

# Surgical Mask Distribution System to Fight against COVID-19 Pandemic in Taiwan: A Minireview

Chih-Long Pan<sup>1</sup>, Jet-Chau Wen<sup>2\*,3</sup>, Venkata Subbaiah Munagapati<sup>4</sup>, and Chun-Lung Lee<sup>5</sup>

## ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is widespread globally thus far. All the governments have made every effort to render adequate medical service, supplies, and education to the general public to cope with the pandemic transmission. Wearing surgical masks is one of the essential non-pharmaceutical interventions means of containing the spray of SARS-CoV-2. Therefore, Taiwan adopted a name-based rationing system (NBRS) for the distribution of surgical masks. The NBRS aims to provide enough surgical masks to curb gouging prices and ensure that most people gain primary protection against droplet infection. Over 96.86% of the National Health Insurance Administration-contacted community pharmacies joined the program to support the policy introduced by the government of Taiwan. Therefore, community pharmacists (CPs) have engaged in the NBRS program and played a vital role in dispensing surgical masks. Although the NBRS program takes up a substantial portion of the business hours and brings in some gratuitous issues, the CPs still make their best endeavors to stand with the citizens against the COVID-19 pandemic. Due to the successful implementation of NBRS in Taiwan, the public can obtain sufficient surgical masks to survive in the severe early stage of the COVID-19 pandemic. For this reason, the article provides a comprehensive review on the detailed mechanism of the NBRS herein to learn the valuable experience in surgical mask distribution.

**Keywords:** COVID-19 pandemic; SARS-CoV-2; surgical mask; name-based rationing system; community pharmacist.

## 1. INTRODUCTION

The World Health Organization (WHO) (2020e) had made the assessment that the coronavirus diseases 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) can be characterized as a pandemic on 11 March 2020. Based on newly updated data from the WHO (2020d), there were 191,148,056 confirmed cases of COVID-19, including 4,109,303 deaths on 21 July 2021 in over 200 countries. Until 19 July 2021, 3,568,861,733 vaccine doses have been administrated

across the world. In response to the widespread global transmission of the COVID-19 pandemic, strategies and actions are implemented to reduce the impact on medical systems, society, public services, and the economy.

The importance of the roles of non-pharmaceutical interventions (NPIs) was highlighted in various researches (Duhon *et al.* 2021; Rowan and Moral, 2021; Soltesz *et al.* 2020), and the surgical mask-wearing policy as an essential NPI was strongly advocated by some public health experts in the prophase of the COVID-19 pandemic (Biermann *et al.* 2021; Tornero-Aguilera *et al.* 2021). Although there are many different opinions and arguments from the health authorities on the utilization of facial masks in the public and community settings, it is evident that the COVID-19 pandemic could be transmitted in an asymptomatic phase (Desai and Aronoff 2020; Eikenberry *et al.* 2020; Liu and Zhang, 2020; Zhou *et al.* 2020); therefore, wearing a surgical mask can help reduce the risk of community infections. The WHO (2019, 2020a, 2020b, 2020c) has also updated its guidance to the general public on mask usage. At the initial stage, WHO (2020a) emphasized that “a medical mask is not required for the individuals without respiratory symptoms”, since “no evidence is available on its usefulness to protect non-sick persons.” On the contrary, the WHO (2020c) has issued the latest interim guidance that “depending on the type, masks can be used either for protection of healthy persons or to prevent onward transmission (source control).”

Manuscript received July 29, 2021; revised September 10, 2021; accepted September 18, 2021.

<sup>1</sup> Assistant Professor, Bachelor Program in Interdisciplinary Studies, College of Future, National Yunlin University of Science and Technology, Taiwan 640301, R.O.C.

<sup>2\*</sup> Professor (corresponding author), Department and Graduate School of Safety, Health, and Environmental Engineering, National Yunlin University of Science and Technology, Taiwan 640301, R.O.C. (e-mail: wenjc@yuntech.edu.tw).

<sup>3</sup> Director, Research Center for Soil & Water Resources and Natural Disaster Prevention (SWAN), National Yunlin University of Science and Technology, Taiwan 640301, R.O.C.

<sup>4</sup> Postdoctoral Researcher, Research Center for Soil & Water Resources and Natural Disaster Prevention (SWAN), National Yunlin University of Science and Technology, Taiwan 640301, R.O.C.

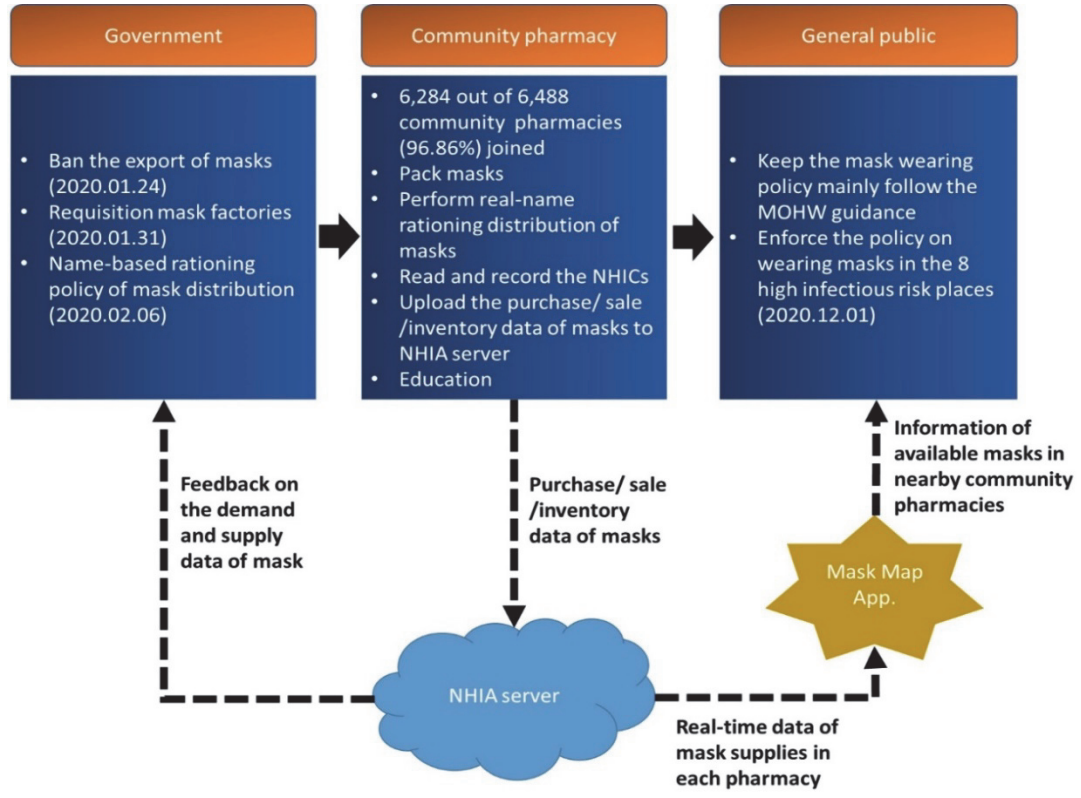
<sup>5</sup> Assistant Researcher, Research Center for Soil & Water Resources and Natural Disaster Prevention (SWAN), National Yunlin University of Science and Technology, Taiwan 640301, R.O.C.

During the COVID-19 pandemic, especially in the early stage, price gouging of surgical masks was prevalent internationally (Ivery and Kochkodin 2020), so every government in the world has tried to avoid price gouging by providing sufficient surgical masks to curb the inflated prices. Besides, every government should consider the reasonable distribution of surgical masks to be another priority to ensure that most of its people may gain primary protection against droplet infection. Once people with a privileged status stockpiling surgical masks, the purpose of comprehensive protection cannot be ensured due to a relatively low ratio of public health. Therefore, the strategy to improve surgical mask dispensing can be a turning point of success in anti-epidemic combat.

The public in Taiwan can buy a limited number of surgical masks within a week at the National Health Insurance Administration (NHIA)-contracted community pharmacies through the name-based rationing system (NBRS) (Ministry of Health and Welfare, 2020a). Since it is the only way for the public to obtain their surgical masks in the early stage of the COVID-19 pandemic, a large stockpile by individuals can be diminished. The purpose of doing so is to avail a sufficient number of surgical masks to the vulnerable population at a reasonable price without any monopolization. Community pharmacists (CPs) play a vital role in implementing NBRS action. With this in mind, this review paper comprehensively addresses the distinctive and intensive critical use of the NBRS for surgical mask distribution to contribute applicable learning lessons.

## 2. SURGICAL MASK DISTRIBUTION NETWORK

Management and use of surgical masks are mainly based on the demand and supply chains. The pathway to the supply of surgical masks is through the government-community pharmacies for the general public in the NBRS (Fig. 1). The Taiwan government first requisitioned the mask factories on 31 January 2020 to control the mask provision and price, so surgical masks have been delivered to NHIA-contracted community pharmacies. According to the data published by the Ministry of Health and Welfare (MOHW) on 5 February 2020, 6,284 out of the 6,488 NHIA-contracted pharmacies (96.86%) joined the NBRS of surgical masks dispensation (Ministry of Health and Welfare, 2020b; Executive Yuan, 2021). After receiving the surgical masks from the official supply sectors, the CPs help pack a specific number of surgical masks into envelopes to facilitate the transaction process and so prevent them from being contaminated by over-exposure in open space. The general public can use their National Health Insurance Cards (NHICs) to buy a limited number of surgical masks by registering through the information system of community pharmacies. The customer's NHICs will be noted on the buying record once the purchase has been made, and then the data will be uploaded to the NHIA server. Also, the card cannot be recorded repeatedly on a specific week to avoid a double claim condition.



**Fig. 1 The name-based rationing system of surgical mask distribution in Taiwan.**

(NHIA: National Health Insurance Administration; NHIC: National Health Insurance Card; MOHW: Ministry of Health and Welfare)

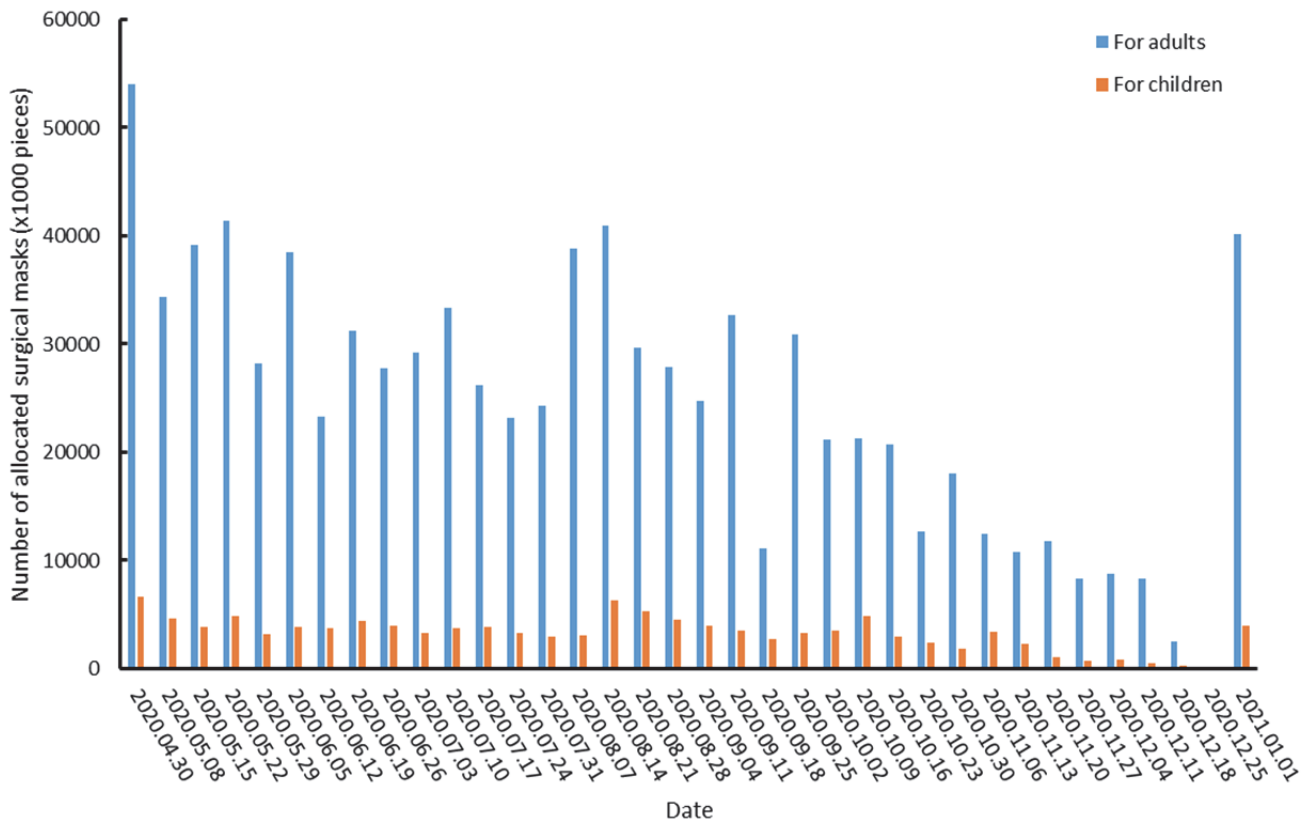
The demand for surgical masks can be identified and retrieved in the information network since the National Health Insurance program is compulsory for all citizens in Taiwan starting from birth, including official residency and Alien Resident Certificate owners. Over 99.9% of Taiwan residents have their NHICs (Executive Yuan, 2021) to record medical matters therein. Community pharmacies have a well-established NHI information system to upload the drug dispensing data onto the NHIA for applying the drug and pharmaceutical service costs. During the COVID-19 pandemic, the MOHW increased bandwidth performance and installed a virtual private network (VPN) system to assist the community pharmacies to facilitate uploading of sales record data and inventory of surgical masks to the NHIA server. When the general public uses their NHICs to obtain their surgical masks on a weekly basis under the rationing system, the NHIA server can save the sales record. Since NHICs cannot be re-recorded on a specified day, large stockpiles by individuals can be diminished, and vulnerable populations can get a sufficient number of surgical masks without any monopolization. Moreover, the government of Taiwan can employ the NHI database to estimate the demand for surgical masks and volunteer programmers to create Mask Map Apps for the general public to find the available community pharmacies nearby (Lee, 2020).

The Taiwan government not only managed the source of supply of surgical masks but also introduced the policy of NBRS to regulate their distribution, while the community pharmacists implemented the policy and played a decisive role in this regard. Moreover, Artificial Intelligence (AI) technology helped balance the supply and demand of surgical masks. Meanwhile, the political

collaborations between the three parties enabled the government to form a successful surgical mask distribution strategy through which the public can obtain enough surgical masks at a reasonable price for their daily needs.

### 3. COMMUNITY PHARMACISTS' ROLE IN SURGICAL MASK DISPENSING

In Taiwan, based on the traumatic experience of the 2003 SARS pandemic (Cheng *et al.* 2020; Lin *et al.* 2020), it has become ubiquitous during the COVID-19 pandemic for the general public to wear surgical masks. Therefore, the government enhanced production of surgical masks to satisfy the needs of the general public, and the CPs were in charge of the surgical mask dispensing duties to jointly support the NBRS policy. The density of NHI-contracted pharmacies is about one community pharmacy per five square-kilometer geographically; nevertheless, the community pharmacies are largely located in the big cities. Since CPs should apply for the daily pharmaceutical service payments after filling prescriptions from NHIA through the Internet, the CPs can organize a well-connected health and medical information network through the NHIA server as a central core. Due to the increased accessibility to the community pharmacies, the CPs can execute the mask dispensing policy. Those surgical masks allocated to community pharmacies were computed weekly using Taiwan Pharmacist Association (TPA) data collected from the 25<sup>th</sup> of April 2020 to the 1<sup>st</sup> of January 2021 (Fig. 2).



**Fig. 2** Weekly computations of the surgical masks allocated to the community pharmacies. Data were collected between the 25<sup>th</sup> of April 2020 and the 1<sup>st</sup> of January 2021 from the Taiwan Pharmacist Association (<https://dpm.taiwan-pharma.org.tw/article/1396/>) and totaled every Friday.

The CPs were in a dilemma about how to achieve a balance between working hours and extra efforts made to voluntarily serve the customers waiting in a long queue to buy surgical masks. Also, CPs have a vast risk of exposure to SARS-CoV-2 through human contact in the crowd. In order to dispense the surgical masks efficiently and conveniently, the CPs tend to spend considerable time packing specified pieces of surgical masks into an envelope. However, this can save the dispensing time and further maintain the quality of masks by examining them in detail during packaging. A report showed that the CPs' workload was increased by about five-fold during the COVID-19 outbreak (Liu 2020; Wang 2020). Besides, the CPs should overcome the shortage of prescription drugs, hygiene products, disinfectants, and thermometers. Nevertheless, the majority of the CPs demonstrate their professionalism, dynamism, and social responsibilities to overcome their personal factors to support and fulfill the NBRS policy. They think that a pharmacist's professionalism can keep the public away from illness and so they can stay healthy via their constant efforts. Subsequently, the CPs have earned huge social admiration and respect, and received personal appreciation from Taiwan's President (Zeng 2020).

Although the NBRS program still occupies a significant portion of the business hours and brings some gratuitous issues, the CPs still make their best endeavors to stand with the citizens against the COVID-19 pandemic. The mask dispensing work enables the CPs to get more connections to the public through which they can even educate them on how to avoid the SARS-CoV-2 infections, such as the correct way of social distancing, handwashing, mask-wearing, household cleaning, and keeping the latest information. From this program, the public can perceive the professionalism, contributions, and selfless dedication of CPs towards people during the COVID-19 outbreak.

#### 4. A WIN-WIN-WIN POLICY

Although the NBRS of surgical mask distribution is one of the strategies for epidemic mitigation introduced and guided by the Taiwanese government, it also shows how effectively this can alleviate the chance of being infected in the community. The success of NBRS is mainly attributed to a combination of well-planned implementation and its administration. For example, the government controls the source of surgical masks, employs the NBRS for surgical mask distribution, and retrieves the NHI database to monitor the supply and demand, as aforementioned.

The CPs voluntarily spend their working hours making efforts to serve the public, help distribute surgical masks and register the NHICs to upload the purchase information of the citizens to the NHIA server. Also, CPs on the frontline have done their best to support the public-health policies that could be a cornerstone to uphold the epidemic-prevention network. The CPs acknowledge the challenge of surgical mask dispensing faced by them because it can lessen the opportunity to provide substantial health care service to the general public. A positive appraisal from the public has further augmented the professional characteristics and attitudes of CPs on the provision of health education and medical services during the COVID-19 pandemic. The CPs have wholeheartedly supported the public health policies in this severe epidemic battle, and everyone in Taiwan can see the contributions to benefit the general public and help fight against the pandemic.

Although the surgical mask-wearing norm is one of the NPIs, the possibility of containing early pandemic transmission was determined by a plethora of research (Brooks and Butler 2021; Bundgaard *et al.* 2021; Scheepers *et al.* 2021; Wang *et al.* 2021).

However, the people in Taiwan are provided with enough surgical masks from the CPs, and they abide by the government guidelines and wear surgical masks in particular places to reach the win-win-win goal of anti-epidemic measures.

#### 5. CONCLUSIONS

Owing to the problem of the excessive number of surgical masks to balance supply and demand, the government lifted a ban on the sales and purchase of surgical masks on 1 June 2020 for the purpose of free trade. The public can buy surgical masks through various sales channels apart from their community pharmacies. However, the NBRS is still administrated and executed by the official supply chains. The NBRS taught us a valuable lesson to learn on how to build the first-line defense against the COVID-19 pandemic by offering sufficient NPIs to the public. It is hoped that the fight against the COVID-19 pandemic can be a success, and the lessons learned by the government of Taiwan in combatting the COVID-19 pandemic can further prepare us for the next epidemic battle.

#### 6. ACKNOWLEDGEMENT

This research was supported by the Ministry of Science and Technology (MOST) for the funding through grants: MOST 108-2625-M-224-004 and 109-2625-M-224-002.

#### REFERENCES

- Biermann, M., Schulze, A., Unterseher, F., Atanasova, K., Watermann, P., Krause-Utz, A., Stahlberg, D., Bohus, M., and Lis, S. (2021). "Trustworthiness appraisals of faces wearing a surgical mask during the Covid-19 pandemic in Germany: An experimental study." *Plos One*, **16**(5), e0251393.
- Brooks, J.T. and Butler, J.C. (2021). "Effectiveness of mask wearing to control community spread of SARS-CoV-2." *JAMA*, **325**(10), 998-999.
- Bundgaard, H., Bundgaard, J.S., Raaschou-Pedersen, D.E.T., von Buchwald, C., Todsén, T., Norsk, J.B., Pries-Heje, M.M., Vissing, C.R., Nielsen, P.B., and Winslow, U.C. (2021). "Effectiveness of adding a mask recommendation to other public health measures to prevent SARS-CoV-2 infection in Danish mask wearers: a randomized controlled trial." *Annals of Internal Medicine*, **174**(3), 335-343.
- Cheng, K., Cheng, V., and Zou, C. (2020). "Urgent Prevention of Corona Virus Disease 2019 (covid-19): Chinese Eating and Mask-wearing Cultures." *Journal of Public Health International*, **2**(2), 8.
- Desai, A.N. and Aronoff, D.M. (2020). "Masks and coronavirus disease 2019 (COVID-19)." *JAMA*, **323**(20), 2103-2103.
- Duhon, J., Bragazzi, N., & Kong, J. D. (2021). "The impact of non-pharmaceutical interventions, demographic, social, and climatic factors on the initial growth rate of COVID-19: A cross-country study." *Science of the Total Environment*, **760**, 144325.
- Eikenberry, S.E., Mancuso, M., Iboi, E., Phan, T., Eikenberry, K., Kuang, Y., Kostelich, E., and Gumel, A.B. (2020). "To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic." *Infectious Disease Modelling*, **5**, 293-308.
- Executive Yuan (Taiwan). (2021). "Introduction to National Health Insurance."

- <https://www.ev.gov.tw/state/A01F61B9E9A9758D/fa06e0d2-413f-401e-b694-20c2db86f404>
- Ivery, B. and Kochkodin, B. (2020). "For New York, 58-Cent Medical Masks Now Priced at \$7.50 Each. Bloomberg."
- <https://www.bloomberg.com/news/articles/2020-03-24/for-new-york-58-cent-medical-masks-now-priced-at-7-50-each>
- Lee, T.-L. (2020). "Legal preparedness as part of COVID-19 response: the first 100 days in Taiwan." *BMJ Global Health*, **5**(5), e002608.
- Lin, C.-F., Wu, C.-H., and Wu, C.-F. (2020). "Reimagining the Administrative State in Times of Global Health Crisis: An Anatomy of Taiwan's Regulatory Actions in Response to the COVID-19 Pandemic." *European Journal of Risk Regulation*, 1-17.
- Liu, R.-J. (2020). "Government stops the export of surgical masks to provide community pharmacies at a fair price." NOWnews.
- <https://www.nownews.com/news/local/cct/5038876>
- Liu, X., & Zhang, S. (2020). "COVID-19: Face masks and human-to-human transmission." *Influenza and Other Respiratory Viruses*, **14**(4), 472-473.
- Ministry of Health and Welfare. (2021a). "Name-based rationing system for purchases of masks to be launched on February 6; public to buy masks with their (NHI) IC cards."
- <https://www.mohw.gov.tw/cp-4638-51319-2.html>
- Ministry of Health and Welfare. (2021b). "Please confirm where to buy surgical masks at National Health Insurance Administration (NHIA)-contracted pharmacies with Ministry of Health and Welfare."
- <https://dep.mohw.gov.tw/dos/cp-3899-51535-113.html>
- Rowan, N.J. and Moral, R.A. (2021). "Disposable face masks and reusable face coverings as non-pharmaceutical interventions (NPIs) to prevent transmission of SARS-CoV-2 variants that cause Coronavirus disease (COVID-19): role of new sustainable NPI design innovations and predictive mathematical modelling." *Science of the Total Environment*, 145530.
- Scheepers, P.T., Wertheim, H.F., van Dael, M., Anzion, R., Holterman, H. J., Teerenstra, S., de Groot, M., Voss, A., and Hopman, J. (2021). "Comparative performance testing of respirator versus surgical mask using a water droplet spray model." *International Journal of Environmental Research and Public Health*, **18**(4), 1599.
- Soltesz, K., Gustafsson, F., Timpka, T., Jaldén, J., Jidling, C., Heimerson, A., Schön, T. B., Spreco, A., Ekberg, J., and Dahlström, Ö. (2020). "The effect of interventions on COVID-19." *Nature*, **588**(7839), E26-E28.
- Tornero-Aguilera, J.F., Rubio-Zarapuz, A., Bustamante-Sánchez, A., and Clemente-Suárez, V. J. (2021). "The Effect of Surgical Mask Use in Anaerobic Running Performance." *Applied Sciences*, **11**(14), 6555.
- Wang, Y., Deng, Z., and Shi, D. (2021). "How effective is a mask in preventing COVID-19 infection?" *Medical Devices & Sensors*, **4**(1), e10163.
- Wang, Z.-Y. (2020). "After lifting the rationing policy- the public still like the government-offered surgical masks in community pharmacies." *United Daily News*.
- <https://health.udn.com/health/story/120952/4610386>
- WHO. (2019). "Non-pharmaceutical public health measures for mitigating the risk and impact of epidemic and pandemic influenza: annex: report of systematic literature reviews."
- <https://apps.who.int/iris/bitstream/handle/10665/329439/WHO-WHE-IHM-GIP-2019.1-eng.pdf>
- WHO. (2020a). "Advice on the use of masks in the community, during home care and in health care settings in the context of the novel coronavirus (2019-nCoV) outbreak: interim guidance 29 January 2020."
- [https://apps.who.int/iris/bitstream/handle/10665/330987/WHO-nCov-IPC\\_Masks-2020.1-rus.pdf](https://apps.who.int/iris/bitstream/handle/10665/330987/WHO-nCov-IPC_Masks-2020.1-rus.pdf)
- WHO. (2020b). "Advice on the use of masks in the context of COVID-19: interim guidance 5 June 2020."
- [https://apps.who.int/iris/handle/10665/332293?locale-attribute=pt&p=374&utm\\_medium=display&jwsourc=cl&fbclid=IwAR1O34cYPEXKqMMSN\\_r1VapUAsikYf0QRdtiuPkpLYcH5MY0Dz2JxBiQ-ng&utm\\_source=facebook&ref=hexometer&page=38&utm\\_campaign=targetingUSA](https://apps.who.int/iris/handle/10665/332293?locale-attribute=pt&p=374&utm_medium=display&jwsourc=cl&fbclid=IwAR1O34cYPEXKqMMSN_r1VapUAsikYf0QRdtiuPkpLYcH5MY0Dz2JxBiQ-ng&utm_source=facebook&ref=hexometer&page=38&utm_campaign=targetingUSA)
- WHO. (2020c). "Mask use in the context of COVID-19: interim guidance 1 December 2020."
- [https://apps.who.int/iris/bitstream/handle/10665/337199/WHO-2019-nCov-IPC\\_Masks-2020.5-eng.pdf?sequence=1&isAllowed=y](https://apps.who.int/iris/bitstream/handle/10665/337199/WHO-2019-nCov-IPC_Masks-2020.5-eng.pdf?sequence=1&isAllowed=y)
- WHO. (2020d). "WHO Coronavirus Disease (COVID-19) Dashboard."
- <https://experience.arcgis.com/experience/685d0ace521648f8a5bceee1b9125cd>
- WHO. (2020e). "WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020."
- <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>
- Zeng, Y.-Y. (2020). "Present Tsai Ing-Wen served as a one-day volunteer to help pharmacists to pack masks: "Thanks to the pharmacists for undertaking the pressure." (in Chinese)." *Apple Daily*.
- <https://tw.appledaily.com/politics/20200306/HFXJGFI3DMBPAOPGXDR3EMZPIA/>
- Zhou, Z., Yue, D., Mu, C., and Zhang, L. (2020). "Mask is the possible key for self-isolation in COVID-19 pandemic." *Journal of medical virology*, **92**(10), 1745-1746.