filosofia unisinos
Unisinos Journal of Philosophy
ISSN 1984-8234

Artigo
doi: 10.4013/fsu.2026.271.15

Addressing global risks through *ante-factum* and *post-factum* mitigation: different meanings of the term *mitigation* across climate and pandemic debates

Enfrentando riscos globais por meio de mitigação ante factum *e* post factum*: diferentes significados do termo mitigação nos debates sobre clima e pandemia*

Marcelo de Araujo[I,II]
Pedro Fior Mota de Andrade[II]
Alessandra Moraes de Sousa[II]

[I] Universidade do Estado do Rio de Janeiro – UERJ, Programa de Pós-Graduação em Filosofia, Rio de Janeiro, RJ, Brasil. E-mail: marceloaraujo@direito.ufrj.br

[II] Universidade Federal do Rio de Janeiro – UFRJ, Programa de Pós-Graduação em Direito, Rio de Janeiro, RJ, Brasil. E-mails: pefimoan@gmail.com; alessandra.m.s@gmail.com

Editores responsáveis:
Inácio Helfer
Leonardo Marques Kussler
Luís Miguel Rechiki Meirelles

ABSTRACT: The term *mitigation* plays a central role in both climate change and pandemic debates, yet it is used with markedly different – and often conflated – meanings across these domains. This article offers a systematic conceptual analysis of mitigation by distinguishing between ante-factum mitigation and post-factum mitigation. Ante-factum mitigation refers to measures aimed at reducing the likelihood that a harmful event will occur, whereas post-factum mitigation concerns efforts to prevent the worst consequences of an event that has already materialized. Drawing on the history of climate ethics, the article shows how early ambiguities surrounding mitigation, adaptation, and prevention re-emerged in pandemic ethics, particularly before and during the COVID-19 pandemic. The analysis demonstrates that much confusion in policy and ethical debates stems from shifting objects of mitigation rather than from substantive disagreement about goals. Clarifying these distinctions is essential for evaluating preparedness, response, and responsibility in the governance of global risks. The article concludes that conceptual precision regarding mitigation is indispensable for coherent ethical analysis and effective policymaking in both climate and pandemic contexts.

Keywords: climate change, pandemics, *ante-factum* mitigation, *post-factum* mitigation, adaptation, prevention.

Como citar:
Araujo, M., Andrade, P. F. M. & Sousa, A. M. 2026. Addressing global risks through *ante-factum* and *post-factum* mitigation: different meanings of the term mitigation across climate and pandemic debates. *Filosofia Unisinos, 27*(1):1-16, e27115. doi: 10.4013/fsu.2026.271.15

RESUMO: O termo mitigação desempenha um papel central tanto nos debates sobre mudança climática quanto sobre pandemias, ainda que seja utilizado com significados marcadamente distintos — e frequentemente confundidos — entre esses domínios. Este artigo oferece uma análise conceitual sistemática da mitigação ao distinguir entre mitigação *ante factum* e mitigação *post factum*. A mitigação *ante factum* refere-se a medidas voltadas a reduzir a probabilidade de que um evento danoso ocorra, ao passo que a mitigação *post factum* diz respeito a esforços para prevenir as piores consequências de um evento que já se concretizou. Com base na história da ética climática, o artigo mostra como ambiguidades iniciais em torno de mitigação, adaptação e prevenção reapareceram na ética das pandemias, especialmente antes e durante a pandemia de COVID-19. A análise demonstra que grande parte da confusão em debates políticos e éticos decorre de mudanças no objeto da mitigação, e não de desacordos substantivos quanto aos objetivos. Esclarecer essas distinções é essencial para avaliar a preparação, a resposta e a responsabilidade na governança de riscos globais. O artigo conclui que a precisão conceitual em relação à mitigação é indispensável para uma análise ética coerente e para a formulação de políticas eficazes tanto no contexto climático quanto no de pandemias.

Palavras-chaves: mudança climática, pandemias, mitigação *ante factum*, mitigação *post factum*, adaptação, prevenção.

1 Introduction

In this article, we propose a conceptual distinction between *ante-factum mitigation* and *post-factum mitigation*. This distinction is necessary for the assignment of responsibility in the context of climate change and pandemics. It pertains to measures expected to be implemented before an event occurs (*ante-factum mitigation*) and to measures expected to be implemented after an event has already occurred (*post-factum mitigation*). We argue that *ante-factum mitigation* measures aim both to reduce the likelihood of a given event and to prepare people and infrastructure for cases in which the event cannot be avoided. *Post-factum* mitigation measures, by contrast, aim to attenuate the worst consequences of an event that has already occurred, whether or not *ante-factum* mitigation has been deployed beforehand. The article is divided into four main sections. First, we provide a historical review of early climate ethics in which the term *mitigation* was used in different ways, including to denote what would now be called *adaptation*. Second, we analyse the concepts of mitigation, adaptation, and prevention in the context of climate change. Third, we examine these concepts in the context of pandemic-related debates. Fourth, we examine cases in which the distinction between *ante-factum* and *post-factum* mitigation becomes blurred, giving rise to conceptual overlap or conflation.

2 Method

This article is situated within applied ethics. Methodologically, it adopts a form of philosophical analysis characteristic of the field, consisting in the systematic examination of fundamental concepts relevant to socially significant problems, with the aim of articulating and justifying normative positions. It also engages with empirical scientific literature produced outside philosophy, which serves to inform and contextualize the normative analysis. However, it does not seek to adopt the methodologies of these disciplines, focusing instead on conceptual and normative inquiry.

3 Abatement, limitation, and mitigation

In the early climate ethics debate, the word *abatement* was often used to refer to policies that we would rather now call *mitigation*, namely policies designed to address the causes of climate change (Jamieson, 2014, p. 206)[1].

Abatement therefore (just like mitigation nowadays) consisted in a cause-oriented approach: the idea was (and still is) to fight climate change by addressing its causes. Well into the 1990s, the word *abatement* was still being used in the climate change debate to denote the kind of policy we would contemporarily call mitigation (see e.g. Schelling 1992). The word *limitation*, and occasionally *minimization* (United States Committee On Environment And Public Works, 1986, p. 309)[2], were also sometimes used instead of *abatement* in the climate change discussions throughout the 1980s (Hare and Quilligan, 1988; Jäger, 1988, p. 19; Fowler, 1989; Pielke, 1998, p. 161)[3].

The problem, however, is not simply that a variety of terms were used in the 1980s to denote mitigation strategies, but rather that the term *mitigation* itself was also sometimes used with a different meaning, closer to what would now be called *adaptation*. Accordingly, mitigation was at times used to refer to an effect-oriented approach: that is, to strategies aimed at coping with the adverse effects of climate change rather than addressing its causes (Kellogg and Schware, 1981, p. 14; National Academies of Sciences, 1983, p. 465; United States Environmental Protection Agency, 1983, ch. 1 (p.7); ch. 5 (p.2); World Climate Programme *et al.*, 1986, pp. 62–65). As late as 1992, the term *mitigation* was still occasionally used in its effect-oriented sense. Consider, for instance, the Article 3 of the UNFCCC (United Nations Framework Convention on Climate Change) from 1992: "The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects" (United Nations, 1992, art. 3). In this formulation, *minimize* corresponds to what is now understood as mitigation, whereas *mitigate* refers instead to enhancing protection against the adverse effects of climate change, that is, to what would now be called adaptation.

The term *mitigation*, as we have seen, is ambiguous, since its object can be either an activity that causes undesirable effects (e.g. greenhouse gas emissions) or the undesirable effects themselves (*e.g.* heatwaves, forest fires, droughts, floods, etc.). As we show in this article, this ambiguity is also apparent in the literature on pandemics. The term may refer either to strategies that make the emergence of a pandemic less likely (a use that was quite common before the COVID-19 pandemic) or, alternatively, to strategies that attenuate the societal impact of a pandemic that has already emerged. In the first case, *mitigation* (or the corresponding verb) denotes a cause-oriented policy; in the second, it denotes an effect-oriented one.

1 Dale Jamieson makes the following remark on the use of *abatement* instead of *mitigation* in the early climate change debate: "In the policy discourse the term that is normally used for reducing emissions of pollutants is 'abatement' while 'mitigation' is normally used to refer to policies that moderate the severity of the effects of the pollution. For example, we abate air pollution by installing catalytic converters on cars or prescribing 'no drive' days, and we mitigate pollution by installing air purifiers or house plants in our houses. My hypothesis is that when people came to see climate change as a pollution problem they began to use 'mitigate' for 'abate,' since the term 'mitigate' was already deeply entrenched in the climate change discussion. The effect of this has been to marginalize sink enhancement or leave it out of the conversation altogether"

2 The relevant passage is this: "A conservative view of global ecosystems favors preventive strategies, but with some climate change inevitable (and perhaps already occurring), strategies which are broadly protective, focusing on climate change minimization but preparing for some adaptation, merit attention."

3 See for instance Jill Jaeger: "As the previous sections have shown, the increasing concentrations of GHGs could cause climatic changes within the next half century with major implications for environment and society. For this reason it is necessary to consider strategies for responding to climatic change. These strategies fall into two categories. *Adaptation* strategies adjust the environment or our ways of using it to reduce the consequences of a changing climate; *Limitation* strategies control or stop the growth of GHG concentrations in the atmosphere and limit the climatic change." (Jaeger 1988, 19, emphasis in original).

4 Mitigation, adaptation, and prevention in the climate change debate

In the climate change debate, it has become usual to draw a distinction between *mitigation* and *adaptation* policies. Both mitigation and adaptation are necessary in order to deal with climate change. Climate mitigation aims mainly at keeping the global temperature increase below 1,5 °C above pre-industrial levels, and reaching carbon neutrality by 2050 (IPCC, 2018b, p. 33). Mitigation policies include, for instance, sharp reduction of greenhouse gas emissions, development of low-carbon and non-fossil sources of energy, preservation and expansion of carbon sinks, and development of technologies for carbon capture and storage. Mitigation policies require strong international cooperation. Climate adaptation policies, on the other hand, aim at reshaping the infrastructure of cities in order to make them more robust against the consequences of heat waves, extreme weather, and sea level rise. Interventions in rural areas may also be necessary for climate adaptation, so as to make them less vulnerable, for example, to wildfires or river floods (United Nations Environment Programme, 2021).

In addition to adaptation and mitigation policies, one might suggest that we should also refer to policies that aim at *preventing* climate change. There is a reason, though, we do not list *prevention* along with *mitigation* and *adaptation* strategies in the current climate ethics debate. Climate change is already occurring, but not as a natural phenomenon, unrelated to human activities. Climate change results mainly, though certainly not only, from the long-standing use of fossil fuels as a source of energy. If at the dawn of the Industrial Revolution richer countries had foreseen the problem and kept away from massive use of fossil fuels, they might have *prevented* climate change from happening. But as richer countries did not prevent climate change from starting in the first place, the world can now only *mitigate* the forces underlying climate change (the greenhouse gas emissions) and *adapt* to the new environment.

As the world struggles to mitigate greenhouse gas emissions and adapt to a changing environment, it is also possible to prevent the worst consequences of climate change from materializing. In this sense, mitigation can be understood as a preventative strategy, not because it prevents climate change itself, but because it aims to prevent its most severe consequences. As Henry Shue puts it: "*Mitigation* is the name that has come to be applied to preventative actions designed to cut back on the human forcing of climate change with the ultimate goal of keeping climate change within a range to which humans can adapt" (Shue, 2017, p. 465). The definition of mitigation provided in the 2018 IPCC report also includes the verb *prevent*, but makes clear that the object of prevention is not climate change itself, but the greenhouse gas emissions that drive it: "Mitigation refers to efforts to reduce or prevent the emission of greenhouse gases, or to enhance the absorption of gases already emitted, thus limiting the magnitude of future warming" (IPCC, 2018a, p. 70). It follows that the terms *prevent*, *preventative*, and *prevention*, when used in connection with climate mitigation policies, do not refer to preventing climate change as such. Rather, the object is not climate change itself, but the most severe consequences likely to result from unmitigated climate change.

In the 1980s, by contrast, at the inception of the climate change debate, some authors assumed that preventing climate change was still possible. The central normative question, for them, was whether priority should be given to prevention or to adaptation, that is, whether to prevent climate change or to allow it to proceed and instead focus on adapting to its consequences. Writing in 1980, Klaus M. Meyer-Abich, for example suggested: "It is important to recognize that prevention, compensation, and adaptation are basically equivalent options, so that it would be a mistake to consider, for instance, prevention as being in principle better than adaptation" (Meyer-Abich, 1980, p. 379). Just six years later, G.N. Golubev suggested that adaptation was actually preferable to prevention: "[…] the price of regulating CO_2 emissions through energy controls may be too high a price to pay and the future lies

in adaptation to rather than in prevention of climate change." (Quoted by R.J. Fowler (Fowler, 1989, p. 695)). It was not until late in 1980s that it became apparent that preventing climate change from happening was not an option anymore. And because climate change was already in full swing, all that remained to be done was to *mitigate* its worst consequences and *adapt* to the new environment. As Dale Jamieson put the problem in 2001:

> "Traditionally it is said that there are three options in responding to climate change: prevention, mitigation, and adaptation. But if the science is at all credible, then for some time prevention has not been an option. The debate is over mitigation. Will the world succeed in significantly mitigating climate change, or will we have a global policy of adaptation?" (Jamieson, 2001, p. 305).

Given the amount of evidence amassed over the past two decades, and with particular reference to the IPCC report *Climate Change 2021: The Physical Science Basis*, the question as to whether "the science is at all credible" can hardly be raised (IPCC, 2021). In an article from 2010, Jamieson also recalls that once it had become apparent that climate change could not be prevented anymore, the concept of *mitigation* "quickly moved to center stage":

> "When I began my research on global climate change in the mid-1980s, it was commonly said that there were three possible responses: prevention, mitigation, and adaptation. Even then we were committed to a substantial climate change, although this was not widely known. This realization began to dawn on many people on June 23, 1988, a sweltering day in Washington, D.C., in the middle of a severe national drought, when climate modeler James Hansen testified before a U.S. Senate committee that it was 99 percent probable that global warming had begun. […] Once it became clear that prevention was no longer possible, mitigation quickly moved to center stage" (Jamieson, 2010, p. 263)[4].

Because the mitigation of an ongoing process can be instrumental to the prevention of some event we would rather keep at bay, it is easy to take one thing for the other and speak of *prevention* when we actually mean mitigation, or to speak of *mitigation* when we actually mean prevention. This kind of confusion has affected the emerging field of pandemic ethics as well.

5 Mitigation, adaptation, and prevention in the COVID Pandemic debate

In the pandemic debate, even prior to the emergence of the COVID pandemic, it has become usual to draw a similar distinction between *response efforts*, on the one hand, and *preparedness efforts*, on the other (MacGregor, Ripoll e Leach, 2020, p. 114). A pandemic may or may not arise, but given the long history of pandemics that have wreaked havoc on humanity (Watts, 1999; Barry, 2004; Snowden, 2008, 2019), states and the international community as a whole have good reasons to be *prepared* for the emergence of a pandemic. In 2020, it became evident that neither states nor the international community was prepared to deal with the COVID pandemic, even though the scientific community and policymakers in countries such as the United States and the United Kingdom had been vividly aware of a lack of pandemic preparedness as early as 2005 (Araujo e Costa, 2023, 2024). Once a pandemic strikes, states and the international community must *respond* accordingly, whether or not they have prepared for this in advance. Successful *response efforts* may also prove instrumental for the strengthening of

4 See also (Jamieson, 2014, p. 201-202).

future *preparedness efforts*. Take, for example, some of the capabilities developed in the course of the COVID pandemic. Part of the pharmaceutical and logistic infrastructure developed in the course of 2020 and 2021 should have been kept in place. This would enable states to react quickly, in case new disease outbreaks occur again in some parts of the world. Thus, what counts as *response efforts* in the present may become part of the *preparedness efforts* later. In some circumstances, the *preparedness effort* itself may also prove instrumental to the *prevention* of a pandemic, even though its main goal is not to prevent a pandemic in the first place, but to make the relevant actors able to address a pandemic effectively once a pandemic has struck. If a new disease outbreak occurs and local authorities are quick to respond – for example, by notifying the WHO (World Health Organization) and imposing mobility restrictions within the region that has been affected – other states will have time to respond, for example, by imposing quarantine on passengers arriving from the affected regions and keeping the local health system alert for patients with the relevant symptoms. Thus, although the preparedness effort by itself may not prevent a new outbreak from occurring, it may still prevent an outbreak from growing into a major pandemic. And if in spite of extensive preparedness efforts an outbreak does grow into a major pandemic, preparedness efforts can still enable the relevant actors to *mitigate* the pandemic. Now, it is important to notice that, in the previous sentence, the word *mitigate* is being used here to refer to an event that has already emerged. The object of the mitigation, in this case, is an actual pandemic.

The concept of *mitigation*, as we have pointed out earlier, must not be confused with the concept of *prevention*. Just as we cannot prevent climate change from happening anymore, for obvious reasons, we cannot prevent the COVID pandemic from having happened. All we can do in the course of a pandemic, or in the current climate crisis, is to *mitigate* their impact by trying to *prevent* the worst consequences, namely: *dangerous* climate change, on the one hand, and the *unbearable* costs (both human and economic costs) of an unmitigated pandemic, on the other. What counts as "dangerous" climate has been the object of some discussion in the climate ethics debate (Schneider, 2001; Dessai *et al.*, 2004; Schnellnhuber e Cramer, 2006; Harris, 2021, p. 41). But the question as to what should count as the *unbearable* costs of an unmitigated pandemic has not been thoroughly examined thus far. One reason for this is that different individuals will show different levels of tolerance towards the short-term and long-term efforts that are required to mitigate pandemics (Mallapaty, 2021a). The act of *mitigating* something, thus, is instrumental to the purpose of *preventing* something else from happening. Still, preventing and mitigating are two different things.

Incidentally, it is worth noting that the verb *prevent* in English is ambiguous. On the one hand, the verb refers to something that stops the occurrence of another thing, or that makes its occurrence impossible. For example, if one removes the air from the interior of a diving bell, one *prevents* the divers from breathing. Once the air has been removed, it is simply impossible to breathe in the diving bell. On the other hand, the same verb may also refer to precautionary measures that make the occurrence of another thing less likely, but not impossible. If policymakers intend to *prevent* crime, they should address social issues such as extreme poverty first. As it happens, though, policymakers can address social issues and still see crimes being committed. Other languages, such as, for example, Portuguese and German, are less prone to ambiguity in this regard. One would ordinarily use the verb *impedir* (in Portuguese) or *verhindern* (in German) in the first case (stopping something from happening), and the verb *prevenir* (in Portuguese) or *vorbeugen* (in German) in the second case (taking precautionary measures)[5]. When Meyer-Abich and Golubev talked about *preventing* climate change in the 1980s, they had in mind measures that would stop climate change from happening, but because those measures

5 For an insightful account of the difference between *verhindern* as opposed to *vorbeugen* in the context of the fight against the COVID pandemic in Germany in 2020, see (Hallich, 2021, p. 59–60).

would be too costly, they thought that it might be economically better to focus on *adaptation* rather than *prevention*. After the strategy of *mitigation* "quickly moved to center stage", however, talk about *preventing* climate change started to mean something else. It was not about stopping climate change, for climate change was already occurring. *Preventing* climate change came to mean primarily, instead, taking precautionary measures that would make the worst consequences of an ongoing event less likely to materialize.

Because mitigation is instrumental to prevention, and because the verb *prevent* is ambiguous, the term *mitigation* is prone to ambiguity as well. When authors and policymakers talk about *mitigating* pandemics, they may have two quite different kinds of strategies in mind: precautionary strategies that aim at making the emergence of a pandemic less likely, on the one hand; or strategies that will (very probably) stop the worst consequences of an ongoing pandemic from materializing, on the other. The effective pursuit of SDG (Sustainable Development Goals), for example, counts as a precautionary strategy, for it makes the occurrence of new disease outbreaks and, ultimately, the emergence of a pandemic less likely to occur (Gostin, 2014, p. 367–372; United Nations, 2015; National Research Council, 2016; Madhav *et al.*, 2017, p. 316). But if another pandemic does emerge, measures such as large-scale vaccination of the population, the enforcement of social distancing and the compulsory use of masks are deployed as an attempt to stop the worst consequences of a pandemic, namely the occurrence of disproportionate number of excess deaths.

Over the last decades, several studies have shown that the main drivers of zoonotic virus spillover to human beings are human activities such as the operation of wet markets, the consumption of bushmeat, illegal wildlife trade, and the encroachment on the habitat of wild species through deforestation (or through the fragmentation of forests) (Daszak, Cunningham e Hyatt, 2000; Knobler *et al.*, 2003, p. 30; Jones *et al.*, 2008; Lindahl e Grace, 2015; Allen *et al.*, 2017; Baum *et al.*, 2017; Carroll *et al.*, 2018; Quick e Fryer, 2018, p. 37–41; Dobson *et al.*, 2020; Morand e Lajaunie, 2021). Now, the pursuit of SDG can help us to *mitigate* the impact of human activities on the environment. It means that SDG can prove instrumental to the prevention of future pandemics. But it must be clear that, in this case, the object of *mitigation* is not an actual pandemic. What has to be *mitigated* here is the impact of human activities that may (or may not) ultimately lead to the emergence of a pandemic. This, however, makes the use of the term *mitigation* ambiguous, for it can also be used to refer to the mitigation of an ongoing pandemic, in which case the mitigation, for obvious reasons, cannot stop the emergence of the pandemic that is being mitigated. It is in this second sense that we can speak, for instance, of social distancing as a mitigation strategy.

Thus, the object of mitigation may be either an ongoing process or its effects, while the object of *prevention* is an event that is not yet going on. And because we do not want an event to be going on in the first place, we have reasons to implement not only measures that may prevent that event from happening (*prevention* or *preventative measures*) but also measures that enable us to forestall its worst consequences from materializing in case the event does emerge (*mitigation measures*). Mitigation measures are likely to be more effective if the relevant actors are *prepared* to deal with an event that they, for whatever reasons, could not prevent from happening (*preparedness measures*). Because the mitigation of an ongoing event (e.g. the mitigation of the impact of human activities on the environment through the pursuit of SDG) can prove instrumental in the attempt to prevent *another* event from happening (e.g. the outbreak of diseases that may lead to pandemics) and because the mitigation of an ongoing event can also, alternatively, prevent *its* worst consequences from materializing (e.g. for example, vaccinating the population in the middle of a pandemic in order to avoid a high number of deaths) it is reasonable to think of mitigation as a means of *prevention*. But the problem, again, is that

there are two different issues that we may intend to prevent by means of mitigation strategies. (1) We may intend to prevent the occurrence of an event that has not yet materialized, i.e. the event is not yet a fact (call it *ante-factum mitigation*). (2) Or we may intend to prevent the occurrence of the worst consequences of an event that did indeed materialize, i.e. the event has already become a fact (call it *post-factum mitigation*) (Figure 1).

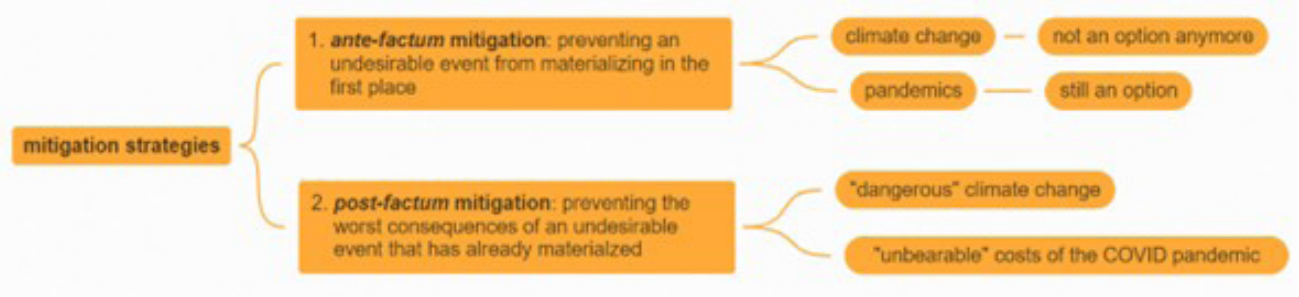

Figure 1. *Ante-factum* mitigation and ***post-factum*** mitigation regarding climate change and pandemics.

Given the distinction between *ante-factum mitigation* and *post-factum mitigation*, it comes as no surprise that before the emergence of the COVID pandemic the word *mitigation* was often used to denote *ante-factum mitigation*, rather than *post-factum mitigation*. Writing in 2014, Jamison Pike and colleagues, for instance, suggested the following analogy between strategies to address climate change and strategies to address pandemics:

> "Globally coordinated strategies to combat pandemics, similar to current strategies that address climate change, are largely adaptive, in that they attempt to reduce the impact of a pathogen after it has emerged. However, like climate change, mitigation strategies have been developed that include programs to reduce the underlying drivers of pandemics, particularly animal-to-human disease transmission" (Pike *et al.*, 2014, p. 18519)[6].

In this passage, it is clear that Pike and colleagues refer to pandemic mitigation strategies as a means to "reduce the underlying drivers of pandemics", and not to the abatement of some specific pandemic that has already emerged. What is at stake here, therefore, is *ante-factum* mitigation. It is also in this sense that, writing in 2018, Dennis Carroll and colleagues discuss the "feasibility of preemptively mitigating pandemic threats" (Carroll *et al.*, 2018), or that Alimi and colleagues propose mitigation measures to promote "pandemic prevention" (Alimi *et al.*, 2021, p. 5)[7]. Both Pike and Carroll, along with their respective colleagues, reckon that the costs of (what we call) *ante-factum* mitigation and pandemic preparedness are far lower than the costs of (what we call) *post-factum* mitigation. In retrospect, as the economic costs of the COVID pandemic became apparent, we might even say these authors had been modest in their respective assessments of the costs resulting from lack of proper investment in *ante-factum* mitigation and pandemic preparedness. As one study put the problem in August 2021: "The COVID-19 pandemic resulted in an estimated global GDP loss of 4.5% in 2020 or nearly US$4 trillion. Although the probability of a pandemic may have grown in recent decades, if COVID-19 is a

6 See also *ibid.*: "Emerging pandemics are increasing in frequency, threatening global health and economic growth. Global strategies to thwart pandemics can be classed as adaptive (reducing impact after a disease emerges) or mitigation (reducing the causes of pandemics)" (Pike *et al.*, 2014, p. 18519).

7 See also (Pike *et al.*, 2014, p. 18519; National Research Council, 2016, p. 17; Dobson *et al.*, 2020).

1/100-year event, this translates into US$40 billion per year over the next century, without accounting for the time value of money" (Alimi *et al.*, 2021, p. 24)[8].

On the other hand, during the COVID pandemic, the word *mitigation* was more frequently used to refer to measures that aimed at minimizing the worst effects of the ongoing global health crisis, that is *post-factum* mitigation. It is in this sense, for example, that some authors, recognizing that evictions might have contributed to an increase in the number of new infections during the COVID pandemic, proposed new housing policies as a "primary pandemic mitigation strategy" (Benfer *et al.*, 2021). Other authors suggested the automation of hospital facilities as a further strategy for "pandemic mitigation" (Magid *et al.*, 2021). These are clearly cases of *post-factum* mitigation strategies. It is also in this sense that the word *mitigation* occurs several times in the 2021 American government's *National Strategy for the* COVID-*19 Response and Pandemic Preparedness*, as, for example, in the following passage: "The United States will also take steps to enhance humanitarian relief and support for the capacity of the most vulnerable communities to prevent, detect, respond to, mitigate, and recover from impacts of COVID-19, such as food insecurity and gender-based violence" (White House, 2021, p. 22). Of course, we do not have to wait until a pandemic has struck in order to estimate the efficacy of possible *post-factum* mitigation strategies. It is important to figure out in advance, as part of the preparedness effort, what the relevant actors will have to do in order to promote effective *post-factum* mitigation measures, in case a pandemic does arise. It is this sense, then, that Nita Madhav and colleagues, writing in 2017, had referred to the use of pharmaceuticals as a key element of (what we call) *post-factum* mitigation strategies: "Vaccines, antibiotics, and antiviral drugs can play a critical role in mitigating a pandemic by reducing the infectiousness of symptomatic patients and the susceptibility of uninfected individuals" (Madhav *et al.*, 2017, p. 329); or that Sadique and colleagues, writing in 2008, had estimated the "costs of school closure for mitigating an influenza pandemic" (Sadique, Adams e Edmunds, 2008)[9]. Sometimes, though, it may not be immediately clear whether the word *mitigation* is being used to denote *ante-factum* or *post-factum* mitigation strategies.

6 Ante-factum mitigation or post-factum mitigation?

What if some individual country manages to keep its borders tightly closed and quickly "eliminates" the existence of a new virus within its own territory, while the pandemic remains rampant everywhere else? Is this country pursuing *ante-factum* mitigation, *post-factum* mitigation, or no mitigation strategies at all? At the beginning of the COVID pandemic, a few countries seemed to have managed to address the health crisis successfully by pursuing this kind of strategy, namely by keeping their borders tightly closed and aiming at a quick virus "elimination". This has led some authors to suggest that "elimination" rather than "mitigation" was the best strategy to tackle the COVID pandemic. In a paper entitled "SARS-CoV-2 elimination, not mitigation, creates best outcomes for health, the economy, and civil liberties", published in *The Lancet*, Oliu-Barton and colleagues suggested the following:

8 Cf. Sylvia M. Burwell *et al.*, *Improving Pandemic Preparedness: Lessons From COVID-19*: "The virtual inevitability and high potential toll of future pandemics make investments in preventive and mitigatory measures both sensible and cost effective. The amount required to prevent and mitigate such incidents pales in comparison to their costs" (Burwell *et al.*, 2020, p. 27).

9 See also (Ferguson *et al.*, 2006; Lugnér e Postma, 2009).

> "Countries that consistently aim for elimination – i.e., maximum action to control SARS-CoV-2 and stop community transmission as quickly as possible – have generally fared better than countries that opt for mitigation – i.e., action increased in a stepwise, targeted way to reduce cases so as not to overwhelm health-care systems" (Oliu-Barton *et al.*, 2021, p. 2234).

The authors listed five countries that favoured "elimination" over "mitigation" strategies, namely: Australia, Iceland, Japan, New Zealand, and South Korea. Not surprisingly, though, except for South Korea, these countries are also islands, which certainly makes the strategy of isolation easier for them. It is unlikely that other countries could have adopted a similar strategy with the same degree of success. Moreover, we must bear in mind that the attempt to eliminate the virus within one's population is itself a *post-factum* mitigation strategy. Once total elimination has been achieved (assuming it is achievable), the country will no longer be pursuing *post-factum* mitigation strategies, as the virus will no longer be circulating within its population. But this country will still be pursuing *ante-factum* mitigation strategies, such as keeping its borders closed, vaccinating its population, and strengthening its internal *preparedness* infrastructure. It must also be emphasised that some studies suggest that closing the borders may, indeed, keep the virus at bay for some time, but this strategy can hardly prevent the virus from penetrating into a country in the longer run (National Research Council, 2016, p. 4; Christakis, 2020, p. 107–109; Horton, 2021, p. 31–32; Mallapaty, 2021c; Normile, 2021). Once a new, more contagious variant of a virus emerges, as for instance the Omicron variant in November 2021, in South Africa, it can easily find its way to other countries, in spite of border controls and travel bans (Mallapaty, 2021b). Moreover, the attempt to promote pandemic mitigation by means of travel bans – or "travel-related risk mitigation measures" (World Health Organization (WHO), 2021) – has some pressing ethical implication as well: if a country is quick to notify the WHO about a new disease outbreak, or about the emergence of a variant of concern (VOC), as South Africa was in November 2021, it runs the risk of being unable to develop further research on the new variant, or to provide adequate medical care to its population, for other countries may feel tempted to ban flights to or from this country. As the WHO put the problem, shortly after the emergence of the Omicron variant was announced: "Blanket travel bans will not prevent the international spread, and they place a heavy burden on lives and livelihoods. In addition, they can adversely impact global health efforts during a pandemic by disincentivizing countries to report and share epidemiological and sequencing data" (World Health Organization (WHO), 2021).

Confusion between *ante-factum* and *post-factum* mitigation strategies may also occur in the course of a pandemic for a different reason, namely because the same set of measures may be used to abate an ongoing pandemic and, simultaneously, to prevent another pandemic from arising. In this case, though, it would be more appropriate to speak, not of a *confusion*, but of a *conflation* of *ante-factum* and *post-factum* mitigation measures. We have in mind here two possible scenarios in which conflation may occur. In one scenario, a pandemic is mitigated and it eventually disappears. But the expertise and infrastructure created during the pandemic are kept in place in order to avert the emergence of another pandemic in the future. In a second scenario, a pandemic (or the negative effects of a major pandemic) protracts for a much longer time than most people had expected. The pandemic recedes in many countries, but it becomes endemic in other parts of the world, so that all countries, at any given time, will be either fighting the virus or making provisions to fight it again, or to fight one of the virus' recurring variants. In this scenario, the distinction between *ante-factum* and *post-factum* mitigation strategies becomes blurred. During the pandemic, some analysts argued that the COVID pandemic might well have been an instance of this otherwise hypothetical scenario.

Back in 2021, it was generally admitted that the COVID pandemic was unlikely to subside soon (Aschwanden, 2021; British Academy, 2021; Greshko, 2021; Telenti *et al.*, 2021; Torjesen, 2021; Zhang, 2021). As one author put the problem early 2021: "The coronavirus is here to stay" (Phillips, 2021). Peter Stock and colleagues suggested, in a similar vein, that the COVID pandemic may "run a protracted and potentially recurrent course" (Stock *et al.*, 2020, p. 1317). Or as Laetitia Atlani-Duault and colleagues put the problem in *The Lancet Public Health*: "The fervently awaited end of this global health crisis might be continually postponed, as new variants emerge and immune evasion reduces vaccination effectiveness in the short and medium term" (Atlani-Duault *et al.*, 2021, p. 1). Other studies have also shown that the vaccines deployed to mitigate the COVID pandemic would become less effective sooner than it had been originally expected (Edridge *et al.*, 2020; Peeples, 2021; Townsend *et al.*, 2021). Thus, instead of returning to their normal, pre-pandemic lives, most people had to adjust their lives to the consequences of the pandemic. There emerges the question, then, if we are not in a position similar to that in which Jamieson and colleagues found themselves in the 1980s: preventing the next pandemic is apparently no longer an option, just in the same way we cannot prevent climate change anymore. *Post-factum* mitigation has become the key strategy on both fronts.

This does not mean, of course, that another pandemic, caused by a different virus, or by further mutations of the coronavirus, or as the result of a bioterrorist attack, cannot emerge and grow into yet another major health crisis in the foreseeable future. Having witnessed the havoc wrought by the pandemic, policymakers on both international and national levels have moral and economic reasons to prevent this from happening. But, in that case, they will be struggling to prevent the next pandemic while still trying to ameliorate the long-term effects of the COVID pandemic. In time, we may eventually reach a scenario where it will be increasingly difficult to distinguish the measures that have been put in place to promote *post-factum* mitigation from measures to promote *ante-factum* mitigation.

7 Conclusion

Although we do not have to live indefinitely under the shadow of dangerous climate change – on the assumption that the long-term goals of the Paris Agreement will be met by the end of this century –, humanity will probably have to live under the shadow of pandemics. This means that pandemics can still emerge in spite of robust *ante-factum* mitigation strategies. And if a pandemic does indeed strike again, we can only hope that *post-factum mitigation* strategies will prevent the worst consequences from materializing. Thus, pandemics may represent an even greater risk to humanity than climate change itself. In this article, we have drawn a distinction between *ante-factum mitigation* and *post-factum mitigation* in order to avoid conceptual confusion between measures that aim at preventing an event from emerging, on the one hand, and measures that aim at preventing the worst consequences of an event that has already materialized, on the other.

References

ALIMI, Y. *et al.* 2021. *Report of the Scientific Task Force on Preventing Pandemics*. Harvard Global Health Institute and the Center for Climate, Health, and the Global Environment at Harvard T.H. Chan School of Public Health, p. 44. Disponível em: https://cdn1.sph.harvard.edu/wp-content/uploads/sites/2343/2021/08/PreventingPandemicsAug2021.pdf.

ALLEN, T. *et al.* 2017. Global hotspots and correlates of emerging zoonotic diseases, *Nature Communications*, **8**(1): p. 1124. Disponível em: https://doi.org/10.1038/s41467-017-00923-8.

ARAUJO, M.; COSTA, D. V. 2023. A survey of pandemic early warnings (1999–2019). Social Science Research Network (SSRN). Disponível em: https://doi.org/10.2139/ssrn.4357126.

ARAUJO, M.; COSTA, D. V. 2024. Promoting science communication for the purpose of pandemic preparedness and response: An assessment of the relevance of pre-COVID pandemic 'early warnings', *Human Affairs, 34*(2). Disponível em: https://doi.org/10.1515/humaff-2023-0083.

ASCHWANDEN, C. 2021. Five reasons why COVID herd immunity is probably impossible. Even with vaccination efforts in full force, the theoretical threshold for vanquishing COVID-19 looks to be out of reach, *Nature, 591*(7851): p. 520–522. Disponível em: https://doi.org/10.1038/d41586-021-00728-2.

ATLANI-DUAULT, L. *et al.* 2021. Immune evasion means we need a new COVID-19 social contract, *The Lancet Public Health*, **6**(4): p. e199–e200. Disponível em: https://doi.org/10.1016/S2468-2667(21)00036-0.

BARRY, J. M. 2004. *The Great Influenza: The Epic Story of the Deadliest Plague in History*. New York: Viking.

BAUM, S. E. *et al.* 2017. Evaluating One Health: Are we demonstrating effectiveness?, *One Health*, **3**: p. 5–10. Disponível em: https://doi.org/10.1016/j.onehlt.2016.10.004.

BENFER, E. A. *et al.* 2021. Eviction, health inequity, and the spread of COVID-19: Housing policy as a primary pandemic mitigation strategy, *Journal of Urban Health, 98*(1): p. 1–12. Disponível em: https://doi.org/10.1007/s11524-020-00502-1.

BRITISH ACADEMY. 2021. *The COVID Decade: Understanding the long-term societal impacts of COVID-19*. The British Academy. Disponível em: https://doi.org/10.5871/bac19stf/9780856726583.001.

BURWELL, S.M. *et al.* 2020. *Improving Pandemic Preparedness: Lessons From COVID-19*. Independent Task Force Report No. 78. New York: Council on Foreign Relations. Disponível em: http://www.jstor.org/stable/resrep26260.1.

CARROLL, D. *et al.* 2018. The Global Virome Project: Expanded viral discovery can improve mitigation, *Science, 359*(6378): p. 872–874. Disponível em: https://doi.org/10.1126/science.aap7463.

CHRISTAKIS, N. 2020. *Apollo's Arrow: The Profound and Enduring Impact of Coronavirus on the Way We Live*. New York: Little, Brown and Company.

DASZAK, P.; CUNNINGHAM, A. A.; Hyatt, A. D. 2000. Emerging infectious diseases of wildlife-threats to biodiversity and human health, *Science, 287*: p. 443–449.

DESSAI, S. *et al.* 2004. Defining and experiencing dangerous climate change, *Climatic Change, 64*(1/2): p. 11–25. Disponível em: https://doi.org/10.1023/B:CLIM.0000024781.48904.45.

DOBSON, A.P. *et al.* 2020. Ecology and economics for pandemic prevention, *Science, 369*(6502): p. 379–381. Disponível em: https://doi.org/10.1126/science.abc3189.

EDRIDGE, A. W. D. *et al.* 2020. Seasonal coronavirus protective immunity is short-lasting, *Nature Medicine, 26*(11): p. 1691–1693. Disponível em: https://doi.org/10.1038/s41591-020-1083-1.

FERGUSON, N. M. *et al.* 2006. Strategies for mitigating an influenza pandemic, *Nature, 442*(7101): p. 448–452. Disponível em: https://doi.org/10.1038/nature04795.

FOWLER, R. J. 1989. Policy and legal implications of the greenhouse effect, em G. I. PEARMAN (org.) *Greenhouse: Planning for Climate Change*. *Greenhouse 87*, Melbourne: CSIRO, p. 694–707.

GATES, B. 2022. *How to Prevent the Next Pandemic*. New York: Alfred A. Knopf.

GOSTIN, L.O. 2014. *Global Health Law*. Cambridge, Massachusetts: Harvard University Press.

GRESHKO, M. 2021. *COVID-19 will likely be with us forever. Here's how we'll live with it*, *Science*. Disponível em: https://www.nationalgeographic.com/science/article/covid-19-will-likely-be-with-us-forever-heres-how-well-live-with-it (Acesso em: 23 de outubro de 2021).

HALLICH, O. 2021. Verhindern oder Vorbeugen? Freiheitseinschränkungen in der Corona-Krise, em *Nachdenken über Corona: Philosophische Essays über die Pandemie und ihre Folgen*. Ditzingen: Reclam, p. 59–72.

HARRIS, P. G. 2021. *Pathologies of Climate Governance: International Relations, National Politics, and Human Nature*. Cambridge, UK ; New York, NY: Cambridge University Press.

HORTON, R. 2021. *The COVID-19 Catastrophe: What' s Gone Wrong and How To Stop It Happening Again*. Cambridge: Polity Press.

IPCC. 2018a. Global Warming of 1.5 °C. Organizado por V. MASSON-DELMOTTE et al. *Intergovernmental Panel on Climate Change*. Disponível em: https://www.ipcc.ch/sr15/.

IPCC. 2018b. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Organizado por V. MASSON-DELMOTTE et al. *Intergovernmental Panel on Climate Change*. Disponível em: https://www.ipcc.ch/sr15/.

IPCC. 2021. *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: IPCC. Disponível em: https://www.ipcc.ch/report/ar6/wg1/.

JAMIESON, D. 2001. Climate change and global environmental justice, em C. A. MILLER; P. N. EDWARDS (org.) *Changing the Atmosphere: Expert Knowledge and Environmental Governance*. Cambridge, Mass: MIT Press (Politics, science, and the environment), p. 287–307.

JAMIESON, D. 2010. Adaptation, mitigation, and justice, em S. GARDINER et al. (org.) *Climate ethics: essential readings*. Oxford; New York: Oxford University Press, p. 263–283.

JAMIESON, D. 2014. *Reason in a Dark Time: Why the Struggle Against Climate Change Failed – And What It Means for Our Future*. Oxford; New York: Oxford University Press.

JONES, K.E. *et al.* 2008. Global trends in emerging infectious diseases, *Nature, 451*(7181): p. 990–993. Disponível em: https://doi.org/10.1038/nature06536.

KNOBLER, S. *et al.* 2003. *Learning from SARS. Preparing for the Next Disease Outbreak – Workshop Summary*. Washington, DC, USA: National Academies Press.

LINDAHL, J. F.; GRACE, D. 2015. The consequences of human actions on risks for infectious diseases: a review, *Infection Ecology & Epidemiology, 5*(1): p. 30048. Disponível em: https://doi.org/10.3402/iee.v5.30048.

LUGNÉR, A. K.; POSTMA, M. J. 2009. Mitigation of pandemic influenza: Review of cost–effectiveness studies, *Expert Review of Pharmacoeconomics & Outcomes Research, 9*(6): p. 547–558. Disponível em: https://doi.org/10.1586/erp.09.56.

MACGREGOR, H.; RIPOLL, S; LEACH, M. 2020. Disease outbreaks: Navigating uncertainties in preparedness and response, em I. SCOONES et al. (org.) *The politics of uncertainty: challenges of transformation*. Abingdon, Oxon ; New York: Routledge.

MADHAV, N. *et al.* 2017. Pandemics: Risks, Impacts, and Mitigation, em D. T. JAMISON et al. (org.) *Disease Control Priorities, Third Edition (Volume 9): Improving Health and Reducing Poverty*. Washington, D.C.: World Bank, p. 315–345. Disponível em: https://doi.org/10.1596/978-1-4648-0527-1.

MAGID, E. *et al.* 2021. Automating pandemic mitigation, *Advanced Robotics, 35*(9): p. 572–589. Disponível em: https://doi.org/10.1080/01691864.2021.1905059.

MALLAPATY, S. 2021a. How many COVID deaths are acceptable in a post-pandemic world?, *Nature, 593*(7859): p. 326–327. Disponível em: https://doi.org/10.1038/d41586-021-01220-7.

MALLAPATY, S. 2021b. Omicron-variant border bans ignore the evidence, say scientists, *Nature*, p. d41586-021-03608–x. Disponível em: https://doi.org/10.1038/d41586-021-03608-x.

MALLAPATY, S. 2021c. What the data say about border closures and COVID spread, *Nature, 589*(7841): p. 185–185. Disponível em: https://doi.org/10.1038/d41586-020-03605-6.

MEYER-ABICH, K. M. 1980. Socioeconomic impacts of CO2-induced climatic changes and the comparative chances of alternative political responses: Prevention, compensation, and adaptation, *Climatic Change, 2*(4): p. 373–385. Disponível em: https://doi.org/10.1007/BF00137206.

MORAND, S.; LAJAUNIE, C. 2021. Outbreaks of vector-borne and zoonotic diseases are associated with changes in forest cover and oil palm expansion at global scale, *Frontiers in Veterinary Science, 8:* p. 661063. Disponível em: https://doi.org/10.3389/fvets.2021.661063.

NATIONAL RESEARCH COUNCIL. 2016. *The Neglected Dimension of Global Security: A Framework to Counter Infectious Disease Crises*. Washington, D.C.: National Academies Press. Disponível em: http://www.nap.edu/catalog/21891 (Acesso em: 15 de janeiro de 2021).

NORMILE, D. 2021. Can 'zero COVID' countries continue to keep the virus at bay once they reopen?, Disponível em: https://doi.org/10.1126/science.acx9109.

OLIU-BARTON, M. *et al.* 2021. SARS-CoV-2 elimination, not mitigation, creates best outcomes for health, the economy, and civil liberties, *The Lancet, 397*(10291): p. 2234–2236. Disponível em: https://doi.org/10.1016/S0140-6736(21)00978-8.

PEEPLES, L. 2021. COVID reinfections likely within one or two years, models propose, *Nature*, p. d41586-021-02825–8. Disponível em: https://doi.org/10.1038/d41586-021-02825-8.

PHILLIPS, N. 2021. The coronavirus is here to stay – here's what that means, *Nature, 590*(7846): p. 382–384. Disponível em: https://doi.org/10.1038/d41586-021-00396-2.

PIKE, J. *et al.* 2014. Economic optimization of a global strategy to address the pandemic threat, *Proceedings of the National Academy of Sciences, 111*(52): p. 18519–18523. Disponível em: https://doi.org/10.1073/pnas.1412661112.

QUICK, J. D.; FRYER, B. 2018. *The End of Epidemics: The Looming Threat to Humanity and How to Stop It*. New York: St. Martin's Press.

SADIQUE, Z.; ADAMS, E. J.; EDMUNDS, W. J. 2008. Estimating the costs of school closure for mitigating an influenza pandemic, *BMC Public Health, 8*(1): p. 135. Disponível em: https://doi.org/10.1186/1471-2458-8-135.

SCHNEIDER, S. H. 2001. What is 'dangerous' climate change?, *Nature, 411*(6833), p. 17–19. Disponível em: https://doi.org/10.1038/35075167.

SCHNELLNHUBER, H. J.; CRAMER, W. P. (org.) 2006. *Avoiding Dangerous Climate Change. International Symposium on Stabilisation of Greenhouse Gas Concentrations, Avoiding Dangerous Climate Change*, Cambridge: Cambridge University Press.

SHUE, H. 2017. Mitigation: First imperative of environmental ethics, em S. GARDINER; A. THOMPSON (org.) *The Oxford Handbook of Environmental Ethics*. New York: Oxford University Press, p. 501–514.

SNOWDEN, F. M. 2008. Emerging and reemerging diseases: A historical perspective, *Immunological Reviews, 225*(1): p. 9–26. Disponível em: https://doi.org/10.1111/j.1600-065X.2008.00677.x.

SNOWDEN, F. M. 2019. *Epidemics and Society: From the Black Death to the Present*. New Haven: Yale University Press.

STOCK, P.G. *et al.* 2020. Ethical issues in the COVID era: doing the right thing depends on location, resources, and disease burden, *Transplantation, 104*(7): p. 1316–1320. Disponível em: https://doi.org/10.1097/TP.0000000000003291.

TELENTI, A. *et al.* 2021. After the pandemic: perspectives on the future trajectory of COVID-19, *Nature, 596*(7873): p. 495–504. Disponível em: https://doi.org/10.1038/s41586-021-03792-w.

TORJESEN, I. 2021. COVID-19 will become endemic but with decreased potency over time, scientists believe, *BMJ*, p. n494. Disponível em: https://doi.org/10.1136/bmj.n494.

TOWNSEND, J.P. *et al.* 2021. The durability of immunity against reinfection by SARS-CoV-2: a comparative evolutionary study, *The Lancet Microbe*, p. 1–10. Disponível em: https://doi.org/10.1016/S2666-5247(21)00219-6.

UNITED NATIONS. 2015. *Transforming our World: The 2030 Agenda for Sustainable Development*. Disponível em: https://sustainabledevelopment.un.org/post2015/transformingourworld/publication (Acesso em: 2 de dezembro de 2020).

UNITED NATIONS ENVIRONMENT PROGRAMME. 2021. *Adaptation Gap Report 2020*. Nairobi, p. 99. Disponível em: https://www.unep.org/adaptation-gap-report-2020.

WATTS, S. J. 1999. *Epidemics and History: Disease, Power and Imperialism*. New Haven: Yale Univ. Press.

WHITE HOUSE. 2021. *National Strategy for the COVID-19 Response and Pandemic Preparedness*. Washington, D.C. Disponível em: https://www.whitehouse.gov/wp-content/uploads/2021/01/National-Strategy-for-the-COVID-19-Response-and-Pandemic-Preparedness.pdf.

WORLD HEALTH ORGANIZATION (WHO). 2021. *WHO advice for international traffic in relation to the SARS-CoV-2 Omicron variant (B.1.1.529)*. Disponível em: https://www.who.int/news-room/articles-detail/who-advice-for-international-traffic-in-relation-to-the-sars-cov-2-omicron-variant (Acesso em: 3 de dezembro de 2021).

ZHANG, S. 2021. *The coronavirus is here forever. This is how we live with it*, *The Atlantic*. Disponível em: https://www.theatlantic.com/science/archive/2021/08/how-we-live-coronavirus-forever/619783/ (Acesso em: 23 de outubro de 2021).

Acknowledgments

Research for this article benefited from extensive discussions with Lukas Meyer (University of Graz, Austria) during the COVID-19 pandemic. We also thank an anonymous reviewer for helpful comments and suggestions. Marcelo de Araujo benefited from support provided by FAPERJ (Grant E-26/200.432/2023) and CNPq (Grant 304635/2022-7). Pedro Fior Mota de Andrade benefited from support provided by CNPq (Grant 153666/2024-2). Alessandra Moraes de Sousa benefited from support provided by FAPERJ (Grant E-26/200.281/2025).

Transparency regarding use of AI

Prior to final submission, a PDF version of this article was generated with numbered lines (444 in total, excluding References and Notes). The PDF file was uploaded to ChatGPT with the command "check for pressing issues concerning language and grammar". Corrections were considered on a case-by-case basis. Apart from the use disclosed above, we did not use AI tools to generate any part of this article.

Declaração de Disponibilidade de Dados:

Todo o conjunto de dados que dá suporte aos resultados deste estudo foi publicado no próprio artigo.

Submetido em 31 de agosto de 2025.

Aceito em 14 de novembro de 2025.