

Side-effects of public health policies against Covid-19: the story of an over-reaction

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ABSTRACT

INTRODUCTION

Let us all take a moment to talk, once again, but this time as wisely as possible, about this new coronavirus pandemic that the world has been facing since November 2019 – let us talk, to be precise, about the global response to it. After a short period marked by the underestimation of the pandemic risk by most governments, the Western world went nuts and overreacted, most probably so as not to be accused of inaction. This quick switch from one extreme to another had a huge impact on the population, the folly of ideas concerning the pandemic being more contagious than the virus itself (crowd psychology being characterized by its mimetic aspect). In many cases, the overall benefits of the chosen policies – which were without precedent – were not sufficiently questioned, which resulted in many *side effects* on global health (not to mention the huge increase in conspiracy theories these harmful side effects brought, resulting in a massive loss of confidence in governments).

The medical motto “*primum non nocere*” (meaning “first, do no harm”), a moral principle everyone should at least consider following, was evidently not taken into account. Or, to be fair, it was, in an extreme utilitarian reading that denied the humanity and complexity of citizens and reduced them to numbers. During the past year it has been overlooked, and the virus has become an obsession, to the extent that nearly everything else, even the most valuable things in life, is still now under appreciated if not simply ignored. This paper highlights facts that go against this simplistic, one-dimensional view; the so-called *solutions* of policy makers do not deserve this name if they only take into account first order factors without nuance or moderation. We, citizens, men and women, are *more* than potential virus spreaders or pandemics victims.

METHODS

We fetched studies on Pubmed, Web of Sciences and Cochrane Library. Given the fact that the number of articles about non-pharmaceutical policies and COVID-19 is rapidly growing, we also manually searched for additional references on the MedRxiv/BioRxiv/PsyArXiv preprint server, on Google Scholar, WHO statements and general press articles.

RESULTS

We found that the literature on the subject highlighted many side effects of the chosen health policies (i.e., lockdowns, masks-wearing and social distancing) – psychomotor, psychological, perceptual, dermatological, psychiatric and sociological (to mention the most important) side effects. In short, we found that every adopted measure had a double-sided effect, and that failing to appreciate the dark sides might result in permanently damaging the global health of the population.

LOCKDOWNS

a) Epidemiological effects

In the Middle Ages, before the discovery of pathogen vectors of disease, patients were seen as presenting a health risk and a social risk. The containment was intended to prevent the spread of epidemics and to protect society. The hospital treated the sick and exercised social control over the needy. The management of epidemics did not change for centuries; “detect, isolate, treat” has almost always been, and still is, the *credo*. Well, we might have radicalized it. Until last century, isolation used to be *selective*: there were lazarettos, prison-like places equipped with infirmaries, that were used to keep ship passengers or patients in quarantine [1]. In 17th Century London, only infected families were “shut-up” in their homes, their doors being marked with red crosses [2] in order to prevent other people from paying them visits. Regarding history, a general lockdown (also concerning healthy or asymptomatic people) is very uncommon. The decision to enact general lockdowns for the COVID-19 pandemic, something without historical precedent or scientific basis, appears to have been taken because social control of the sick was unacceptable to well-meaning policy makers.

Stay-at-home mandates' impact on mortality is subject to debate, for many studies report its epidemiological impact but others evoke its complete uselessness. Nevertheless, many studies suggest an absence of COVID-19 – or other disease – mortality reduction due to the lockdown. A Canadian country level exploratory analysis finds that full lockdowns have no direct impact on COVID-19 mortality (per

million people); however, it shows that full lockdowns (RR=2.47: 95%CI: 1.08–5.64) are significantly related to increased patient recovery rates [3]. Another study, dealing with the impact of military quarantine on COVID-19 transmission, showed that 2.00% of CHARM's recruits still contract the virus after a 2-week enforced quarantine (slightly higher than control group's rate of 1.7%) [4]. According to a French Principal Component Analysis and a correlation matrix with a Pearson correlation test, the death rate appears not to be linked with governments' responses [5]. Using a generalized phenomenological method based on official daily deaths records only, an American observational study showed a general decay trend in the growth rates and reproduction numbers two to three weeks before the full lockdown policies would be expected to have visible effects. Moreover, the comparison of pre- and post-lockdown observations reveals a counter-intuitive slowdown in the decay of the epidemic *after* lockdown [6]. Furthermore, a report from the National Bureau of Economic Research highlighted that effective reproduction numbers in all US regions remained low relative to initial levels after the removal of lockdowns, indicating that they had very little effect on transmission rates [7]. (And let us note that this is consistent with a post-lockdown Chinese study revealing that the asymptomatic positive cases detected in Wuhan were unlikely to be infectious [8].)

This quote from a Stanford epidemiological study [9] perfectly sums up things: “While small benefits cannot be excluded, we do not find significant benefits on case growth of more restrictive NPIs. Similar reductions in case growth may be achievable with less restrictive interventions.” In a nutshell, all these studies suggest a global

uselessness of lockdowns when it comes to COVID-19 mortality, and even sometimes SARS-CoV-2 mere *transmission*. Not to mention the fact that, according to a CDC report [10] concerning excess deaths in the US between January 26th and October 3rd, 1/3 of them (or 100,000) were not COVID-related, *The New York Times* says [11].

That being said, let us now show how bad things may be in general. A vector-autoregression done by the National Bureau of Economic Research estimated that, for the overall US population, the proportion of COVID-19-related unemployment is today between two and five times larger than the typical unemployment shock, resulting in a 3.0% increase in mortality rate and a 0.5% drop in life expectancy over the next 15 years [12]. We believe this to be linked with lockdown policies, and more generally, with many changes that were made in health-care practices since the beginning of 2020. According to a British coronial study, deaths from drug and alcohol misuse significantly increased during the lockdown period in comparison to the same period in 2018 [13]. The difference in life expectancy between white and blue collar workers and between employees and the unemployed is well known. The destruction of the economy by lockdowns will cost many years of life. Poverty is a silent killer. Many excess deaths, although COVID-related, may themselves be linked to inappropriate care, i.e. the use of vents (and of the accompanying sedation protocol) on every patient, which is not standard practice for seasonal flus and colds – and also not practiced in Asia, where there were little or no excess deaths [14]. In short, thanks to the world's hysterical reaction, we stopped treating elderly and infirm people like we always did; and we got excess

deaths curves due, in some significant part, to the lockdowns and related not-standard-practice health interventions – not to COVID at all (see also [15]).

Lockdowns are far from being a magic spell that can save the world from a pandemic, and might not even narrowly work to lower mortality. On the contrary, there is no doubt that lockdowns damage people's health – and that they already *did*. We therefore think it is crucial to *not* set aside the many long-term harms lockdowns will cause due to the tremendous economic downturns that are to come.

b) Psychological side-effects

A research team used a prediction algorithm based on machine learning techniques, and found that that economic vulnerability is associated with a strong risk of stress and worsening mental health. 42.8% of the populations of the three countries that were studied were shown to be at a high risk of stress, anxiety and depression, these results being based on their economic vulnerability and exposure to a negative economic shock [16]. Moreover, according to researcher Sonia Mukhtar, lockdowns, whose consequences are self-isolation quarantine and social distancing, are far from being leisure time vacations; instead, they constitute collective traumatic events that seriously threaten people, and have already resulted in a considerable loss of lives and in an impoverishment of global hygiene [17]. Indeed, as Mingke Song assessed for China, COVID-19 and lockdown policies not only brought upon a life crisis, but also incurred psychological stress: tension, anxiety, fear and despair among affected populations [18]. An integrative review also found that some factors increasing

women's vulnerabilities to violence have been exacerbated during the social distancing and lockdown period [19]. As many articles assessed, COVID-19 general lockdowns have a variety of harmful psychological side-effects.

The psychological effects of isolation in non-epidemic situations have already been studied in specific cases, such as that of imprisonment. A French multi-centered study notably assessed that detainees already suffering from cognitive impairment do not necessarily seek help – perhaps do not ever consider the fact that their health or quality of life may have been badly affected – and that communication deficits may also reduce their participation in prison activities that could prevent, slow or halt cognitive decline [20]. A British article also consistently revealed the existence of severe mental health consequences amongst detainees across a wide range of settings and jurisdictions [21]. Not everyone is able to be as positive and creative as Xavier de Maistre was when he wrote his impressive *Voyage autour de ma chambre* during his imprisonment in Turin, in 1794.

Previous epidemics and the specific lockdowns they caused also had psychological effects, which were described by specialists. The medical staff that performed MERS-related tasks showed that the risk of PTSD (post-traumatic stress disorder) symptoms was at its highest, even after a while, and even after home quarantine [22]. Concerning people isolated in quarantine during the 2005 Australian highly infectious equine influenza, extremely high levels of non-specific psychological distress was

reported by respondents, with 34% reporting high psychological distress compared to levels around 12% in the Australian general population [23].

That lockdowns led to most medical care being done via cyber-visits, which greatly reduces the physician's ability to perceive health signs. Doctors are often not even consciously aware of their fine-tuned perceptual abilities. For example, our variety of color vision evolved so as to sense oxygenation modulations under the skin (for recognition of emotion, health and state) [24], and it has been recognized since the Greeks that the acute pallor of the skin is helpful for diagnosis [25]. These blood-mediated health signals are only visible in person, not through cameras.

c) Physiological effects

According to a systematic review, lockdowns have likely increased the time where people are sedentary, which has a variety of harmful side effects including: altered energy expenditure, adipogenic signalling, immunomodulation, autonomic stability and hormonal dysregulation perpetuating underlying chronic diseases such as obesity, cardiovascular disease, cancer and mental health disorders [26].

In addition, Digital Eye Syndrome (which concerns a difficulty with a user's visual system regulation of accommodation, convergence and refraction mainly caused by an overuse of digital devices) may have been exacerbated during the COVID-19 pandemic, precisely because of lockdown [27].

MASKS

Why do we have to wear masks? Well, it appears that it is, in major part, because surgeons wear them. But let us not forget that surgeons wear them not to prevent viral transmission, but to prevent always-bacteria-laden saliva or mucus droplets from landing in an open wound – which is not quite the same thing...

a) Effectiveness

Concerning mask wearing and its potential impact in transmission, we compared the literature dealing with SARS-CoV-2 to that dealing with other broncho-pulmonary diseases. When it comes to SARS-CoV-2 transmission, the official recommendation to wear surgical masks in order to supplement other public health measures did not significantly reduce SARS-CoV-2's infection rate among wearers (in a community with modest infection rates, some degree of social distancing, and uncommon general mask use) [28]. A May 2020 review focused on the importance of targeting a specific group and not the whole population, and stated that there is weak evidence for the fact that wearing a face mask is an efficient hygienic tool to prevent the spread of a viral infection [29]. According to another review, a CDC influenza policy one, although mechanistic studies support the potential effect of hand hygiene or face masks, evidence from 14 randomized controlled trials do not support a substantial effect of either on transmission of laboratory-confirmed influenza [30].

Even if, counter to the evidence mentioned above, face masks provide some measure of protection, there are side effects that could undermine any efficacy they may have.

First, wearing a mask may give a false sense of security and make people less compliant with social distancing, ventilation and other important infection control schemes [31, 32]. Second, people have to avoid touching their masks and adopt other management measures, otherwise masks are counterproductive [33] – and we all agree that this is a difficult thing to do.

While face masks can stop larger droplets, such droplets tend to fall to the ground due to their weight [34, 35, 36], and are not the route for viral transmission. Viruses spread via smoke-like aerosols [37] via breath or flatulence, which go through and jet out the sides of surgical masks, and infect mainly by inhalation deep into the lungs. Yet, despite the risk of inhaling and exhaling infected virions via leaks of particles, this was never evaluated in applied norms for surgical masks, and only for personal protective equipment (PPE) under norms FFP in Europe, N or P in the USA. Moreover, the European norm for surgical masks (EN14683), as well as the US one (ASTM), only applies to bacterial filtration efficiency (BFE), and the size of the bacteria used for testing (3 microns) is much larger than the Sars CoV2 (maximum size of 140 nm [38]). (And PPE norms don't even test BFE). Virus filtration efficiency (CFE) was never tested in Chinese and European norms.

In addition to the filtration capabilities, the breathability of the mask and face tightness should be correctly weighed. It is obvious that humidity quickly damages the filtration efficiency of the electrically charged filtration medium (melt-blown), and especially when the fit is tighter because of the humidity of each breath. As a

consequence, a more efficient and less breathable mask entails more air leaks around the edge of the mask, and reduces the global efficiency in normal general public usage. And it also leads to the reduction of the time one can safely wear such a mask – and we shall discuss this further below – which is why all P3 or N99 masks are equipped with respiratory valves that improve the exhaling comfort, but undermine the mask's ability to stop aerosols escaping.

b) Psychomotor effects

The global application of mask-wearing could affect infants' and children's psychomotor development, and possibly induce anosognosia/prosopagnosia. In fact, our brain taking into account masks for facial recognition may alter different aspects of our face recognition system, as a study -- which presented to a large online sample of adult observers (n=496) an adapted version of the Cambridge Face Memory Test [39] -- has shown.

Moreover, one could speculate that because brain areas in left fusiform cortex were recycled for reading expertise [40] while face recognition expertise is more lateralized in homolateral fusiform cortex [41], some upcoming dyslexic syndromes could be expected from a lack of face visual recognition skills' development due to a bilateral ventral stream impairment, consecutive to chronic face mask use in childhood. Even without face masks, elderly people sometimes have visual field amputations, especially of inferior visual fields, and the fall risks for them are already elevated [42]. It is important to remember that visual field deficits are often not consciously

detectable, and often go unreported, for a suppression mechanism occurs due to binocular stereoscopic properties of our visual system that also basically suppress the blind spot from our retina, glasses frames and nose while they both appear in our visual field [43, 44, 45]. Face masks represent a new cause of visual field artifacts that may mimic pathologic field defects: indeed, they block the vision of one's lower far peripheral visual field, which is crucial for visuomotor feedback when engaged in walking. And the fact that one is visually handicapped when wearing a face mask is almost never consciously realized [46], when it is a major public health problem [47] because:

- (1) Falls are the second leading cause of accidental or unintentional injury deaths worldwide,
- (2) Each year, approx. 646 000 individuals (worldwide) die from falls, of which over 80% are in low- and middle-income countries,
- (3) Adults over 65 years old suffer the greatest number of fatal falls,
- (4) 37.3 million falls are severe enough to require medical attention occur each year.

c) Psychological effects

Masks hide the expression of emotions fundamental to human social interaction [48], and make lip-reading impossible, which is an important limitation of social interaction (and especially so for the hard of hearing). According to a literature review, masks have now become semi-permanent face accessories, blocking our ability to express

and perceive each other's facial expressions, dividing it into a visible top half and invisible bottom half [49], which significantly restricts our ability to accurately interpret emotions based on facial expressions and strengthens our perceptions of negative emotions produced by frowning. Lower accuracy and lower confidence in one's own assessment of the displayed emotions also indicate that emotional reading is strongly handicapped by the presence of a mask [50]. Moreover, this mutilation of our ways of communicating and perceiving things *do* have consequences in health diagnoses: for instance, the use of personal protective equipment significantly diminishes speech perception, and alternative communication strategies have to be developed for effective communication [51]. A randomized clinical trial has shown that encounters with health care professionals wearing masks have a significant and negative impact on the patient's perceived empathy and diminish the positive effects of relational continuity [52]. A recent study also showed that each type of mask caused a low-pass filter effect, attenuating higher frequencies (2000-7000 Hz) in the speaker's voice by 3 to 4 dB (medical mask) and nearly 12 dB for the N95 mask (respirator/FFP) [53]. In addition to this, masks significantly prevent binding mechanisms through which de-synchronized auditory and motor signals from language are usually fused into conscious workspace – a phenomenon known as the McGurk effect [54]. It's another reason why communication is not easy between people wearing masks.

A review notably supports the idea that panic-prone individuals may be at higher risk of respiratory discomfort when wearing RPDs, thereby reducing their tolerance for these devices [55].

d) Dermatological effects

Many studies have described the dermatological impact of prolonged mask wearing. In handling COVID-19 outbreak, mask wearing induced itches [56] and contact dermatitis [57]. It is to be noted that facial ACD can mimic other diseases, such as acute cutaneous lupus erythematosus, seborrheic dermatitis and sarcoidosis, especially if occurring on specific body areas or evaluated by a non-dermatologist. In terms of frequency, the most common adverse skin reactions among healthcare workers wearing N95 masks have been nasal bridge scarring (68.9%) and facial itching (27.9%): when healthcare workers wear PPE for a long period of time, they experience adverse skin reactions, the incidence of these reaction to the N95 mask being 95.1% [58]. A study conducted by Foo and al. revealed that 35.5% of the staff using N95 masks regularly experienced acne, facial dermatitis and pigmentation of nasal bridge, cheeks and chin [59]. N95 respirators are associated with more skin reactions than medical masks [60], and skin tears and open wounds such as these are a potential source of infection [61]. Last but not least, the current form of fluid resistant surgical masks (FRSM) used in day-to-day practice has elastic ties that go behind the ears, and an extended use of these masks causes discomfort and irritation behind them, especially if they are used for prolonged procedures [62].

e) Physiological effects

This first randomized cross-over study concerning the effects of surgical masks and FFP2/N95 masks on cardiopulmonary exercise capacity yields clear results: both varieties of mask have a marked negative impact on exercise parameters [63]. Furthermore, a German MD thesis [64] showed that the usage of a face mask leads to:

- (a) increased rebreathing of expelled carbon dioxide,
- (b) significant increase in respiration, increased respiratory rate, and hyperventilation,
- (c) increased heart rate,
- (d) increase in Co_2 in the blood,
- (e) hypoxemia, which is an abnormal decrease in the partial pressure of oxygen in the arterial blood,
- (f) a hypercapnia, which is an increase in the pressure of Co_2 in the blood.

To sum up things, as WHO claimed in August 2020: “People should not wear masks when exercising, as masks may reduce the ability to breathe comfortably” [65].

At this point we’ve shown that masks are far from a perfect protection, and that their usage is way too often just “better than nothing” – which, in fact, suggests that masks only have marginal side effects. Yet they are still mandatory – actually, FFP2/N95 are now mandatory in Germany and Austria, and the American press even invites people to wear *two* masks rather than just one. “Better than nothing”, right? But what if, as

we *did* reveal, the side effects were bigger than we thought when masks are worn for long periods by the entire population?

And a final consequence of universal mask wearing worth mentioning is one at the societal level: once an unmasked face becomes verboten in most public circumstances, it can end up psychologically treated as a “private part” that must be covered, like all our private parts. The development of such cultural taboos can be very difficult to reverse, and may remain with us long after the pandemic is gone. We would thereby be “stuck” with masks that prevent interactions with our fellowmen and with our environment more than they prevent encounters with viruses...

SOCIAL DISTANCING

a) Epidemiological side

China's experience with the novel coronavirus pneumonia taught us that social distancing is the most effective measure to take in the current situation [66]. Mathematical models indeed suggest that social distancing can provide the time that is needed to increase our healthcare capacity – but it also shows that it must be combined with testing and contact tracing of all suspected cases in order to mitigate virus transmission [67].

b) Side effects

Just as was the case with masks, social distancing has an impact on speech audibility because sound amplitude rapidly decreases with distance. An American study [68] found that, whereas conversational distances between two talkers in the United States typically ranges from 1.5 to 3 feet, the currently recommended social distancing distance is at least 6 feet. At 2 to 4 times the usual talking distance, the intensity of sound considerably decreases, by 6 dB to 12db, which is a *disproportionate* difficulty for individuals with hearing loss.

Social distancing is one of the – if not *the* – best interventions we have for a pandemic, but it is far from perfect. In addition to making communication more difficult, social distancing has rather severe psychological side effects, for it removes us from the others, whether our best friends or complete strangers. It therefore dangerously upsets

our very human desire to be among other people, which is also a basic need, for it is only in contact with others that we are able to adapt ourselves to the world, to evolve in it, to expand ourselves, in brief, to be and become fully what we are – human beings and fulfilled individuals.

PREPRINT

CONCLUSION

Our literature overview highlighted many side effects of the health policies that have been adopted by our governments since the beginning of this crisis. Policy makers must consider the many dimensions to the non-pharmaceutical interventions that have been used in an effort to combat COVID-19, including their side effects and their effectiveness in practice – not to mention the implications for civil rights, freedom of movement being, for instance, one of the main civil rights public health policies have been smashing since 2020. Far from being benign, these interventions indeed impact physical and mental health, as well as the economy, trampling the “*primum non nocere*” principle underfoot. Even in a terrible epidemic, decisions cannot do without exhaustive risk benefit analysis. Belief-based policies damage human lives. The truth must not become a victim too.

REFERENCES

[1] Devaux C. Small oversights that led to the Great Plague of Marseille (1720–1723): Lessons from the past. *Infection, genetics and evolution: journal of molecular epidemiology and evolutionary genetics in infectious diseases*. 2012 Dec 11;14.

[2] King K, Hurst G, Lewis Z. Let's emerge from the pandemic lockdown into a fairer academic world. *Current Biology*. 2020 Jun 1;30.

[3] Chaudhry R, Dranitsaris G, Mubashir T, Bartoszko J, Riazi S. A country level analysis measuring the impact of government actions, country preparedness and socioeconomic factors on COVID-19 mortality and related health outcomes. *EClinicalMedicine*. 2020 Jul 1;25:100464.

[4] AG L, Ramos I, A O, Goforth C, D W, Y G, et al. SARS-CoV-2 Transmission among Marine Recruits during Quarantine. 2020 Nov 11;

[5] Laroche Lambert Q, Marc A, Antero-Jacquemin J, Bourg E, Toussaint J-F. Covid-19 Mortality: A Matter of Vulnerability Among Nations Facing Limited Margins of Adaptation. 2020 Nov 19;

[6] Meunier T. Full lockdown policies in Western Europe countries have no evident impacts on the COVID-19 epidemic. *medRxiv*. 2020 Apr 21;

[7] Atkeson A, Kopecky K, Zha T. FOUR STYLIZED FACTS ABOUT COVID-19 [Internet]. Cambridge, MA 02138: NATIONAL BUREAU OF ECONOMIC RESEARCH; 2020 Aug [cited 2020 Dec 2]. Report No.: 27719. Available from: https://www.nber.org/system/files/working_papers/w27719/w27719.pdf

[8] Cao S, Gan Y, Wang C, Bachmann M, Wei S, Gong J, et al. Post-lockdown SARS-CoV-2 nucleic acid screening in nearly ten million residents of Wuhan, China. *Nature Communications*. 2020;11.

[9] Bendavid E, Oh C, Bhattacharya J, Ioannidis J. Assessing Mandatory Stay-at-Home and Business Closure Effects on the Spread of COVID-19. *European Journal of Clinical Investigation*. 2021;

[10] Excess Deaths Associated with COVID-19, by Age and Race and Ethnicity — United States, January 26–October 3, 2020. *Morbidity and Mortality Weekly Report*. 2020 Oct 1;69:1522–7.

[11] Roni Caryn Rabin. The Pandemic's Real Toll? 300,000 Deaths, and It's Not Just From the Coronavirus [Internet]. *New York Times*. 2020 [cited 2020 Nov 25]. Available from:

https://www.nytimes.com/2020/10/20/health/coronavirus-excess-deaths.html?fbclid=IwAR24gC-86qZv23Hd7Vc_xiYLDmu6PzqWUzAIUy72NMAXyDJMVi-IpTZ0pvQ

[12] Bianchi F, Bianchi G, Song D. The Long-Term Impact of the COVID-19 Unemployment Shock on Life Expectancy and Mortality Rates [Internet]. National Bureau of Economic Research; 2020 Dec. (Working Paper Series). Report No.: 28304. Available from: <http://www.nber.org/papers/w28304>

[13] Pell R, Fryer E, Manek S, Winter L, Roberts I. Coronial autopsies identify the indirect effects of COVID-19. *The Lancet Public Health*. 2020;5.

[14] Evans M. Hospitals Retreat From Early Covid Treatment and Return to Basics [Internet]. *The Wall Street Journal*. 2020 [cited 2020 Jan 11]. Available from: <https://www.wsj.com/articles/hospitals-retreat-from-early-covid-treatment-and-return-to-basics-11608491436>

[15] Rancourt D, Baudin M, Mercier J. Evaluation of the virulence of SARS-CoV-2 in France, from all-cause mortality 1946-2020. 2020.

[16] Codagnone C, Id F, Mez C, Charris R, Montealegre F, Liva G, et al. Assessing concerns for the economic consequence of the COVID-19 response and mental health problems associated with economic vulnerability and negative economic shock in Italy, Spain, and the United Kingdom. *PLoS ONE*. 2020 Oct 27;

[17] Mukhtar S. Mental Health and Psychosocial Aspects of Coronavirus Outbreak in Pakistan: Psychological Intervention for Public Mental Health Crisis. *Asian Journal of Psychiatry*. 2020 Apr 1;51:102069.

[18] Song M. Psychological Stress Responses to COVID-19 and Adaptive Strategies in China. *World Development*. 2020 Jul 1;136:105107.

[19] Sánchez O, Vale D, Rodrigues L, Surita F. Violence against women during the COVID-19 pandemic: An integrative review. *International Journal of Gynecology & Obstetrics*. 2020 Sep 1;151.

[20] Combalbert N, Pennequin V, Ferrand C, Lenormand M, Anselme M, Geffray B. Cognitive impairment, self-perceived health and quality of life of older prisoners. *Criminal Behaviour and Mental Health*. 2018 Jan 1;28:36–49.

[21] von Werthern M, Robjant K, Chui Z, Schon R, Ottisova L, Mason C, et al. The impact of immigration detention on mental health: A systematic review. *BMC Psychiatry*. 2018 Dec 1;18.

[22] Lee S, Kang W, Cho A-R, Kim T, Park J. Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. *Comprehensive Psychiatry*. 2018 Oct 1;87.

[23] Taylor M, Agho K, Stevens G, Raphael B. Factors influencing psychological distress during a disease epidemic: Data from Australia's first outbreak of equine influenza. *BMC public health*. 2008 Oct 1;8:347.

[24] Changizi M, Zhang Q, Shimojo S. Bare skin, blood and the evolution of primate colour vision. *Biology letters*. 2006;2:217–21.

[25] Changizi M, Rio K. Harnessing color vision for visual oximetry in central cyanosis. *Medical hypotheses*. 2009;74:87–91.

[26] Chandrasekaran B, Ganesan T. Sedentarism and chronic disease risk in COVID 19 lockdown – a scoping review. *Scottish Medical Journal*. 2020;003693302094633.

[27] Munsamy A, Chetty V. DIGITAL EYE SYNDROME – COVID 19 LOCKDOWN SIDE EFFECT? *South African Medical Journal*. 2020 Jun 2;110.

[28] Bundgaard H, Bundgaard JS, Raaschou-Pedersen DET, et al. 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. *Ann Intern Med*. 2020 Nov 18.

[29] Matuschek C, Moll F, Fangerau H, Fischer J, Zänker K, van Griensven M, et al. Face masks: Benefits and risks during the COVID-19 crisis. *European Journal of Medical Research*. 2020 Dec 1;25.

[30] Xiao J, Shiu E, Gao H, Wong JY, Fong MW, Ryu S, et al. Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings—Personal Protective and Environmental Measures. *Emerging infectious diseases*. 2020 May 1;26:967–75.

[31] Greenhalgh T, Schmid M, Czypionka T, Bassler D, Gruer L. Face masks for the public during the covid-19 crisis. *BMJ : British medical journal*. 2020 Apr 9;

[32] Cartaud A, Quesque F, Coello Y. Wearing a face mask against Covid-19 results in a reduction of social distancing. *PLOS ONE*. 2020;15:e0243023.

[33] Desai A, Aronoff D. Masks and Coronavirus Disease 2019 (COVID-19). *JAMA*. 2020 Apr 17;323.

[34] Prather K, Marr L, Schooley R, McDiarmid M, Wilson M, Milton D. Airborne transmission of SARS-CoV-2. *Science*. 2020 Oct 16;370:303.2-304.

[35] Guzman, Marcelo. (2020). Bioaerosol Size Effect in COVID-19 Transmission. 10.20944/preprints202004.0093.v2.

[36] Stadnytskyi V, Bax C, Bax A, Anfinrud P. The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. *Proceedings of the National Academy of Sciences*. 2020;117:202006874.

[37] Alonso C, Raynor P, Davies P, Torremorell M. Concentration, Size Distribution, and Infectivity of Airborne Particles Carrying Swine Viruses. *PloS one*. 2015;10:e0135675.

[38] Na Zhu, Dingyu Zhang, Wenling Wang et Xingwang Li, « A Novel Coronavirus from Patients with Pneumonia in China, 2019 », *N Engl J Med* 2020; 382:727-733 <https://www.nejm.org/doi/10.1056/NEJMoa2001017>

[39] Freud E, Stajduhar A, Rosenbaum R, Avidan G, Ganel T. The COVID-19 pandemic masks the way people perceive faces. *Scientific Reports*. 2020;10.

[40] Paulesu E, Perani D, Blasi V, Silani G, Borghese NA, Giovanni U, et al. A Functional-Anatomical Model for Lipreading. *Journal of neurophysiology*. 2003;90:2005–13.

[41] Baron R. Mechanisms of Human Facial Recognition. *International Journal of Man-Machine Studies*. 1981;15:137–78.

[42] Marigold D, Patla A. Visual information from the lower visual field is important for walking across multi-surface terrain. *Experimental brain research Experimentelle Hirnforschung Expérimentation cérébrale*. 2008;188:23–31.

[43] Häkkinen L. Vision in the elderly and its use in the social environment. *Scandinavian journal of social medicine Supplementum*. 1984;35:5–60.

[44] Horton J, Fahle M, Mulder T, Trauzettel-Klosinski S. Adaptation, perceptual learning, and plasticity of brain functions. *Graefe's Archive for Clinical and Experimental Ophthalmology*. 2017;255.

[45] Changizi M, Shimojo S. “X-ray vision” and the evolution of forward-facing eyes. *Journal of Theoretical Biology*. 2008;254:756–67.

[46] Young S, Smith M, Tatham A. Visual Field Artifacts from Face Mask Use. *Journal of Glaucoma*. 2020 Jul 14; Publish Ahead of Print.

[47] WHO. Falls [Internet]. World Health Organisation. 2018 [cited 2020 Nov 25]. Available from: <https://www.who.int/news-room/fact-sheets/detail/falls>

[48] Changizi M, Barber T. UNMASKED: Why We Express Emotions. 2021.

[49] Nestor M, Fischer D, Arnold D. “Masking” our Emotions: Botulinum Toxin, Facial Expression and Well-Being in the Age of COVID-19. *Journal of Cosmetic Dermatology*. 2020 Jun 27;19.

[50] Carbon C-C. Wearing Face Masks Strongly Confuses Counterparts in Reading Emotions. *Frontiers in Psychology*. 2020 Sep 25;11.

[51] Bandaru S, Augustine A, Lepcha A, Sebastian S, Gowri M, Philip A, et al. The effects of N95 mask and face shield on speech perception among healthcare workers in the coronavirus disease 2019 pandemic scenario. *The Journal of laryngology and otology*. 2020 Sep 28;1–10.

[52] Wong C, Yip B, Mercer S, Griffiths S, Kung K, Wong M, et al. Effect of facemasks on empathy and relational continuity: A randomised controlled trial in primary care. *BMC family practice*. 2013 Dec 24;14:200.

[53] Goldin A, Weinstein B, Shiman N. How Do Medical Masks Degrade Speech Reception? [Internet]. *Hearing Review*. 2020 [cited 2020 Nov 26]. Available from: <https://www.hearingreview.com/hearing-loss/health-wellness/how-do-medical-masks-degrade-speech-reception>

[54] Ujiie Y, Asai T, Wakabayashi A. Individual differences and the effect of face configuration information in the McGurk effect. *Experimental Brain Research*. 2018;236.

[55] Perna G, Cuniberti F, Daccò S, nobili maria, Caldirola D. Impact of respiratory protective devices on respiration: implications for panic vulnerability during the COVID-19 pandemic. *Journal of Affective Disorders*. 2020 Dec 1;277:772–8.

[56] Xie Z, Yang Y, Zhang H. Mask-induced contact dermatitis in handling COVID-19 outbreak. *Contact Dermatitis*. 2020 May 1;83.

[57] Szepietowski J, Matusiak L, Szepietowska M, Krajewski P, Białyński-Birula R. Face Mask-induced Itch: A Self-questionnaire Study of 2,315 Responders During the COVID-19 Pandemic. *Acta dermato-venereologica*. 2020 May 25;100.

[58] Hu K, Fan J, Li X, Gou X, Li X, Zhou X. The adverse skin reactions of health care workers using personal protective equipment for COVID-19. *Medicine*. 2020 Jun 12;99:e20603.

[59] Foo CCI, Goon ATJ, Leow YH, Goh CL. Adverse skin reactions to personal protective equipment against severe acute respiratory syndrome—a descriptive study in Singapore. *Contact dermatitis*. 2006;55:291-294.

[60] Hua W, Zuo Y, Wan R, Xiong L, Tnag J, Zou L, et al. Short-term Skin Reactions Following Use of N95 Respirators and Medical Masks. *Contact Dermatitis*. 2020 May 13;83.

[61] Gefen A. Skin Tears, Medical Face Masks, and Coronavirus. *Wound Management & Prevention* [Internet]. 2020 Apr;66(4). Available from: <https://www.o-wm.com/article/skin-tears-medical-face-masks-and-coronavirus>

[62] Fikenzer S, Uhe T, Lavall D, Rudolph U, Falz R, Busse M, et al. Effects of surgical and FFP2/N95 face masks on cardiopulmonary exercise capacity. *Clinical Research in Cardiology*. 2020 Dec 1;109.

[63] Butz U. Rückatmung von Kohlendioxid bei Verwendung von Operationsmasken als hygienischer Mundschutz an medizinischem Fachpersonal [Internet]. [Doktors der Medizin]: Institut für Anaesthesiologie der Technischen Universität München; 2004. Available from: <https://mediatum.ub.tum.de/doc/602557/602557.pdf>

[64] Kainth G. Novel tip to prevent ear irritation with surgical face masks (FRSM) during the coronavirus (COVID-19) pandemic. *The Annals of The Royal College of Surgeons of England*. 2020 Jun 8;102:1–2.

[65] World Health Organisation. People should NOT wear masks while exercising [Internet]. 2020 [cited 2020 Dec 3]. Available from: https://www.youtube.com/watch?v=1_AxGswGnno&feature=emb_title

[66] Qian M, Jiang J. COVID-19 and social distancing. *Journal of Public Health*. 2020 May 25;

[67] Matrajt L, Leung T. Evaluating the Effectiveness of Social Distancing Interventions to Delay or Flatten the Epidemic Curve of Coronavirus Disease. *Emerging Infectious Diseases*. 2020 Apr 21;26.

[68] Hulzen R, Fabry D. Impact of Hearing Loss and Universal Face Masking in the COVID-19 Era. *Mayo Clinic Proceedings*. 2020 Aug 1;95.