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CARDIORESPIRATORY FITNESS TO BOOST IMMUNITY AND FIGHT PANDEMICS A TRANSLATIONAL META-SYNTHESIS

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ABSTRACT

The COVID-19 pandemic and related political and public health strategies have given rise to controversial discussions about general restrictions such as social distancing, adverse impact on mental health, social harm and economic damage, and the sense of pinning all hope on vaccination. SARS-CoV-2 infection covers a wide range from asymptomatic carriers via mild and moderate courses of disease to life-threatening conditions, and robust immune functions can be regarded as an efficient protective shield.

By means of systemic meta-synthesis the present article elucidates inner connections between cardiorespiratory fitness (CRF) and the immune system and discusses how CRF can modulate critical co-factors such as stress, depression and metabolic syndrome. Understanding translational medicine from a public health perspective involves health education alongside steps to enhance health awareness and self-administered health promotion in the wider population. These interdisciplinary challenges call for appropriate models, which also involve arts-based activities and creative sports.

Keywords: *Cardiorespiratory fitness, immune system, COVID-19, post COVID-19 era, translational epidemiology, public health, arts therapies, sports cardiology*

INTRODUCTION AND PURPOSE

The medical scene of the year 2020 has been dominated by the COVID-19 pandemic, and critical discussions focused on the balance between measures such as general social distancing and curfews on the one hand and focused protection considering different vulnerability on the other. Moreover, analyses of the pandemic and political steps to control its epidemiological dynamics have given evidence to the complexity of the issue and its factors such as adverse impacts on the individual development of children (Mastnak, 2020), as well as multifarious psychosocial and psychiatric sequelae (Dubey et al., 2020).

From a cardiological perspective, two main clinical COVID-19-associated issues have been identified: cardiovascular complications in patients with COVID-19 (Long et al., 2020) and heart patients with COVID-19, as well as multifaceted interactions between these two conditions as a new interdisciplinary challenge (Bansal, 2020, 247):

> Many patients with coronavirus disease 2019 (COVID-19) have underlying cardiovascular (CV) disease or develop acute cardiac injury during the course of the illness. Adequate understanding of the interplay between COVID-19 and CV disease is required for optimum management of these patients.

There is robust evidence that heart patients form a SARS-CoV-2 high-risk population and research suggests that namely patients with heart failure are more susceptible to COVID-19 and have a more severe clinical course once infected (Tomasoni et al., 2020). In this context clinicians have drawn attention to the problem that 'the coronavirus-2019 (COVID-19) infection pandemic has affected the care of patients with heart failure (HF) who have contracted COVID-19 as well as those without COVID-19 who have been impacted by the restructuring of health care delivery' (DeFilippis et al., 2020).

Particularly the last phrase 'restructuring of health care delivery' inspires further considerations about systemic health care systems and dynamic public health challenges. Broadly speaking, there is a certain polarity between general policies, which are characterised by social distancing, curfews, and guideline such as the universal use of face masks, and highly specified research-based intensive care. And there is a remarkable bias between measures which have been disapproved of ignoring the broad spectrum of different vulnerabilities, socio-economic damage, singular focus on the number of infections, panicmongering and their adverse impact on mental health, and a medical scene, which proved their capacity of efficient bench-to-bedside-work.

Nonetheless, observing these polarities, two questions arise: Firstly, how shall we assess the COVID-19 pandemic in comparison with other pandemics, as well as how healthcare systems should handle future epidemic phenomena? And secondly, why is there such a lack of common awareness of how a strong immune system could help to keep viral threats at bay? In this context, the inner connection between cardiorespiratory fitness and immunity plays a crucial role and calls for interdisciplinary translational activities, which crucially involve cardiology, sports medicine, immunology, epidemiology and public health. To contribute to this topic and to suggest practical approaches is the main purpose of this article.

TRANSLATIONAL SYSTEMIC META SYNTHESIS

Systemic meta synthesis (SMS) is an advanced form of common meta-syntheses and was inspired by history of science, which witnesses the power of epistemological syntheses and sheds light on ground-breaking concepts in medicine and humanities. Great minds discovered the inner logic of data from clinical experience, subjective theories and interdisciplinary sciences and created consistent frameworks, and this is precisely the way how systemic meta-syntheses are built.

There are two main ways to create a systemic meta-synthesis: a bottom-up and a top-down mode. In bottom-up mode studies on a given issue or thematic field are taken into account and explorative comparative processing tries to trace down general principles as well as their inner logic and coherence. This process generates hypotheses, which usually appear more robust than results from single hypothesis generating studies.

The top-down mode starts with a given hypothesis and goes on searching for confirmatory or contradictory evidence. While the whole process reminds of conventional hypothesis testing, the 'timeline inversion' makes the decisive difference: What supports or destroys the hypothesis is derived from previous studies. The advantage of this approach lies in the enormous pool of relevant data and also characterises the present article.

While meta-analyses usually select studies on account of clearly delineated topics and adherence to prescribed guidelines, systemic meta-syntheses are generally free to include all types of research but have to scrutinise their core value. In other words, meta-analyses apply external criteria to judge their components while systemic meta-syntheses try to appraise the studies' scientific essence, and the disparity between both can be huge. It goes without saying that both scientific open-mindedness and consideration of the whole spectrum of philosophy of sciences is needed to avoid systemic errors. Consequently, also this SMS-based article welcomes critical discussions and improvements.

The term 'translational' relates to the core idea of translational medicine, i.e. to make basic research such as biomedical findings applicable in clinical practice, and this is also the reason for its nickname 'bench-to-bedside'. The present article, however, goes far beyond clinical practice and concerns – with specific focus on pandemics, immunology and cardiorespiratory fitness – public health and health education.

CARDIORESPIRATORY FITNESS, IMMUNITY & PANDEMICS

Completely without trivialising the seriousness of COVID-19, there are good reasons for taking different degrees of vulnerability – a term that inspired its re-definition under COVID-19 circumstances (The Lancet, 2020) – and large variations in disease severity into account.

The first perspective relates to a broad spectrum of factors such as underlying genomic susceptibility to this disease (Godri Pollitt et al., 2020), as well as the relationship between age and COVID-19 associated morbidity or mortality, which is considered 'useful in determining the treatment policies and preventive measures of COVID-19' (Kang & Jung, 2020). This also involves the aggressive nature of pre-existing underlying diseases such as cancer (Gosain et al., 2020) or the increased prevalence of preterm deliveries in women with COVID-19 – together with the hypothesis that 'COVID-19 may alter immune responses at

the maternal-fetal interface, and affect the well-being of mothers and infants' (Liu et al., 2020). In this context we also read about social vulnerability (Kim & Bostwick, 2020), which challenges public health and urgently calls for medical ethics in practice, a topic that also touches upon the matter of this article.

The second perspective concerns an extremely broad range of degrees of severity, which is inextricably linked with the aspect of vulnerability. A review study sheds light on this problem in children and adolescents (Liguoro et al., 2020):

> Papers published between 1 January and 1 May 2020 including children aged 0-18 years were selected. Sixty-two studies and three reviews were included, with a total sample size of 7480 children (2428/4660 males, 52.1%; weighted mean age 7.6 years). Patients showed mainly mild (608/1432, 42.5%) and moderate (567/1432, 39.6%) signs of the infection. About 2% of children were admitted to the pediatric intensive care unit. The most commonly described symptoms were fever (51.6%) and cough (47.3%). Laboratory findings were often unremarkable. Children underwent a chest CT scan in 73.9% of all cases, and 32.7% resulted normal. Overall, the estimated mortality was 0.08%. A higher proportion of newborns was severely ill (12%) and dyspnea was the most common reported sign (40%).

Such findings, which go hand in hand with the wide range of severity of COVID-19 phenomena, substantiate the core hypothesis and target of the present article, namely that a healthy immune system can be regarded an efficient agent to prevent a more severe course of COVID-19 – and this is very different to other pathogens such as the neurotropic rabies virus (RABV), which is considered lethal (Katz et al., 2017), and we refer to Malik (2020): 'With the recent detection of SARS-CoV-2, there are now seven human coronaviruses. Those that cause mild diseases are the 229E, OC43, NL63 and HKU1, and the pathogenic species are SARS-CoV, MERS-CoV and SARS-CoV-2 Coronaviruses ...'.

This difference is also consistent with comparative research focusing on SARS-CoV-2, SARS-CoV and other influenza pandemics and suggests to precisely identify vulnerability-dependent distributions of differently severe symptoms (Petersen et al., 2020):

> SARS-CoV-2 causes mild or asymptomatic disease in most cases; however, severe to critical illness occurs in a small proportion of infected individuals, with the highest rate seen in people older than 70 years. The measured case fatality rate varies between countries, probably because of differences in testing strategies. Population-based mortality estimates vary widely across Europe, ranging from zero to high. Numbers from the first affected region in Italy, Lombardy, show an all age mortality rate of 154 per 100 000 population. Differences are most likely due to varying demographic structures, among other factors.

Nevertheless, the relationship between COVID-19 and the immune system is not trivial and requires in-depth considerations, and the question 'The immune system and COVID-19: Friend or foe?' (Yazdanpanah, 2020) goes hand in hand with the fact that 'although the immune system plays an important role in fighting COVID-19, paradoxically it could also be harmful'. Broadly speaking (Ahmadpoor & Rostaing, 2020) 'it seems that when the body is unable to produce an adequate adaptive response against the virus, the persistent innate - induced inflammation can then lead to a cytokine storm, ARDS, and diffuse organ involvement', where the authors particularly speak about 'populations at risk (elderly, associated comorbidities, immunosuppressed)'.

There is a broad consensus that adequate immune responses may decide between efficient fight against the SARS-CoV-2 virus and the generation of COVID-19 symptoms, which may even lead to death (Tay et al., 2020):

> SARS-CoV-2 infection and the destruction of lung cells triggers a local immune response, recruiting macrophages and monocytes that respond to the infection, release cytokines and prime adaptive T and B cell immune responses. In most cases, this process is capable of resolving the infection. However, in some cases, a dysfunctional immune response occurs, which can cause severe lung and even systemic pathology.

In order to avoid misunderstandings: This article is not about immunological perspectives of COVID-19. It clearly focuses on the benefits of cardiorespiratory fitness under pandemic conditions, as well as associated challenges of preventive cardiology, public health and health education, hence these immunological considerations, which shall provide a plausible background for the following arguments.

An international study (Zbinden-Foncea et al., 2020) comes straight to the point: Does high cardiorespiratory fitness confer protection against proinflammatory responses after infection by SARS-CoV-2? And the authors conclude, both with caution and with hope:

> Whether a high level of cardiorespiratory fitness can reduce the early amplified pro-inflammatory responses in patients infected with the SARS-CoV-2, and confer some protective effect against the development and severity of the disease remains to be established from retrospective epidemiological data. Given the positive effects of moderate doses of exercise on select immune markers associated with many disease states, we suggest that prior exercise training and high levels of cardiorespiratory fitness are likely to be immuno-protective in patients who contract SARS-CoV-2.

In many medical disciplines, particularly when it comes to translational issues, cardiorespiratory fitness is inextricably linked with physical exercise and studies highlight the crucial role of individually shaped doses of exertion which decide whether outcomes are beneficial or adverse. In this context, Simpson et al. (2015) stated:

> Exercise has a profound effect on the normal functioning of the immune system. It is generally accepted that prolonged periods of intensive exercise training can depress immunity, while regular moderate intensity exercise is beneficial ... Single bouts of prolonged exercise may impair T-cell, NK-cell, and neutrophil function, alter the Type I and Type II cytokine balance, and blunt immune responses to primary and recall antigens in vivo ... single bouts of moderate intensity exercise are "immuno-enhancing" and have been used to effectively increase vaccine responses in "at-risk" patients. Improvements in immunity due to regular exercise of moderate intensity may be due to reductions in inflammation, maintenance of thymic mass, alterations in the composition of "older" and "younger" immune cells, enhanced immunosurveillance, and/or the amelioration of psychological stress. Indeed, exercise is a powerful behavioral intervention that has the potential to improve immune and health outcomes in the elderly, the obese, and patients living with cancer and chronic viral infections such as HIV.

The potential of physical exercise to alleviate psychological stress is an important topic of the next chapter, and the consideration of ‘the elderly, the obese’, cancer patients and people with chronic viral infections mirror the inestimable scope of individuals who can boost their immune system through exercise and improved cardiorespiratory fitness.

In other words, depending on training frequency and intensity levels, physical exercise influences the immune system and exhibits anti-inflammatory effects and these ‘are also likely to be responsible for the suppressed immunity that makes elite athletes more susceptible to infections. The anti-inflammatory effects of regular exercise may be mediated

via both a reduction in visceral fat mass (with a subsequent decreased release of adipokines) and the induction of an anti-inflammatory environment with each bout of exercise' (Gleeson et al., 2011).

These questions form the core of the discipline of exercise immunology, which looks back to decades of interdisciplinary translational innovations (cf. Nieman, 1997 & 2003), and Wang et al. (2020) pointed out that there is robust evidence of the profound effect of exercise on the normal functioning of the immune system, as well as the anti-inflammatory effects of regular exercise and its immune regulating functions.

Considering and synthesising these findings and arguments, this article assumes the beneficial effect of cardiorespiratory fitness on the immune system, hence its protective function in pandemics and its importance to preventive public health. Nevertheless, there is this well-known critical gap between theoretical knowledge on the one hand and modification of life-styles throughout a whole society on the other, and this calls translational public health into play.

FACTORS OF CARDIORESPIRATORY FITNES AND INTERTWINED BENEFITS

Referring to Nieman and Wentz's (2019) study on the link between physical activity and the body's defence system, which particularly sheds light on relevant biomarkers, Simpson et al. (2020) drew attention to the complexity of immune functions and shed light on influential factors such as 'anxiety, sleep disruption, travel, exposure, nutritional deficits, environmental extremes, etc.'.

The Harvard Medical School provides – for the wider population – a series called 'Harvard Health Publishing' suggesting means to promote health. Posing the question 'how to boost your immune system' (2020), the authors particularly recommend:

> Don't smoke. Eat a diet high in fruits and vegetables. Exercise regularly. Maintain a healthy weight. If you drink alcohol, drink only in moderation. Get adequate sleep. Take steps to avoid infection, such as washing your hands frequently and cooking meats thoroughly. Try to minimize stress.

From the perspective of the present article, these recommendations not only speak of healthy life-styles, but also shed light on the complexity of the human immune system, as well as the diversity of relevant habits. Nonetheless, the present article emphatically emphasises cardiorespiratory fitness and elucidates its close interdependency with (some of) these key factors.

Although the present article speaks with a cardiological voice, it addresses a broader audience which is concerned with issues of immunity and public health, hence a short clarification of the term 'cardiorespiratory fitness' – this might be helpful to avoid misunderstandings.

Sports cardiology uses the term 'cardiorespiratory fitness' (CRF) to indicate the total capacity of the circulatory and the respiratory system to supply the skeletal muscles with oxygen, particularly during physical activity, and suggests the measure of VO_2max: the maximal oxygen uptake. Cardiorespiratory fitness is not only a useful diagnostic and prognostic health indicator for patients in clinical settings, but also a 'strong and independent predictor of all-cause and cardiovascular disease mortality strongly associated with mortality [and] based on the evidence, health professionals should encourage their patients to improve

CRF through regular physical activity' (Lee et al., 2010) – a suggestion, which also relates to public health and health promotion in general. Although cardiorespiratory fitness depends on a number of nonmodifiable factors such as gender, age and genetic factors, it can be greatly improved through individually adjusted physical activity.

Taking the adverse impact of stress on the immune system into account, Gerber et al. (2013) concluded that better cardiovascular fitness seems to be associated with decreased symptoms of burnout and a better capacity to cope with stress, and a Swedish study (Lindegård et al., 2019) showed statistically significant associations between level of fitness and reduced symptoms of stress-related exhaustion – and best improvements over time were seen in patients having a medium cardiorespiratory fitness level. However, no associations could be found between cardiorespiratory fitness levels over time and anxiety, depression and sleep disturbances.

The Harvard recommendations how to enhance the immune system touch upon stress management, while clinical observations encourage researchers to examine interdependencies between the immune system and a broader spectrum of mental disorders such as depression and anxiety. In this context, Robson et al. (2017) refer to 5-HT as a key contributor to the regulation of mood and anxiety and its association with the aetiology of major depressive disorder (MDD), as well as its role as a modulator of several immunological key functions:

> Copious amounts of research have outlined a connection between alterations in immune system function, inflammation status, and MDD. Supporting this connection, peripheral immune activation results in changes in the function and/or expression of many components of 5-HT signaling that are associated with depressive-like phenotypes ... [there is] evidence that immune system alterations related to depression affect CNS 5-HT signaling that can alter MDD-relevant behaviors and that 5-HT regulates immune system signaling within the CNS and periphery. We suggest that targeting the interrelationships between immune and 5-HT signaling may provide more effective treatments for subsets of those suffering from inflammation-associated MDD.

Widely consistent with clinical observations, Rahman et al. (2018) refer to studies suggesting that exercise improves cardiorespiratory fitness and reduces depressive symptoms in people with depression and conclude 'that improvements in VO_{2max} predict a greater reduction in depression severity among individuals who were clinically depressed. This finding indicates that improvements in VO_{2max} may be a marker for the underpinning biological pathways for the antidepressant effect of exercise'.

Particularly the ongoing COVID-19 pandemic goes hand in hand with increased anxiety, panic and paranoid tendencies (cf. Ho et al., 2020) and politicians and media have often been blamed for panicmongering. In this context, interdependencies between anxiety, stress and the immune system greatly gains in importance and an Indian review (Ray et al., 2017) summarises:

> Stress and stressful events are common occurrences in our daily lives and such aversive situations bring about complex changes in the biological system. Such stress responses influence the brain and behavior, neuroendocrine and immune systems. Anxiety is a common neurobehavioral correlate of a variety of stressors, and both acute and chronic stress exposure could precipitate anxiety disorders. Psychoneuroimmunology involves interactions between the brain and the immune system and there could be a possible link between anxiogenesis and immunomodulation during stress. Physiological and pharmacological data have highlighted the relationship between stress, anxiety, and immune responsiveness.

Moreover, there are many systemic interdependencies between factors influencing the immune system, and individual dispositions, behaviour and attitudes come into play. As mentioned above, The Harvard immune-enhancing life-style guidelines suggest that people, who drink alcohol, should only drink 'in moderation'. There is robust evidence of the causal linkage between alcohol use disorders and (major) depression (cf. Boden & Fergusson, 2011) and recent studies speak of under-identification of co-occurring depression and alcohol misuse in general practice (Hobden et al., 2018) and even suggest double screening for the 'dual disorder' comprising depression and alcoholism (Pavkovic et al., 2018).

In this context, we have to take the positive influence of cardiorespiratory fitness on depression into account and discuss how the compound of CRF and sports-oriented lifestyles and healthy body awareness may prevent alcohol addiction and/or excessive alcohol consumption. Although alcohol-misuse is known among athletes, 'moderate and high-intensity aerobic exercises ... mind-body exercises can be an effective and persistent treatment for those with SUD [substance use disorders]' (Wang et al., 2014), and the FitForChange project (Hallgren et al., 2018) suggests physical activity to treat alcoholism.

In-depth-analysis of how the immune system is inextricably linked with the whole complex of cardiorespiratory fitness eventually requires individual case studies and involves psychological and physiological factors of sleep quality, e.g. concerning sleep-related breathing disorders (cf. Vanhecke et al., 2008) or body awareness that helps to fight obesity and the metabolic syndrome, both conditions with significant impact on the immune system (Andersen et al., 2016) and relevance to the COVID-19 era (Bansal et al., 2020):

> Individuals with metabolic syndrome are at increased risk for poor disease outcomes and mortality from COVID-19 ... A critical interaction between SARS-CoV-2 and the angiotensin-converting enzyme 2 (ACE2) facilitates viral entry into the host cell. ACE2 is expressed in pancreatic islets, vascular endothelium, and adipose tissue, and the SARS-CoV-2 – ACE2 interaction in these tissues, along with other factors, governs the spectrum and the severity of clinical manifestations among COVID-19 patients with metabolic syndrome. Moreover, the pro-inflammatory milieu observed in patients with metabolic syndrome may contribute toward COVID-19-mediated host immune dysregulation, including suboptimal immune responses, hyperinflammation, microvascular dysfunction, and thrombosis.

The more we are dealing with individual dispositions and conditions, the more translational issues of individualised medicine come into play – and this is precisely the recommendation of this article: to consider systemic psycho-physiological and behavioural conditions of cardiorespiratory fitness and immune regulation and to apply them to individual preventive or therapeutic measures, hence the (uncommon) idea of 'individualised public health', which must not be confused with the relationship between 'individual and population health' (cf. Arah, 2009).

BENCH TO BEDSIDE TO LIFE-STYLE

Systemic meta-syntheses intend to provide new theoretical frameworks by synthesising highly specialised (isolated) scientific findings, and translational medicine contributes to bridging the gap between theory and practice. Both issues are neither trivial nor easy to solve and 'transfer of results or new knowledge achieved in the laboratory into health innovation' (Valdés et al., 2018) is as challenging as the discovery of the systemic truth that inheres in huge puzzles of single studies in medicine.

In this context, translational epidemiology has gained ground and 'entering a brave new world of team science' (Shah et al., 2016) describes lively its interdisciplinary features, challenges and hopes. While the expression 'bench to bedside' brings the problem of how to apply e.g. biomedical findings in clinical contexts, today translational medicine also relates to public health issues (cf. Woolf, 2008) and associated interdisciplinary, e.g. economical and political, perspectives – and this broader perspective goes hand in hand with the purpose of the present article.

Although socially unbiased health care facilities and appropriate protection through carefully selected vaccination are cornerstones of public health, only providing such professional support is not sufficient for advanced health states in the entire population. There is a crucial need of health awareness, readiness to self-administered healthy life-styles and efficient health promoting behaviour, hence the broad spectrum of relevant factors which differ from the meaning of 'bench to bedside' in an exclusively clinical sense. In this context, the present article also involves arts-based activities to improve one's cardiorespiratory fitness and immune system (cf. Khan & Moss, 2017).

Enhancement of cardiorespiratory fitness and immune functions in the wider population requires five prerequisite conditions: (i) adequate knowledge, health awareness and self-responsibility (cf. Gasparri et al., 2016), (ii) practical ability to perform relevant exercises, as well as adherence to healthy lifestyles, (iii) readiness to regular training and health promoting activities, (iv) individualised models of cardiorespiratory trainings and (v) adequate and easily accessible facilities to put them into practice.

Particularly readiness to regular health activities greatly depends on motivation, habituation and self-identity with sports and physical activity (cf. Mastnak 2018 & 2019), as well as body-awareness and body-image. Taking all these aspects into account, promoting such activities requires (i) consideration of cultural traditions and social conditions, which facilitate implementation, (ii) scientifically based models, which can be tailored to individual conditions and (iii) generation of educational, occupational medical and further public health relevant networks.

To cite an instance, there are rich Chinese traditions of health related martial arts such as Tai Chi and Qi Gong, which have positive influence on cardiorespiratory fitness and are viable means in cardiac rehabilitation (cf. Mastnak, 2017), as well as a wealth of traditional and modern dance genres which can be used or modified for immunological purposes.

Practising Tai Chi and Qi Gong is still a vivid tradition in China, although rather performed by the older generation, and throughout China a sort of 'square dance', often including a huge number of participants, is practiced in public parks and facilitates the improvement of cardiorespiratory fitness, which boosts the immune system. In this context we also have to pay attention to vivid dance traditions of the 55 officially recognised ethnicities in China and their role in regional public health activities.

The Research Centre for Arts Therapies of Beijing Normal University conducts research on arts-based models and creative sports activities which are designed to satisfy relevant parameters. It provides in-service-training for teachers and professionals involved in public health and generates associated networks.

CONCLUSION AND PERSPECTIVES

Although the COVID-19 era has brought global fear and panic, comparative epidemiological research qualifies the threat of the SARS-CoV-2 virus and refers to data of the World Health Organisation. A pandemic was declared on the 11th of March 2020 and as of the 23rd of July 15 million cases and 619150 deaths have been notified globally (WHO, 2020). To estimate the epidemiological significance of these numbers requires comparison such as that 'seasonal influenza is a major cause of morbidity, mortality, and use of healthcare services globally. In accordance with the World Health Organization (WHO), up to 650,000 deaths are associated with seasonal influenza respiratory infections annually' (Iuliano et al., 2018).

Although we must not downplay the fact that 'in this pandemic several countries experienced an unprecedented surge demand on their healthcare systems, which greatly exceeded their capacity to respond' (Verelst et al., 2020) we also have to consider voices from different disciplines that the COVID-19 pandemic should not be considered the novel plague or pestilence.

Taking these perspectives into account, there is a high probability that political standpoints and public health attitudes towards epi- and pandemics have changed and will tend to a 'post COVID-19 new normality'. Nonetheless, there are highly sensitive issues to be taken into account and related problems to be explored: Will future influenza waves cause similar social restrictions and political behaviour? How will people cope with – from a cultural anthropological perspective – inhumane and potentially psychopathogenic life-conditions? Will there be ideological camps and civil-war-like protests to re-establish traditional life-styles? How will political and public health systems respond to pandemics with a more aggressive pathogen than SARS-CoV-2? And how are health systems prepared to focused protection and to avoid disadvantage of people with other medical conditions such as chronic cardiovascular diseases?

In this context this article greatly suggests a general promotion of cardiorespiratory fitness and associated improvement of immune functions, as well mature, interdisciplinary and ethical re-considerations of balanced and humane public health.

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