Behavioural public health? Experts' biases and responses to pandemics

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Abstract

The COVID-19 pandemic has documented an unprecedented series of biased, distorted, or sub-optimal decisions and behaviours by 'expert' decision-makers such as: health policy-makers; leaders of national and regional health systems and public health organisations; managers of territorial health agencies and hospitals; managers of hospital units and public health departments; and other experienced professionals with decision-making responsibilities in terms of public health. Some of these biased decisions and behaviours have had dramatic cascade effects on population health and behaviours. We list, name, and describe some of the biases and behavioural distortions by 'expert' decision-makers that emerged during the COVID-19 pandemic. Many of these behavioural biases have not been previously categorized as such, or may have been discussed under different names.

Main text

The recent COVID-19 pandemic has revamped the interest in the behavioural analysis of public health policies and responses to epidemics and health emergencies.

The area of application is particularly intricate, and intriguing, for three main reasons. Firstly, because public policies in this area aim to influence and change individual behaviour, but have as their ultimate goal public health, that is, health and well-being at the level of the entire population, not of individuals.

Secondly - and precisely linked to such an ultimate goal - because public health policies cannot ignore other factors and reasons that influence well-being at the level of a population, including mental well-being (not only physical health) but also material, social and economic well-being, as well as, of course, other cultural, institutional and social factors.

Finally, because in order to reach citizens in order to influence and change their individual and population behaviour, public health policies must typically act through a series of 'expert' decision-makers whose behaviours and decisions are equally crucial to achieve the ultimate goals of public policies. These experts include, for example, health policy-makers and leaders of national and regional health systems and public health organisations; managers of territorial health agencies and hospitals; managers of hospital units and public health departments; hospital doctors, GPs, and other health professionals with decision-making responsibilities in terms of public health.

These expert decision-makers are actually the most interesting subject of analysis for the purpose of a behavioural analysis of public health policies, because they are precisely these actors who determine, or at least influence, rules and public health messages that target citizens. Biases, mis-reactions, or distorted perceptions or decisions by these expert decision-

makers are therefore particularly worrying because they potentially have deleterious cascade effects on citizens and thus on public health as a whole.

Behavioural analysis has traditionally focused on the biases of the decision-makers considered less experienced or informed, such as consumers and citizens.

Behavioural analysis of health behaviours is no exception to this rule, having the literature developed behavioural analyses especially at the level of patients and citizens, to understand, influence and change individual risky behaviours such as lack of exercise, excess food, alcohol, and unhealthy diets, the use of cigarettes and other drugs, the absence of prevention or diagnostic tests (Loewenstein et al., 2017; Galizzi & Wiesen , 2018; Jarke et al., 2022).

Behavioural analyses of expert health decision-makers have been much rarer, with a few dozen behavioural studies on doctors and other health care professionals more generally, and very few studies on health policy-makers and public health decision-makers specifically.

Some notable exceptions are the works by Gigerenzer & Edwards (2003), Loewenstein, 2005a,b), Gigerenzer et al. (2007), Wegwarth & Gigerenzer (2011), Bakshi et al. (2017, 2020), Crea et al. (2019), and a few others that we will discuss in greater detail below.

A possible reason beyond the scarce behavioural literature on expert health decision-makers and policy-makers may be related to the assumption that these expert actors might be considered free from behavioural biases or distortions, being typically perceived as fully rational, well-informed decision-makers who benefit from their long work experience in the field.

In this paper we review some of the biases by health policy-makers, public health decision-makers and other health experts that have caught our attention during the current COVID-19 pandemic.

There is no doubt that the COVID-19 pandemic has highlighted and made salient the formidable and tireless work of thousands of doctors, nurses and health care professionals. Their behaviours have literally saved, and continue to save, the lives of millions of people, and it is no wonder that they have often been considered 'heroes' by the public.

However, the COVID-19 pandemic has also documented an unprecedented series of distorted or sub-optimal decisions and behaviours by health policy-makers and expert health decision-makers in countries considered to be at the forefront of public health, such as the United Kingdom or Italy, for example. Some of these biased decisions and behaviours have actually had dramatic effects, and therefore deserve a critical analysis under the lens of behavioural sciences.

In this paper we list and describe some of the behavioural distortions that emerged during the COVID-19 pandemic. Many of these behavioural biases may have not previously been categorized as such, or may have been discussed under different names.

-*Here is different* **bias**: it describes the incorrect belief that the spread of an infectious agent (e.g. a virus or bacterium) is entirely explained by the environment and its socio-cultural factors, thus neglecting the epidemiological characteristics and features of the agent itself and of the host. Statements dictated by this bias have been made by leaders of national or regional healthcare organisations. For example, the Veneto regional governor in Italy claimed the coronavirus in Italy represented a lesser threat than in China: to justify such a claim, he added that, unlike Chinese people, Italians do not "*eat live mice*" (Reuters, 2020). While this is perhaps an extreme example, a similar sort of 'exceptionalism' bias has been repeatedly proposed as an explanation of the UK's resistance to follow the recommendations of the World Health Organization (WHO) or to learn from the previous experiences of other

countries, such as Italy, during the COVID-19 pandemic (O'Toole, 2020; Sample, 2020c; Woodcock, 2020). For example, on 22nd September 2020, the UK Prime Minister justified the different responses to COVID-19 in the UK compared to Italy saying that "*this is […] a freedom-loving country*". Looking at the minutes, it is also interesting to notice that the meetings of the government's Scientific Advisory Group for Emergencies (SAGE) were called "*SAGE meeting on Wuhan Coronavirus (COVID-19)*" until the sixteenth SAGE meeting on 16th March 2020. It is only starting from the 17th SAGE meeting on 18th March 2020 that the term 'Wuhan' before 'Coronavirus' was dropped. The minutes of that same SAGE meeting stated, for the first time, that "*Based on limited available evidence, SAGE considers that the UK is 2 to 4 weeks behind Italy in terms of epidemic curve. The consensus is that growth of the UK pandemic is tracking at the same rate as in other countries*". On 1st December 2020 the former UK Chief Medical Officer (CMO) Dame Sally Davis explicitly told the committee hearing of the Parliament that "*British exceptionalism undermined pandemic preparedness*" and that "*our infectious diseases experts […] did not really believe that another SARS would get to us, and I think it's a form of British exceptionalism*" (Sample, 2020c).

-***Wrong guidelines, yet still sticking to the guidelines* bias**: it describes the attitude by experienced decision-makers and physicians who continue to adhere, passively and uncritically, to guidelines even when the guidelines are manifestly inadequate or outdated by later evidence. In the early stages of the COVID-19 epidemic, both the World Health Organization (WHO) and the Italian Ministry of Health had issued guidelines according to which only and exclusively patients returning from Wuhan or in contact with someone exposed to the virus should be tested for COVID-19. Although cases of abnormal pneumonies were intensifying inexplicably in the province of Bergamo at least from mid-January 2020 (Galizzi & Ghislandi, 2020; Imariso, Ravizza & Sarzanini, 2020; Nava, 2020; Cereda et al., 2021), the practice of the Lombardy regional health system remained uncritically adhering to those guidelines at least until early March, when the situation became out of control. Actually, the so-called Italian patient 0 was identified in mid-February 2020 thanks to a doctor who deviated from the guidelines.

-***Absolute number of cases neglect* bias**: it describes the distorted perception of the severity of an epidemic due to the emphasis on (low) percentage frequencies rather than (high) absolute numbers. In the early stages of the outbreak several experienced decision-makers argued that the COVID-19 mortality rate was not particularly high. While WHO's Director General explicitly spoke of a 3.4% mortality rate, the UK's Chief Medical Officer said mortality would be 1% or less (Costello, 2020; Devlin & Boseley, 2020). However, talking about, say, 2% mortality generates a distorted representation of fatal cases of the epidemic when the absolute number of infected is high. Take, for example, the province of Bergamo, the most affected in the world by COVID-19, which has 1,100,000 inhabitants. If the virus infects one in three inhabitants of the province (which is in line with the contagion rate in the province calculated by ISTAT in July 2020), it means that about 366,667 are infected with the virus, of which 7,333 die from the virus, which is, tragically, even an underestimate of the figure at the moment more reliable of about 8,000-11,000 deaths in the province of Bergamo alone. If the same epidemiological data for Bergamo were extrapolated in absolute numbers, deaths throughout Italy would be quantifiable as about 400,000 deaths, which is much more salient

(and chilling) than talking about a 2% mortality. Using absolute numbers also allows us to immediately understand the implicit death toll of policy proposals revolving around the 'herd immunity' idea (see also *Follow the expert* bias): if, for example, to achieve such herd immunity it is necessary to infect with COVID-19 about 90% of the population, the herd immunity proposal would amount to a death toll of 1,2000,000 people in Italy alone.

-*Baseline neglect* **bias**: it describes the attitude by health decision-makers to report the absolute number of infections ('positive cases') in a day without reporting the number of tests conducted. Since the beginning of the pandemic, in fact, decision-makers from regional and national health systems, e.g. in Italy and the UK, have continued discussing the data on cases found positive to the swab tests, presenting them in absolute terms: e.g. *"1,281 cases today"*. While presenting the figures in absolute terms is more transparent (see previous bias), it also clear that, in order to be interpretable in a meaningful way and in order to draw correct inference on the evolution over time and on the comparability across different countries, the data on positive cases would need to be complemented at least by the ratio between the tests found positive and the total number of tests conducted. This is especially true when the comparability over time or across countries involves settings at either different phases of the pandemic, or with different testing capacity. For example, right at the beginning of the first wave in Italy there was only one laboratory in northern Italy – the Policlinico San Matteo hospital in Pavia - that had the technical expertise and capability of conducting the tests for COVID-19. At the peak of the crisis the hospitals in Bergamo were so rapidly overwhelmed by the incoming flows of patients in critical conditions that few diagnostic tests were actually conducted, mainly prioritising the ones to test healthcare professionals, to uncover potential new hotspots (e.g. nursing homes), and to discharge patients after effective treatment. A pragmatic compromise solution would be to report. To be fair, at the beginning of the second wave of the pandemic (e.g. October 2020), some countries (e.g. Italy) indeed started reporting the absolute number of positive cases together with the ratio between the tests found positive and the total number of tests. Among other things, such a reporting practice also made more salient the growing capacity of the different regional health systems in Italy to perform tests.

-*Bottleneck resources neglect* **bias**: it describes the underestimation of the crucial role of the bottlenecks in the healthcare systems. The provinces of Brescia, Pavia and Bergamo in the Lombardy region - some of the most affected provinces by COVID-19 in Italy - had one of the highest number of hospital beds per inhabitant in Italy, in Europe, and also in the world (4.45 beds per thousand inhabitants in Brescia, for example). The sudden swept of the first wave of the pandemic, however, showed that the real scarce resource and the key bottleneck in a local health system is not the total number of hospital beds, but the number of beds in intensive care (ICU) and in sub-intensive care. In Bergamo, the Papa Giovanni XXIII hospital alone – one of the most modern and technologically advanced hospitals in the country - had an intensive care unit of 80 beds, the largest ICU in all Europe. Even so many beds were not sufficient to contain the overwhelming impact of the first wave of the pandemic: on March 28th 2020, COVID-19 patients in critical conditions occupied 498 of the 779 beds available throughout the whole hospital in Bergamo, almost two thirds. It was precisely this inescapable bottleneck that forced local health decision-makers to make dramatic choices at

that time, including deciding to whom, among the many COVID-19 patients in critical conditions, those life-saving resources should be dedicated to.

Until the outbreak of the first wave of the crisis in Bergamo, the role of ICUs and sub-intensive care units had never been taken seriously into account by the regional and national health decision-makers in Italy as the crucial bottlenecks when discussing public health preventive measures in response to epidemics and other health emergencies. It is thus not surprising that Italy responded by almost doubling the number of ICU beds in the national health system (*Sistema Sanitario Nazionale*, SSN): thanks to a first implemented expansion of 3,360 ICU beds and a further ongoing expansion of 2,400 ICU beds, Italy rapidly expanded its ICU capacity from about 5,300 beds in 2019 to the current 9,084 beds (Aimone Gigio et al., 2020). The number of ICU beds in Italy is still below the corresponding capacities in countries with comparable sizes and national health systems, such as France (13,980 ICU beds), Germany (20,556 ICU beds), and the UK (10,353 beds) (Covidsim.org, 2020). It is also not surprising that one of the most striking responses by local charities and volunteers to the early tragic events in Bergamo was the setting-up – in a record week - of a field hospital to provide further 72 ICU beds in support to the local hospital.

The bottleneck neglect bias does not seem to be automatically corrected by experience. For example, after the first wave of the pandemic, health decision-makers in the UK may have been better placed in foreseeing the key capacity constraints in the hospitals and NHS during the second wave, starting from the ICU resources. Unfortunately, there is ample evidence that this was not the case (Batt-Rawden, 2020; Marsh, 2020a,b).

-Silver bullet **bias**: it describes the distorted belief that to respond to an epidemic such as COVID-19 it is sufficient to implement a single policy measure, whatever it is, that is considered "the" right thing to do. It is a distorted belief because there is no evidence that a single policy measure would really works. As the WHO Director-General said on 6th April 2020 in his opening remarks at the media briefing on COVID-19, "*There is no black or white answer, and no silver bullet*" (WHO, 2020a,b). There is, actually, increasing evidence that the effects of behavioural interventions, for example informational campaigns, messages, and 'nudges', are often very heterogeneous, varying widely from person to person, and thus justifying the idea of using multiple and personalized behavioural interventions (Castleman & Page, 2015; Schultz et al., 2016; Doss et al., 2019; Galizzi et al., 2022).

Realistically, in order to beat COVID-19 we need a strategy that combines different interventions and approaches, a 'combination prevention' that uses at the same time preventive behaviours such as defaults; different measures of reduction of transmissions through not only frequent and accurate cleaning of the hands, but also physical distancing, use of masks, respiratory etiquette (e.g. cough or sneeze into own elbow), surface and object cleaning, and reduction of permanence in closed and poorly ventilated public spaces; rapid and capillary tests; detailed and timely test and contact tracing systems; self-isolation, quarantines, and support measures for isolating and self-isolating people; school and workplace measures and closures; travel restrictions, and border closures; avoiding crowding measures, and other combined measures to implement physical distancing (WHO, 2019; Association of Directors of Public Health, 2020).

-Wash-your-hands **bias**: it describes the distorted belief that, in order to respond to an epidemic such as COVID-19, it is enough to convince citizens to do something pro-active, for example to wash their hands more often, or longer (Hutton, 2020). For example, on 3rd March

2020 the UK Prime Minister Boris Johnson said in his first televised press conference flanked by the UK Chief Medical Officer (CMO) Professor Chris Whitty and the UK Government Chief Scientific Adviser (GCSA) Sir Patrick Vallance: "*I was at a hospital the other night where I think there were actually a few coronavirus patients and I shook hands with everybody. […] We should all basically just go about our normal daily lives. The best thing you can do is to wash your hands with soap and hot water while singing Happy Birthday twice*". Two days after, on 5th March, there was the first official report of somebody dying in a hospital having tested positive for COVID-19 caught in the UK. This perception is distorted not only because it focuses exclusively on a single vehicle of infection, the one through contaminated objects (fomite transmission), and neglecting the other vehicles of infection, i.e. the ones through droplets transmission, or through airborne transmission, much more insidious and widespread (Association of Directors of Public Health, 2020; Sample, 2020b); but also because it exploits the, seemingly reassuring but substantially wrong, idea that, in order to effectively fight the pandemic, it is enough to engage in some simple, familiar, pro-active behaviour. From this perspective the bias is a special case of the *silver bullet* bias discussed above, which emphasises one single familiar pro-active behaviour. In general it is true that adherence to guidelines is expected to occur if: i) the pandemic threat is perceived as severe; ii) an effective coping is perceived to be available; and iii) people believe that they are capable of executing an effective coping response (Taylor, 2019). People still fail to wash their hands even in absence of a pandemic. However, provided that they can have access to clean water and to soap, virtually everybody can wash their hands. The problem is that the emphasis on a familiar, simple, pro-active behaviour runs the risks of tapping into the 'illusion of control' tendency and of over-simplifying, almost trivialising, the real pandemic threat. For example, the idea to also cover one's face was not considered by the UK health policy makers. Covering the face is a simple behaviour too. It is actually easier to enforce and directly and publicly verify than washing the hands. Covering the face, however, is a less familiar behaviour than washing the hands. It may also appear more defensive, passive, perhaps even submissive, than washing the hands, seemingly accepting the fact that the epidemic is overwhelming and predominant (see the *double standard* bias below). From this perspective, this distorted perception is in line with other similar biases in health and healthcare, such as the 'therapeutic illusion', that is the tendency to over-prescribe healthcare treatments, or to believe that it is always worth actively fighting with new cycles of therapies a terminal disease, instead of improving the quality of life in the last moments, for example with palliative care (Casarett, 2016; Dolan, 2019).

-*Bergamo is running* **bias**: it is a sub-case of the previous bias, which refers to the distorted attitude of emphasizing the vitality of doing, of activism, to show how the economic and productive system does not give up in the face of an epidemic. This unfortunate slogan of Confindustria Bergamo (the local Confederation of Business Industry), and initially endorsed also by the mayor of Bergamo, contributed to strengthen the resistances by the local entrepreneurs to the idea of setting up a so-called 'red zone' (a full lockdown) in Val Seriana, despite the discovery of a COVID-19 outbreak that had already infected an entire local hospital (the Pesenti Fenaroli di Alzano Lombardo) (Galizzi & Ghislandi, 2020; Imarisio et al., 2020; Nava, 2020).

-*Follow the expert* **bias**: it describes a distorted, or opportunistic, attitude of health decision-makers by which they claim to just follow the advice of independent experts, when this is not

actually, or consistently, the case. It nests a series of diverse cases which all share the same, false, presumption that health policies are directly informed by independent experts. These cases are instances where: either i) experts are directly employed or line-managed by the decision-makers; or ii) experts have vested interests or conflicts of interest, or are supported and funded by companies and lobbies with vested interests or conflicts of interest; or finally iii) health decision-makers follow the advice of independent experts, but only selectively or intermittently, as based, opportunistically, on the specific content of the scientific advice.

For the former case - **experts directly employed or line-managed by the decision-makers** - a typical example came from the Lombardy region in Italy during the first wave of the COVID-19 pandemic. On 12th March 2020, the Lombardy region established two 'experts' units to manage the pandemic emergency. The first was the so-called 'crisis unit' that included as many as 154 members. Only a small minority of those members, however, appeared to have directly relevant medical, epidemiological, or public health expertise: of the 154 members, in fact, 90 were employees of the regional administration itself, 49 were employees of regional public companies – thus nominated by the region itself - , and only 15 came from the healthcare sector, including two hospital directors in Milan and a director of the territorial public health agency of Milan - all of whom were directly appointed by the Lombardy region itself. On the same day, the Lombardy region also established a COVID-19 'task force' within its regional health directorate, consisting of 16 people, mostly managers of the regional directorate itself (Openpolis, 2020). Thus, out of a total of 170 (!) experts, not a single one was not directly appointed, or line managed, by the region itself. It is only by 7th April 2020 (therefore quite late after the start of the pandemic, and in any case after the lockdown decided by the national government) that the Lombardy region established a 'scientific committee'. While this consisted of 26 independent members, all of which had clear medical and public health expertise, it is still unclear how this scientific committee interacted with the above described crisis unit and task force in informing the decisions of the Lombardy region (Bosa et al., 2021, 2022).

An archetypical example of the second case of the bias – namely, **experts with vested interests or supported and financed by companies and lobbie**s - is instead the group of 'experts' beyond the so-called *Great Barrington Declaration* (https://gbdeclaration.org). Pompously presented by three academics from major universities (Harvard, Oxford, and Stanford), symbolically reconvened physically together in a wooden-panelled room, the declaration aimed to convince health decision-makers to let COVID-19 take its course in order to 'naturally" reach 'herd immunity', without the need of implementing further restrictions or containment policy measures (see also the *I am not an expert but…*bias). The declaration was allegedly signed by more than 13,000 medical and public health scientists, as well as by more than 39,000 medical practitioners and 700,000 concerned citizens. The declaration was also welcome by Scott Atlas, the White House science adviser under the Trump administration - a colleague at Stanford University of one of the three authors - and by the health and human services secretary of the US administration (Mandavilli & Stolberg, 2020). It quickly emerged, however, the central role that various economic lobbies opposed to restrictive policies and new lockdowns had in the declaration (Greenhalgh et al., 2020a; Mandavilli & Stolberg, 2020). The declaration triggered in response an alternative initiative, the *John Snow Memorandum* (https://www.johnsnowmemo.com) - named after the legendary London epidemiologist - which argued that, on the contrary, lockdowns were essential to reduce mortality. It also argued that the idea behind the *Great Barrington Declaration* - that is, the idea that a large uncontrolled outbreak of COVID-19 in the low-risk population while protecting the vulnerable

would lead to the development of infection-acquired immunity in the low-risk population without harming the vulnerable – was "*flawed*" and "*a dangerous fallacy unsupported by scientific evidence*". The memorandum was published on *The Lancet* on 14th October 2020 (Alwan et al., 2020) and it was signed by almost 7,000 (vetted) signatures of scientists, researchers, and healthcare professionals. On 2nd November 2020, echoing the M*emorandum*, the UK Chief Medical Officer (CMO) said the idea behind the *Great Barrington Declaration* was "*dangerously flawed and operationally impractical*", while the UK Government Chief Scientific Adviser (GCSA) agreed with the assessment and added that the government's Scientific Advisory Group for Emergencies (SAGE) had reviewed the proposal and found "*fatal flaws in the argument*" (Conn et al., 2020; Summers, 2020).

The lack of transparency and accountability on the identity of the 'experts' and of their possible vested interests is, however, a broader and more general issue. For example, the whole initial approach by the UK government was marked by a lack of transparency. The membership of the SAGE and its sub-committees was initially kept secret. It was made public by the government only in May after *The Guardian* newspaper revealed the names of the participants to the SAGE meetings, including the Prime Minister's controversial chief of staff Dominic Cummings and his adviser Ben Warner (Sample, 2020a). Furthermore, the government did not publish any SAGE minutes or evidence used until 29th May 2020, when it published a backlog of 34 meetings, and even after that, the minutes of the SAGE meetings were often published more than a month after that the meetings took place (UK Government, 2020).

Arguably the most typical example of the latter case - *health decision-makers following the advice of independent experts, but only selectively or intermittently* - is illustrated by the relationship of the UK government with the experts. The UK has indeed been a pioneer in the use of science advice in crises and in government. It was the first country in the world to create in 1855 the post of Chief Medical Officer (CMO), as the 'nation's doctor' acting as the interface between the government and the medical and clinical professionals, and being responsible for advising on epidemics and disease prevention. The UK was also the second country (after the US in 1957) to appoint in 1964 a Government Chief Scientific Adviser (GCSA), as the prime minister's top adviser on scientific issues. During a public health emergency, the GCSA and the CMO co-chair the Scientific Advisory Group for Emergencies (SAGE). During the COVID-19 pandemic the SAGE worked tirelessly to provide timely evidence to the UK government. Despite the fact that SAGE was not designed for a semi-permanent role (the key is the "E" for emergencies) and that many of its members worked *pro bono*, by the end of 2020 it had met 70 times (during the H1N1 epidemics in 2009 it met about 20 times, and it met less than 5 times for the Ebola or Zika epidemics); it produced more than 360 working papers; and often worked over a 24-hour shift pattern at very short notice. It is reckoned that, overall, SAGE provided high-quality advice across a large range of areas and under massive strain (Sasse et al., 2020).

It is also fair to acknowledge that the Government Office for Science provided a support package for SAGE members, including funding to back-fill their teaching and academic commitments. It also increased its supporting secretariat to a staff of more than 100 people (from the initial 7 people); and that it was a good call by the CMO and the GCSA to also invite and involve specialist committees of experts on modelling (Scientific Pandemic Influenza Group on Modelling, SPI-M), on emerging infectious diseases (New and Emerging Respiratory Virus Threats Advisory Group, NERVTAG) and on social and behavioural interventions

(Scientific Pandemic Influenza Group on Behaviors, SPI-B) - originally established to advise the Department of Health - and to bring them together under SAGE (Sasse et al., 2020).

The key issue, however, is that during the COVID-19 pandemic the UK government chose sometimes to listen to its scientific experts, while sometimes clearly not to. At the very beginning of the crisis in the UK, for example, the government argued it was just "*following the science*" when it delayed the first national lockdown while waiting for scientists to provide certainty. The UK government was acting as if it was waiting for scientists to make judgements and decisions that only politicians could make, or – according to Professor Graham Medley, chair of the SPI-M sub-committee – as if it was "*passing the buck*" to scientists (Conn et al., 2020). This alleged "*following the science*" position, however, was often undermined by the ambiguous and contradictory statements by the UK government. For example, on 27th March 2020 the UK Prime Minister failed to timely and appropriately react to the scandal of his chief of staff Dominic Cummings' trip from London to Barnard Castle in the north-east of England during a national lockdown. This likely caused an erosion of public trust in the government's recommendations and in the science behind them.

When restrictions were lifted from May, moreover, the government failed to bring different streams of experts' advice together to form a coherent strategy (Sasse et al., 2020). For example, scientific experts were not consulted or ignored about policies implemented during the summer, such as the 'travel corridors' (i.e. passengers allowed to travel for holidays to specific countries without isolating); the 'eat out to help out' scheme (i.e. customers receiving government-subsidised half-priced meals for eating out in restaurants) which is now reckoned to have spread the infections (Fetzer, 2022); or the return of students to university, at least until when it was too late to influence decisions (Conn et al., 2020).

After the summer, on 21st September 2020, SAGE recommended to "*be considered for immediate introduction*" a two-week "*circuit breaker*" to curb a rise in case that was becoming "*exponential*". At the end of September such a recommendation was rejected by the UK Prime Minister, and so it was several times by ministers in early October. It later emerged that these decisions not to endorse the SAGE recommendation were influenced by a meeting involving the UK Prime Minister himself, the chancellor of the exchequer, and three proponents of the above discussed 'herd immunity' approach (see also the *I am not an expert but…*bias): Professor Sunetra Gupta, one of the three main signatories of the above discussed *Great Barringdon Declaration*; Professor Carl Heneghan, her colleague at the University of Oxford and Director of the Centre of Evidence-Based Medicine there; and Professor Anders Tegnell, the Swedish epidemiologist who was behind the COVID-19 approach in Sweden (Insight, 2020; McNally, 2020). It was argued that it was wrong to present the Prime Minister such a "*fringe view*" while he was weighing a crucial decision, and that the delay in imposing further restrictions resulted in an estimated 1.3 million extra COVID-19 infections (McNally, 2020). Similarly, scientific experts believed that the measures implemented by the government in October-November 2020 (e.g. the 'rule of six', the 10 pm curfew in pubs and bars, and the plan for a regional approach based on 'tiers') were insufficient to curb the spread of the virus (Conn et al., 2020).

In sum, while at the start of the crisis the UK government seemed to hide *behind* the science, at the end of 2020 it seemed to hide *from* the science, until there was no other option (Sasse et al., 2020).

-I am not an expert but… **bias**: it describes the distorted attitude of 'experts' to voice, express, or support judgments related to areas of scientific expertise which are outside of, or not aligned with, the areas of their own scientific expertise.

The most emblematic instance of such a distorted attitude is arguably the one around the claims about 'herd immunity' expressed in the UK in the early phase of the COVID-19 pandemic. In early March 2020 **herd immunity** came to be seen as the UK government's strategy, and despite the fact that it was, and still continues to be, a highly unorthodox and controversial strategy in the scientific debate (Arrowsmith et al., 2020; Meyerowitz-Katz, 2020; Stewart & Busby, 2020). This was likely due to confusing communication by policy-makers and scientific advisers around the government overall strategy and the science behind it. In an interview on 10th March 2020, for example, David Halpern, the CEO of the Behavioural Insights Team and a SAGE member, appeared to suggest that one way to deal with the pandemic was to "*cocoon*" the vulnerable and for the rest of the population to naturally reach herd immunity "*There's going to be a point, assuming the epidemic flows and grows, as we think it probably will do, where you'll want to cocoon, you'll want to protect those at-risk groups so that they basically don't catch the disease, and by the time they come out of their cocooning, herd immunity 's been achieved in the rest of the population*" (Conn et al., 2020; Easton, 2020). The day after, the UK Prime Minister added "*I must level with the British public: many more families are going to lose loved ones before their time*" (Conn et al., 2020; McLellan & Piper, 2020). That same day, on 11th March 2020, the WHO formally declared COVID-19 a pandemic and criticized the "*alarming levels of inaction*" by some countries. Then on 13th March 2020, the UK GCSA explained on the radio the government's strategy: "*Our aim is to try and reduce the peak, not suppress it completely. Also, because the vast majority of people get a mild illness, to build up some kind of herd immunity, so more people are immune to this disease, and we reduce the transmission. At the same time we protect those who are most vulnerable to it. Those are the key things we need to do*" (Conn et al., 2020; Stewart & Busby, 2020). The day after, on 14th March 2020, an p open letter was signed by more than 500 key scientists in the UK criticizing the government's position and stating that "*going for 'herd immunity' at this point does not seem a viable option, as this will put NHS at an even stranger level of stress, risking many more lives than necessary*" (Arrowsmith et al., 2020). Such a confused communication was heavily criticised by leading experts on strategy and national security: "*it appeared that the government was preparing to let the disease rip through the community as part of a cold-blooded experiment in disease managemen*t" (Freedman, 2020).

By looking at the minutes of the SAGE meetings, it appears that the concept of 'cocooning' was in fact repeatedly discussed in the 13th, 14th and 15th SAGE meetings on 5th, 10th and 13th March, respectively, (UK Government, 2020b,c,d). The minutes do not specify who, among the participants to the SAGE meetings, discussed the 'cocooning' proposal. However, the minutes state that the Prime Minister's chief of staff Dominic Cummings was also present when the 'cocooning' idea was first discussed by the SAGE on its 13th meeting on 5th March 2020. Also his aide and Prime Minister's special adviser Ben Warner was there. Among the behavioural science members of SPI-B only Dr David Halpern and Professor Brooke Rogers (by phone) attended that meeting (UK Government, 2020b).

In the next 14th SAGE meeting on 10th March the 'cocooning' idea was discussed again. There was no explicit mention of 'herd immunity'. That meeting was again attended by Ben Warner, the Prime Minister's special adviser, as well. Among the behavioural science members of SPI-

B, Dr David Halpern, Professor Brooke Rogers and Dr James Rubin (by phone) attended that meeting (UK Government, 2020c).

The 'cocooning' or 'shielding' idea for the elderly was discussed again also in the following 15th SAGE meeting on 13th March. There was no mention of 'herd immunity'. Ben Warner attended that meeting too, and so did Dr David Halpern, Professor Brooke Rogers and Dr James Rubin, the only three behavioural science members of SPI-B (UK Government, 2020d). Ben Warner, Dr David Halpern, Professor Brooke Rogers and Dr James Rubin (again, the only three behavioural science members of SPI-B) also attended (either in person or by phone) the 16th and 17th SAGE meetings on 16th and 18th March, respectively. In those meetings, however, the cocooning idea was no longer discussed (UK Government, 2020e,f). On 16th March, however, the UK government announced a shielding policy for vulnerable people for a duration of 12 weeks starting on Saturday 21st March 2020.

The Prime Minister's special adviser Ben Warner did not attend the following 18th SAGE meeting on 23rd March. That meeting was attended by Dr David Halpern, Professor Brooke Rogers and Dr James Rubin, but also, for the first time, by Professor Susan Michie (all by phone). In that meeting there was no mention to the cocooning or shielding idea, nor to the herd immunity concept (UK Government, 2020g).

The minutes also confirm that the cocooning or herd immunity ideas were not discussed again in any of the future SAGE meetings (from the 19th SAGE meeting onwards), which were no longer attended by Dr David Halpern. Dominic Cummings attended only the 25th SAGE meeting on 14th April 2020, where the use of masks was discussed (see the *double standard bias*). Ben Warner attended only the 21st SAGE meeting on 31st March 2020.

-*There is evidence that...* **bias**: describes the distorted attitude of citing studies in support of an idea in a way that is completely detached from the consideration of the context of the study and of the complex and more general empirical evidence. It is clearly always possible to find some single study directly or indirectly supporting what one intends to argue. This attitude to a partial analysis or reporting of the evidence, however, conflicts with the spirit of the scientific method which would suggest that one should review systematically, transparently and critically *all* the studies conducted on a hypothesis and evaluate the overall scientific evidence both in support of the hypothesis and against it (Miguel et al., 2014; Simonsohn et al., 2014a, b; Munafo' et al., 2017; Maynard & Munafo', 2018). It is similar to another bias in health contexts, the tendency to select a subset of variables in a study so that the report of the results is effectively incomplete (*outcome reporting bias*: Gigerenzer & Gray, 2011).

The most striking example of this bias was the justification provided by the UK government in support of its decision to delay the lockdown in the first wave of COVID-19 despite the epidemiological picture suggested to close most activities immediately (Gill, 2020) and despite the fact that, in those same days (the week between 11th and 15th March 2020), the coronavirus was already mowing down victims by the thousands in northern Italy.

The justification used in that occasion was based on the argument that closing too soon would tire citizens by generating 'behavioral fatigue' (Devlin, 2020). The minutes of the 15th SAGE meeting on 13th March 2020 stated that *"there is some evidence that people find quarantining harder to comply with the longer it goes on. The evidence is not strong but the effect is intuitive"* (UK Government, 2020d). That meeting was attended by Ben Warner, and also by Dr David Halpern, Professor Brooke Rogers and Dr James Rubin - the only three behavioural science members of SPI-B (UK Government, 2020d). There is no further mention of this idea,

or of 'behavioural fatigue', in the minutes of any other SAGE meetings, before or after that 15th meeting.

In March 2020 the Minister of Health and Social Care Matt Hancock publicly endorsed the behavioural fatigue idea in an interview: "*The evidence of past epidemics and past crises of this nature shows that people do tire of these sorts of social distancing measures, so if start them too early, they lose their effect and actually it is worse. The social science and the behavioural science are a very important part of the scientific advice that we rely on*" (Conn et al., 2020). Similar remarks were made also by the CMO Professor Chris Whitty who said the idea was based on both "*common sense*" and "*behavioural science*" (Conn et al., 2020).

It is unclear to which evidence they were referring to. A quick (unsystematic) review of the term 'behavioural fatigue' conducted in March 2020, screening the literature on previous epidemic outbreaks, found some studies allegedly reporting behavioural fatigue (Brooks et al., 2020). Neither by then nor today, however, a systematic review of the literature ever provided evidence in support of behavioral fatigue in the context of a pandemic or epidemic such as COVID-19 (Abbasi, 2020; Chater, 2020). Most of the studies on what is informally labelled as ***behavioural fatigue*** come from laboratory studies with students in very different contexts, such as the studies on ego depletion that have been replicated only partially. These studies, moreover, have nothing to do with lockdown or epidemics, and are of variable scientific quality as evidenced by the fact that they have not been systematically replicated or reproduced. The only noteworthy exception was a single study on the pandemic in Hong Kong in 2009 (Cowling et al., 2010).

The justification was so weak that the entire UK behavioural science community rallied behind an open letter to disavow the scientific basis of the government's justification and to demand more evidence and transparency in support of its decision (Hahn et al., 2020). The open letter was signed by more than 650 behavioural scientists within hours (with the notable exceptions of the Behavioral Insights Team and Susan Michie's group at UCL CBC). The executive editor of the *British Medical Journal* published an editorial on 6th August 2020 titled: "*Behavioural fatigue: a flawed idea central to a flawed pandemic response*" (Abbasi, 2020). The embarrassment of the UK government's 'experts' following the behavioural fatigue case was second only to the embarrassment from another, equally unsupported, scientific claim, namely the justification for not locking down the economy based on 'herd immunity' (see the *I am not an expert but…* bias).

With the onset of the second wave of COVID-19, and pending a second lockdown, the idea of a pandemic behavioural fatigue returned to be discussed even by the WHO (WHO, 2020b). In this case, however, the hypothesis appeared more understandable in relation to the plausible fatigue due to prolonged, repeated, and intermittent lockdown scenarios, not so much to the devastating initial phase of the first wave.

-***Double standard*** bias*:* it describes the use of a double standard in assessing the scientific evidence. A particularly worrying example of this bias refers to the scientific experts advising the UK policy makers. On the one hand, as discussed above, SAGE actively delayed the introduction of the first lockdown in the UK by giving credit to the 'behavioural fatigue' idea that was, at the very best, a mere hypothesis, a pure speculation with virtually no support in terms of evidence. On the other hand, however, the same SAGE delayed the recommendations to use face coverings and to ban mass gatherings based on the argument that there was not enough evidence to do so. In other words, while in the latter case SAGE

set up a too high bar on the evidence, in the former it set a too low bar on the evidence, thus effectively using two different standards for assessing scientific evidence.

The case of **_using face masks_** is emblematic. Neither the UK government nor SAGE ever talked about face covering in their first guidelines against the pandemic. In March 2020 the groups of two senior behavioural science advisors in SAGE (i.e. David Halpern and the Behavioural Insights Team; and Susan Michie and the UCL Centre for Behavioural Change) issued some early guidelines on protective behaviours against COVID-19, and neither group mentioned face covering or face masks (Behavioural Insights Team, 2020; Michie et al., 2020). More generally, echoing their initial hesitance in supporting a full lockdown, the scientific advisers did not initially recommend masks: rather than adopting a 'precautionary approach' - like Vietnam and the Czech Republic did from the very beginning of the crisis, followed by several other Asian countries and by most African countries (Felter & Bussemaker, 2020) – SAGE experts in the UK were waiting to see stronger evidence in favour of wearing masks (Sasse et al., 2020).

On 14th April 2020, for example, after a review of the literature, in its 25th meeting SAGE concluded that "_overall, the evidence that masks could prevent spread is weak, but probably marginally in favour of a small effect. If there are benefits, these are only likely in specific circumstances. Circumstances where there may be benefits included enclosed environments with poor ventilation, and around vulnerable people. Conversely, there are unlikely to be any significant benefits in use of masks outdoors_". The same meeting added that "_there are theoretical drawbacks to increased use of masks in the population. However, the evidence on these drawbacks may not be applicable to the current situation, particularly evidence around compliance_", and that "_other operational considerations around supply chain and distribution impacts but these were not considered as part of this review_" (UK Government, 2020h). Interestingly, that SAGE meeting was attended also by Dominic Cummings, the prime minister's chief of staff (UK Government, 2020h, minutes published on 29th May 2020).

Similar conclusions were drawn by SAGE in its next 26th meeting on 16th April 2020: "_SAGE remained of the view that mask supply should be prioritised for high-risk environments, where they are clearly needed. Beyond healthcare settings, evidence of effectiveness is weak but as noted at the last meeting, marginally positive. If increasing community use were to threaten stocks of masks for medical, nursing, and social care, or other high-risk environments this would be a net increase in risk in public health terms_" (UK Government, 2020i, minutes published on 29th May 2020).

So, SAGE advised against using face masks based on the argument that the evidence on it was "_weak_" but, at the same time, advised against implementing a lockdown based on the above behavioural fatigue argument that, admittedly, had "_not strong_" evidence.

It was not until 11th May 2020 that the UK government issued a new guidance recommending the use of face coverings in enclosed public spaces, including public transport and shops. The use of face masks was then made compulsory on public transport and in shops and supermarkets, but not until 15th June and 24th July 2020, respectively.

Interestingly, in mid-April, an article was published in the _British Medical Journal_ that reviewed all the systematic reviews and existing evidence on the same topic. Its main conclusion was, contrarily to SAGE, that even limited protection by masks could prevent some transmission of COVID-19 and could thus save lives (Greenhalgh et al., 2020b). The article argued that "_in the face of a pandemic the search for perfect evidence may be the enemy of good policy_" and that therefore it was time to use the _precautionary principle_: policy-makers

should encourage people to wear face masks on the grounds that they have little to lose and they can potentially gain something from this measure.

The same article also reviewed the four main arguments proposed to justify why not wearing a mask. The first argument claims that there is limited evidence that masks are effective, and it is essentially the main justification put forward by SAGE. The second argument claims that trials have indicated that people may not wear masks properly and consistently. The third argument claims that there are trials showing that wearing a mask makes some people disregard other public health recommendations such as washing hands or distancing from others. Finally, a fourth argument claims that the public should not wear masks because healthcare workers need them more.

The article then continued by challenging each of these four arguments to justify why not wearing a mask. The main reply to the first argument is that absence of evidence is not the same of evidence of absence (Greenhalgh et al., 2020b). This important point speaks directly to the discussion on how high the bar should be set in reviewing the evidence, and how constant such a bar should be kept across different scientific recommendations.

The second and third arguments could be internally valid in the randomized controlled trials (RCTs) where they are produced, but there is no evidence why they should also be externally valid in the specific context of COVID-19 (Greenhalgh et al., 2020b). There are actually good reasons to believe that real-world people (as opposed to healthy volunteer participants in RCTs) who live during the current deadly pandemic would likely be more motivated to learn how to properly and consistently wear masks, or to how to properly and fully engage with all other protective behaviours as well, such as hand washing and social distancing. Moreover, wearing a mask or a face covering can help not to touch one's nose and mouth, which we unconsciously do even 10-20 times in an hour (Lunn et al., 2020). Furthermore, the third claim is directly related to the so-called 'risk compensation' or 'risk homeostasis' hypothesis (Wilde, 1998; Houston & Richardson, 2007). The evidence on this hypothesis, however, is far from being clear or conclusive, and is, on the contrary, very mixed in general, or tendentially negative for the COVID-19 pandemic (Levym & Miller, 2000; Brewer et al., 2007; Marcus et al., 2013; Kasting et al., 2016; Cartaud et al., 2020; Aranguren, 2021; Guenther et al., 2021; Luckman et al., 2021; Seres et al., 2021; Liebst et al., 2022).

Finally, the fourth argument that the public should not wear a mask because healthcare workers need them more is a valid one, but it is more an argument for manufacturing more masks than for denying masks to populations who could potentially benefit from them (Greenhalgh et al., 2020b). In any case, such an argument can be challenged more directly and substantially by recommending that, until masks are available in sufficient numbers, cloth masks should be used by the public, as also recommended by US Centre for Disease Control and Prevention (CDC) (CDC, 2020).

The US CDC, in fact, originally advised against the idea that the public should wear masks. However, on 4th April 2020 (hence before the SAGE recommendation not to use masks) CDC changed its guidance and published the following clear and simple recommendations: that the public should cover their "*mouth and nose with a cloth face cover when around others*"; that "*everyone should wear a cloth face cover when they have to go out in public*", and "*the cloth face cover is meant to protect other people in case you are infected*"; that the public should "*not use a face mask meant for a healthcare worker*"; and that "*the cloth face cover is not a substitute for social distancing*" (CDC, 2020). Interestingly, and in contrast with the scientific advice in the UK, in the same CDC guidelines "*wash your hands often*" is listed only as the fifth most important recommendation after (in this order): "*wear a mask over your*

nose and mouth"; "*stay 6 feet away from others*"; "*avoid crowds*"; and "*avoid poorly ventilated spaces*" (CDC, 2020).

It is fair to notice that even the WHO contributed to generate mixed messages at the beginning of the crisis about the use of face masks. On 6th April 2020, for example, in his opening remarks at the media briefing on COVID-19, the WHO Director-General said: "*countries could consider using masks in communities where other measures such as cleaning hands and physical distancing are harder to achieve because of lack of water or cramped living conditions. If masks are worn, they must be used safely and properly. WHO has guidance on how to put on, take off and dispose of masks. What is clear is that there is limited research in this area. We encourage countries that are considering the use of masks for the general population to study their effectiveness so we can all learn. Most importantly, masks should only ever be used as part of a comprehensive package of interventions. There is no black or white answer, and no silver bullet. Masks alone cannot stop the pandemic. Countries must continue to find, test, isolate and treat every case and trace every contact. Mask or no mask, there are proven things all of us can do to protect ourselves and others – keep your distance, clean your hands, cough or sneeze into your elbow, and avoid touching your face*" (WHO, 2020a,b).

It is also fair to add, however, that, since early April 2020, the WHO changed its guidance and recommendations. For example, in its interim guidance issues on 1st December 2020 – that updated the guidance published on 5th June 2020 - the WHO reiterates that "*in areas of known or suspected community or cluster SARS-CoV-2 transmission, WHO advises that the general public should wear a non-medical mask in indoor (e.g. shops, shared workplaces, schools) or outdoor settings where physical distancing of at least 1 metre cannot be maintained*" (page 1).

Interestingly, in October 2019, before the COVID-19 pandemic, the WHO already endorsed the use of face masks as an effective measure to reduce the spread of infectious diseases. In its global influenza programme report on non-pharmaceutical public health measures to mitigate the risk and impact of epidemic and pandemic influenza, in fact, the WHO stated that "*face masks worn by asymptomatic people are conditionally recommended in severe epidemics or pandemics, to reduce transmission in the community. Disposable, surgical masks are recommended to be worn at all times by symptomatic individuals when in contact with other individuals. Although there is no evidence that this is effective in reducing transmission, there is mechanistic plausibility for the potentially effectiveness of this measure*" (page 27) and it concluded: "*when to apply: at all times for symptomatic individuals (disposable surgical mask), and in severe epidemics or pandemics for public protection (face masks)*" (page 27) (WHO, 2019).

Another emblematic case of *double standard* bias by experts refers to the SAGE advice against **banning large gatherings**. It is interesting from this perspective to look at the minutes of the 13th SAGE meeting on 5th March 2020: "*SAGE agreed there is no evidence to suggest that banning very large gatherings would reduce transmission. Preventing all social interaction in public spaces, including restaurants and bars, would have an effect, but would be very difficult to implement*" (UK Government, 2020). It is difficult to see the logic here: if banning all social interactions in public spaces, including restaurants and bars, would have an effect on reducing transmission, why would not be the same for large gatherings too, where the risk of transmission should be even higher due to more people involved? Also, banning large gatherings is arguably easier to implement than banning all social interactions in public spaces. The supporting evidence could have been little, weak, or mixed by then, but, for the

same reasons discussed above for the case for using masks or face coverings, the precautionary principle should have suggested to recommend banning mass gatherings.

The same argument was reiterated in the next 14th SAGE meeting on 10th March 2020, whose minutes state: *"SAGE noted that public gatherings pose a relatively low but not zero public risk. People are more likely to be infected by people they know, no strangers".*

In the week of 13th March the following mass gatherings were therefore allowed to take place, among others: the Cheltenham Festival of horseracing (10-13th March 2020, between 60,000 and 68,500 attendants in each of the four days: Wood & Carroll, 2020); the Liverpool vs. Atletico Madrid Champions League match (11th March, about 54,000 attendants: Conn, 2020); and the Stereophonics concert in Cardiff (14-15th March 2020, about 15,000 attendants over the two days: McEvoy, 2020). An estimated number of 340 league and cup football matches took place in England in March 2020, with a combined attendance of 1.625m people (Olczak et al., 2020). Causal inference on the links between these and other mass gatherings and COVID-19 cases and deaths is not straightforward. However, some estimates find evidence that the football matches in England in March 2020 were consistent with more COVID-19 cases and deaths, even controlling for measurable characteristics of local areas: on average, a football match was consistent with around 6 additional COVID-19 cases per 100,000 people, and 2 additional COVID-19 deaths per 100,000 people (Olczak et al., 2020). By that time, football matches such as the Atalanta-Valencia Champions League final match in Milan on 19th February 2020 were already identified as likely super-spreading events one month earlier in northern Italy (Galizzi & Ghislandi, 2020; Giuffrida, 2020).

There is a striking asymmetry in the use of evidence for decision-making here because, as seen above, the decision to delay the first lockdown was made on arguably even less, even weaker and even more mixed evidence about the possible risks related to 'behavioural fatigue'. Why were different conclusions drawn in the cases for banning mass gatherings or using face coverings/masks? As seen above, on 13th March 2020 SAGE stated that "*the evidence*" on the 'behavioural fatigue' *"is not strong but the effect is intuitive".* Even if the evidence was not strong in the cases of using masks or banning mass gatherings either, why did not SAGE find their effects "*intuitive*" in their cases as well? It seems indeed quite intuitive and common sense to expect that transmission would be reduced by not attending mass gatherings or by using face coverings.

Despite using two different standards in assessing the available evidence, the decisions of delaying the first lockdown and of allowing mass gatherings likely had a common effect: the likely increase in spreading the virus. Professor Neil Ferguson, an epidemiological modeller member of SAGE, said MPs that "*had we introduced lockdown a week earlier we'd have reduced the final death toll by at least half*" (Ferguson, 2020; Sasse at al., 2020).

-*This time is different* **bias**: it describes the distorted perception that the current epidemic is completely new and different from all the previous epidemics. Many expert decision makers immediately declared that the COVID-19 epidemic could only take everyone unprepared because nothing like that had ever been seen before, since no one, realistically, could remember the Spanish flu a hundred years ago. It is certainly true that every epidemic is unique and peculiar in its own way, and history never repeats itself in exactly the same way. However, governments and international institutions could also have learned some lessons by looking at previous experiences during: the Zika virus epidemic in 2015-2016 (29 deaths); the Ebola virus outbreak in 2014-2016 in West Africa (11,000 deaths, with another epidemic currently underway in the Democratic Republic of the Congo); the Middle Eastern Respiratory

Syndrome (MERS) virus outbreak in 2015 (858 deaths); the H1N1pdm09 virus pandemic, or 'swine flu', in 2009-2010 (between 100,000 and 400,000 deaths in the first year alone); the SARS (South Asia Respiratory Syndrome) epidemic in 2002 (800 deaths); the HIV pandemic from 1976 (more than 36,000,000 deaths); the H3N2 pandemic, or 'Hong Kong flu', (or 'space flu'), in 1969-1970 (between 750,000 and 2,000,000 deaths); the H2N2 virus pandemic, or 'Asian flu', in 1957-1958 (1,100,000 deaths); and the above mentioned H1N1 pandemic, or 'Spanish flu' in 1918-1919 (between 50,000,000 and 100,000,000 deaths). One thing they certainly should have learned was how to improve emergency management, for example the preparation of health systems and resources to face an epidemic (see the *planning & coordination hot-cold gap/projection* bias).

-Planning & coordination hot-cold gap/projection bias: it describes the distorted behavioural attitude for which in the moments immediately following an epidemic - and again in the wake of the strong emotions evoked by the epidemic itself (hot) – the national and regional health policy makers state their objectives to invest more resources and to plan better coordination to face the next epidemic, but such intentions then remain a dead letter with the passage of time and the waning of attention on the past epidemic (cold) - until it is rekindled, too late, when the next epidemic starts. This bias is somewhat the equivalent at the level of health policy makers of the more well-known *hot-cold empathy gap* and the related *projection bias* (Loewenstein, 2005a,b). The history of *the Global Health Security Agenda* (GHSA: https://ghsagenda.org/) is emblematic. The GHSA was activated on the proposal of US President Barack Obama in 2014 in the wake of the above mentioned Ebola epidemic. The original mission of the GHSA was to expand the range of action of a previous initiative, the *Global Health Security Initiative* (GHSI), founded in 2001 by the G7 following the terrorist attacks on the World Trade Center in New York in order to thwart attacks with bacteriological weapons, and since then only functioning on paper. The GHSA was supported first by 30, finally by 69 signatories, including countries and international organizations such as the WHO, for example. Italy got the first mandate for the leadership of its Steering Group for the five years 2014-2019, with the mission of managing the progress of the work of the various task forces. The main mission of the GHSA was precisely to coordinate common standards for disease surveillance, diagnostic tests, and the management of emergencies, including those from epidemics of animal origin - such as the coronavirus. In practice, the GHSA should have concretely implemented the international regulations approved by the WHO in 2005 in the wake of the mentioned SARS epidemic of 2002, but these remained a dead letter since then. During the years of the Italian management of the GHSA, Italy did not pay out anything of what was promised for the activities of the GHSA, and neither did so most of the other signatory countries, to the point that the GHSA funds dried up and were not sufficient even to follow up on the key action points following the 2015 MERS epidemic. The GHSA story is not the only story to illustrate this distorted behavioural attitude. Another example, and again related to Italy, concerns the so-called pandemic plans of national governments (pandemic preparedness plans), practically the manuals to be followed in the management of epidemics and pandemics. In 2009 and 2013, the WHO called on all countries to update and strengthen their pandemic plans. In 2017, the European Center for Disease Prevention and Control (ECDC) revealed that Italy's pandemic plan was last updated before 2009. The same was true for the pandemic plan of the Lombardy region which highlighted important gaps even after the H1N1 epidemic of 2010 (Tedeschi, 2020). It is therefore perhaps no coincidence that the

Italian Prime Minister stated on 10th June 2020 that "*there was no manual to follow in the crisis, but only decisions to be made day by day*" (Cuzzocrea, 2020).

-***There will be a vaccine soon*** bias: it is a sub-case of both the *silver bullet* bias and the *this time is different* bias, which describes the distorted perception that the present epidemic will be automatically and entirely resolved by a vaccine. In the case of COVID-19, such claims have been made repeatedly by the UK government. Vaccines have clearly worked in massively reducing the infections and the number of deaths by COVID-19, saving estimated 20 millions lives globally (Watson, 2022). It is a distorted perception because, historically, epidemics have been defeated by coordinated attacks of multiple joint measures, rather than solely and exclusively by a vaccine. For example, if it is true that the H1N1 epidemic was eradicated thanks to the vaccine, it is also true that even before the distribution of the vaccine it was largely controlled by means of antiviral treatments (zanamivir and oseltamivir, or Tamiflu). The MERS and SARS outbreaks were defeated entirely with tracking and isolation measures, while, to date, there are no vaccines against Zika, Ebola and HIV viruses, for example.

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