS-CoV-2 variants of concern distribution from the beginning of the COVID-19 pandemic to 5 July 2023. Vaccination rates presented are as of 5 July 2023. We took the data from Our World in Data [8].

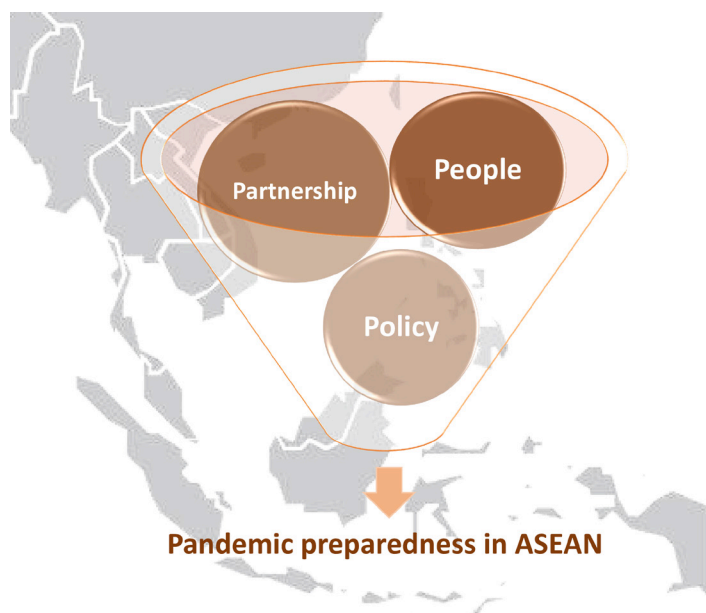


Photo: ASEAN preparedness for future pandemics with a focus on the 3P – People, Partnership and Policy. Underlying map of Asia: [https://en.wikipedia.org/wiki/File:Blank\\_Asia.png#file](https://en.wikipedia.org/wiki/File:Blank_Asia.png#file), image in public domain (free to use, no specific license).

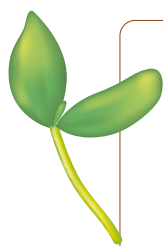
mentation of their strategies, and clear guidelines and recommendations for vaccine distribution. National task forces that have been established in each country to oversee pandemic responses helped to coordinate efforts across different sectors, including engagement of public health, medicine, economics, social work, private sector, and religious leaders. Decentralisation of decision-making to municipal governments promoted tailoring of strategies to address local challenges and limitations on handling COVID-19.

To date, COVID-19 cases and deaths are under control, and all member countries have successfully vaccinated 60–90% of their populations, while booster vaccination rates vary between 20.6 and 78.8% (Figure 1, Panel C). As the pandemic emergency recedes, ASEAN must conduct a risk assessment, and initiate preparations and strategic planning to predict, identify, and prevent outbreaks from escalating into pandemics, focusing on the 3P's – partnership, people and policy. The ASSESS Working Group has identified a few key areas of partnership to mitigate the effects of COVID-19 pandemic crises and prepare for future pandemics:

- enhance disease surveillance for early outbreak detection;
- establish and harmonise research tools such as virus, serum or cell line banks that will enable the rapid assessment of transmission dynamics and population susceptibility to emerging pathogens in the future;
- accelerate local medical diagnostics and equipment development with pilot production, quality assurance, regulatory clearance and scale-ups;
- adopt One Health and Planetary Health approaches to address human threats related to animals, climate, and the environment;
- establish formal and informal scientific networks for information and knowledge sharing to enable rapid response to outbreaks before they escalate into pandemics;
- collaborative funding to support efforts in pandemic preparedness, for example, a revolving fund for vaccine development and procurement for the ASEAN region could be established by fostering public and private collaborations [10].

With a large multi-ethnic population and rapidly developing economies, ASEAN is rich in diverse talent and expertise. Leaders play a crucial role in combating future pandemics by establishing clear communication structures, promoting accountability, empowering people, and leveraging enabling technologies. Implementing policies to enhance communication, build public trust, and engage communities in pandemic management can further enhance our preparedness for future outbreaks.

Overall, ASEAN has demonstrated commendable efforts in managing the COVID-19 pandemic. We hold an optimistic outlook that ASEAN initiatives such as ASSESS will champion pandemic preparedness by building basic research to translational research during peacetime and grow further in the future encompassing all the ASEAN member countries. Such an accomplishment would be remarkable, signifying a significant stride towards effectively tackling COVID-19 and future epidemics and pandemics. As epidemiologist, Larry Brilliant, who played a significant role in eradicating smallpox, aptly stated: 'Outbreaks are inevitable, but pandemics are optional.'



**The Association of Southeast Asian Nations (ASEAN) Sero-Surveillance Study on COVID-19 vaccines (ASSESS) Working Group:** Opass Putcharoen, Supaporn Wacharapluesadee (Thai Red Cross Emerging Infectious Diseases Clinical Centre, King Chulalongkorn Memorial Hospital, Thailand); Sharifah Faridah Syed Omar, Reena Rajasuriar, Anjanna Kukreja, Sazali Basri, Adeeba Kamarulzaman (Department of Medicine, Faculty of Medicine, Universiti Malaya, Kuala Lumpur, Malaysia); Cheng Siang Tan, Asri Said, Lela Su'ut (Faculty of Medicine and Health Sciences, University Malaysia Sarawak, Kuching, Malaysia); Nguyen Thi Kha Tu (Centre for Disease Control, Dong Thap, Vietnam); Cao Thu Thuy, Lam Anh Nguyet, Le Kim Thanh, Nguyen Thi Han Ny, Nguyen Thi Thu Hong, Le Nguyen

Truc Nhu, Tran Tan Thanh (Oxford University Clinical Research Unit, Ho Chi Minh, Vietnam); Nguyen Thanh Truong (Tan Phu Hospital, Ho Chi Minh, Vietnam); Yuan Lu Ho, Rahul Pandey (Diagnostics Development Hub, Agency for Science, Technology and Research, Singapore); Shiau Hui Diong, Eshale Anak Libau, Juwinda Ongko, Jonathan Lim, Ridzwan Abdullah, He Ping Yeo, Yi Qing Chin, Jocelyn Yu Jin (Singapore Infectious Diseases Clinical Research Network, National Centre for Infectious Diseases); Beng Lee Lim, Feng Zhu, Yap Wee Chee (Duke-NUS Medical School, Programme in Emerging Infectious Diseases, Singapore); Mayan U Lumandas (Biologicals Management Division, Research Institute for Tropical Medicine, Philippines); Timothy John R Dizon (Molecular Biology Laboratory, Laboratory Research Division of the Research Institute for Tropical Medicine, Muntinlupa, Philippines); Catalino S Demetria, Mary Glazel N Biocarles (National Reference Laboratory for Special Pathogens, Laboratory Research Division of the Research Institute for Tropical Medicine, Muntinlupa, Philippines); Marianne T Inobaya, Johanna Beulah T Sornillo (Department of Epidemiology and Biostatistics, Clinical Research Division of the Research Institute for Tropical Medicine, Muntinlupa, Philippines); Jonjee C Morin (Virology Department, Laboratory Research Division of the Research Institute for Tropical Medicine, Muntinlupa, Philippines); Arjay Niño A Digman, Celine Bernice A Roxas, Mario Antonio L Jiz II (Microbiology Department, Laboratory Research Division of the Research Institute for Tropical Medicine, Muntinlupa, Philippines); Komang Januartha Putra Pinatih, Putu Cintya Denny Yuliyatni (Faculty of Medicine Udayana University, Bali, Indonesia); Ida Bagus Jelantik Manuaba and teams (Public Health Centre of North Denpasar III, Bali, Indonesia); I Nyoman Dharma Wisnawa, Amy Yelly Kusmawati, Pande Putu Ayu Rissa Cempaka (Faculty of Medicine Udayana University, Bali, Indonesia).

**Funding:** The ASSeSS Working Group was supported by ASEAN Science, Technology, and Innovation FUND (ASTIF) and Temasek Foundation. LVT is supported by Wellcome (226120/Z/22/Z). The funders had no role in preparation of the manuscript. The article publication charge (APC) was funded by National Medical Research Council Singapore (OFLCG19May-0034 and COVID19RF-003).

**Authorship contributions:** JYLF, INS, BY and YFC wrote and revised the manuscript. All authors approved the final version of the manuscript.

**Disclosure of interest:** The authors completed the ICMJE Disclosure of Interest Form (available upon request from the corresponding author) and disclose no relevant interests.

## REFERENCES

- 1 World Health Organization. WHO Coronavirus (COVID-19) Dashboard. 2021. Available: <https://covid19.who.int/>. Accessed: 10 January 2024.
- 2 Association of Southeast Asian Nations (ASEAN). ASEAN comprehensive recovery framework and its implementation plan. 2020. Available: <https://asean.org/asean-comprehensive-recovery-framework-and-its-implementation-plan/>. Accessed: 21 August 2023.
- 3 Southeast Asia Development Solutions. 5 key initiatives to safely reopen borders in ASEAN. 2021. Available from: <https://seads.adb.org/solutions/5-key-initiatives-safely-reopen-borders-asean>. Accessed: 21 August 2023.
- 4 World Health Organization. Considerations for implementing and adjusting public health and social measures in the context of COVID-19-Interim guidance 30 March 2023. 2023. Available: <https://www.who.int/publications/i/item/who-2019-ncov-adjusting-ph-measures-2023.1>. Accessed 21 August 2023.
- 5 Zhai K, Yuan X, Zhao G. The impact of major public health emergencies on trust in government: From SARS to COVID-19. *Front Psychol.* 2022;13:1030125. [Medline:36467202](https://pubmed.ncbi.nlm.nih.gov/36467202/) [doi:10.3389/fpsyg.2022.1030125](https://doi.org/10.3389/fpsyg.2022.1030125)
- 6 Petty M, Widiyanto S. COVID cases climb as Southeast Asia feels force of Delta variant. 2021. Available: <https://www.reuters.com/world/asia-pacific/caseloads-climb-southeast-asia-feels-force-delta-variant-2021-07-09/>. Accessed: 21 August 2023.
- 7 Yean TS, Kam AJY. Determinants of COVID-19 vaccine rollouts in Southeast Asia. 2022. Available: <https://www.iseas.edu.sg/articles-commentaries/determinants-of-covid-19-vaccine-rollouts-in-southeast-asia-by-tham-siew-yeen-and-andrew-kam-jia-yi/>. Accessed: 21 August 2023.
- 8 Mathieu E, Ritchie H, Rodés-Guirao L, Appel C, Gavrillov D, Giattino C, et al. Coronavirus pandemic (COVID-19). 2020. Available: <https://ourworldindata.org/coronavirus>. Accessed: 21 August 2023.
- 9 Logistics Asia. Logistics performance vital to halt the spread of COVID-19 in Asian countries. 2022. Available: <https://logistics.asia/logistics-performance-vital-to-halt-the-spread-of-covid-19-in-asian-countries/>. Accessed: 21 August 2023.
- 10 Seraj Ahmad FN, Khor SK, Lim J, Roth S, Dewi S, Becerra F. Southeast Asia needs a revolving fund for vaccines. *Lancet Glob Health.* 2022;10:e1557-8. [Medline:36240817](https://pubmed.ncbi.nlm.nih.gov/36240817/) [doi:10.1016/S2214-109X\(22\)00406-5](https://doi.org/10.1016/S2214-109X(22)00406-5)

**Correspondence to:**

Yoke Fun Chan  
 Department of Medical Microbiology,  
 Faculty of Medicine, Universiti Malaya,  
 Kuala Lumpur  
 Malaysia  
[chanyf@um.edu.my](mailto:chanyf@um.edu.my)