



# Preventing pandemic risks from dual-use research

JANUARY 2026

RECOMMENDED

# Health security report:

## Advocating for academic guidelines to limit dual-use research of concern

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**Date of publication:** June, 2023

**Research period:** 2022

Thanks go to Melanie Basnak whose research was crucial at the early stages of our work on health security and helped us narrow down on the topics for these reports.

We are also grateful to all the other experts who took the time to offer their thoughts on this research.

For questions about the content of this research or about the research process, please contact Morgan at [morgan@charityentrepreneurship.com](mailto:morgan@charityentrepreneurship.com).

## Executive summary

Dual-use research of concern (DURC) refers to research that aims to provide benefits but may cause harm, either through accidents or through misapplication by hostile actors.

Estimating the scale of DURC risks is challenging and unclear. DURC poses a risk of newly emerging infectious diseases; to date, most epidemic and pandemic-related deaths have resulted from newly emerging diseases (most outbreaks are of known diseases, but these natural outbreaks tend to be easier to respond to). The rate of past pandemic deaths, lab incidents and future forecasts, suggest that DURC is a significant driver of pandemic risk and could cause a sizable percentage, or even the majority of pandemic-related deaths over the next 50 years. While natural causes are still expected to dominate in terms of the number of outbreaks, CE staff estimate that DURC will account for slightly over 50% of the projected pandemic deaths over the next five decades. This results, in expectation, in an annual death toll of approximately 1.5 million. It should be noted that this estimate is based on low probabilities of catastrophic events.

We examined 12 case studies that involved the prohibition or attempted prohibition of potentially hazardous or unpopular research across various areas, including life sciences and other fields. We concluded from these that:

- (1) Public condemnation and/or stigmatization have been key factors of success.
- (2) Academics play a pivotal role in initiating, implementing and maintaining changes in regulation.
- (3) Policy makers have been the drivers of change in cases where national security was of importance.
- (4) Cooperation between researchers and funders/regulators seems crucial for long-term success in preventing dangerous research.

Based on our findings, a prioritization exercise, and the current status of the DURC debate, we very tentatively concluded that engaging with academics and academic institutions is a crucial step in limiting DURC. One approach could involve a charity collaborating with academics and universities to establish guidelines, cultural norms, or moratoriums to prevent DURC. When more academics are on board policy change can follow. We consider the next best strategy, after engaging with academics and academic institutions, would be to work with funders of DURC.

We believe that a small charity can achieve this goal. There is substantial evidence of activists influencing academic institutions, and small charities have played a role in limiting research, such as on the ethical use of animals in research. While we think that advocating for restrictions on DURC is tractable, we also acknowledge that it may be challenging and time-consuming due to various limiting factors. These include funding constraints and entrenched academic interests. Our case studies suggest that public engagement is often crucial for research bans. If engaging academics alone might not be sufficient to drive change, involving the public may also be necessary. However, this approach also presents its own set of challenges; engaging the public poses the risk of information hazards, such as promoting the notion that bioresearch can be exploited by malevolent actors to cause harm.

We acknowledge that there is also a risk that preventing DURC could actually prevent very high-value, useful research being done, although we think this specific risk is quite small.

Our opinion is that this work should be done outside of the US. This is partly because it is more neglected outside of the US, and partly because this issue has become highly politicized and difficult to work on in the US. Good target countries to initiate this intervention could be the United Kingdom, Germany, France, Japan, India or the EU.

The experts we consulted were generally in favor of this idea, but they also highlighted several potential risks. For instance, there is a risk of leakage, where banned research could be conducted in other jurisdictions where it is still legal. There is also the risk of the issue being politicized, as has been observed in the US already.

Our cost-effectiveness estimate suggests that this intervention could lead to a life saved for every \$30, although this figure is very speculative.

**Overall, we recommend this idea for a new Charity Entrepreneurship charity.**

# 1 Introduction

This report has been produced by Charity Entrepreneurship (CE). CE's mission is to cause more effective charities to exist in the world by connecting talented individuals with high-impact intervention opportunities. We achieve this goal through an extensive research process and our Incubation Program. In 2022, our research process focused on the top interventions within health security.

'Developing high-priority biosecurity technologies' was chosen by CE research staff as a potentially promising intervention within this category. This decision was the result of a four-month process designed to identify interventions that were most likely to be high-impact avenues for future charity entrepreneurs. This process began by listing over 150 ideas and gradually narrowing down, examining them in more and more depth. You can see our long lists at: [2022 Bio \\_ Health Security \\_ Summary of ideas and research progress tracker](#).

In order to assess how promising interventions would be for future charity entrepreneurs, we use a variety of different decision-making tools. These include group consensus decision-making, weighted-factor models, cost-effectiveness analyses, quality of evidence assessments, case study analyses, and expert interviews. You can see our tabulated summary of our top six ideas here: [2022 Health Security \\_ Decision-making spreadsheet \\_ Version to share / make public](#).

This process was exploratory and rigorous, but not comprehensive – we did not research all 150 ideas in depth. As such, our decision not to proceed with a charity idea to the point of writing a full report should not be interpreted as a reflection of the idea's lack of merit.

## 2 Background

Dual-use research of concern (DURC) describes research that is intended to provide a benefit, but which could be misapplied to do harm ([WHO](#)).

Dual-use life sciences research could include research work involving particular dangerous organisms and pathogens, the development of research technological platforms that could be misapplied to do harm ([Sandbrink et al., 2022](#)), or carrying out “experiments of concern” ([NRC](#)). A particular kind of DURC that is often discussed is enhanced potential pandemic pathogen (ePPP) research, which is when pathogens are modified to become more transmissible or more virulent (note, some authors alternatively talk about risky “gain of function” to refer to this). An example of ePPP research would be when a team of researchers conducted an experiment to modify the deadly influenza A (H5N1) virus to gain airborne transmissibility in ferrets ([Herfst et al., 2012](#), [Selgelid, 2016](#)). There are numerous other instances of research that have been conducted which have the potential to cause national and global security threats ([Urbina et al., 2022](#), [Barash et al., 2014](#), [Tumpey et al., 2005](#)).

Different actors have defined DURC in various ways, some narrower than others ([Sandbrink et al., 2022](#)). For the sake of this paper we are considering all life sciences research that has the potential to cause harm, either through accidents or misuse.

The conduct of DURC, as well as the increasing access to biological science and biotechnology, means that there are two main risks:

1. **Biosafety risks.** There is a risk of a pathogen leak from a laboratory conducting research with classified pathogens. There are countless examples of lab leaks throughout history ([Wikipedia, Open Mind](#)), with several prominent reports suggesting that there is a non-trivial chance that COVID-19 could have been the result of a lab leak ([Senate Committee USA, 2022](#), [Knight, 2021](#)).
2. **Biosecurity risks.** DURC could enable the creation of biological weapons. The risk here is that a malicious actor – whether it be a country, rogue state, or terrorist group – uses available DURC to deliberately engineer harmful pathogens. ([Open Philanthropy, MacIntyre 2015](#)). State and non-state actors have used biological agents as a form of warfare in the past ([Charlet, 2018](#), [Global Terrorism Database, Frischknecht, 2003](#)).

Advances and developments in life sciences research need to be responsibly managed, with effective strategies put in place to mitigate potential safety and security concerns. These could include developing technologies that reduce or identify lab leaks or malicious use of biotechnology, establishing global treaties on lab safety or

biological weapons programs (such as the Biological Weapons Convention or the Australia Group), having policies and protocols to manage DURC, and so forth.

There is growing concern about DURC, and a growing apparatus of organizations and stakeholders working to improve the safety and security of research. However, at this time it seems likely that the issues are neglected relative to the potential scale of negative impact that could occur, and that there are niches and avenues for a new organization to contribute meaningfully.

To understand pandemic prevention and the various risks, it is helpful to understand how those risks are distributed.

**Most epidemics (~87%, n=71) are acute increases of endemic health issues** (like measles or ebola), and the minority (~13%) are due to new emerging pathogens, or existing pathogens identified in new areas. The quantitative estimates here are based on comparing the UK government-tracked cases of emerging infections between 2002 and 2023 ([UK government, 2023](#)), and the Wikipedia lists of epidemics over the same period. Of 71 epidemics, only nine match the list of emerging infections.

**Most deaths from epidemics or pandemics (~99%) are due to newly-identified emerging infections**, although these might be closely related to existing diseases, such as a new strain of influenza. This quantitative estimate is based on the same data sources. Even ignoring COVID, this number only drops to 76% due to 2009 Swine Flu also being considered an emerging pathogen.

**The impacts appear to follow a power law distribution.** This means that we should expect that most cases lead to very minimal impact, while a very small number of cases lead to very large impacts. This applies to:

- All pandemics/epidemics. Most epidemics kill relatively few people (10s to 100s), but a small number, such as COVID or HIV, kill millions.
- New emerging infections. The 63 cases mapped in the aforementioned UK government data mostly affected a very small number of people, but four cases killed more than 1000 people, and two cases [COVID and Influenza A(H1N1)] killed more than 100,000 people.
- High-risk human-caused pathogen exposure events. Of 71 cases between 1975 and 2016, most affected just a single person; although, a 1979 Anthrax accident in Russia killed 100+ people and the 1977 release of H1N1 influenza infected millions (Manheim and Lewis, 2021) and killed potentially 700,000 people worldwide ([Wikipedia](#)).

## Scale of the risks from DURC

Historically, pandemics have caused some of the deadliest periods in human history— even more deadly than wars. For example, the Black Death killed 30-60% of the European population (Scott and Duncan, 2011), and the Justinian Plague wiped out 10% of the global population (Rosen, 2010).

**It is likely that DURC will only cause the minority of future pandemics, but may result in the majority of future pandemic deaths—** although estimates on this are very unclear. Historical analysis suggests that deaths due to DURC-caused pandemics are somewhat fewer than deaths due to natural pandemics, and forecasts suggest that deaths due to DURC-caused pandemics are greater. Overall, we expect DURC to be the cause of just over 50% of future pandemic deaths. We concluded this by considering:

### A. Historical analysis of number of deaths

Data on recent pandemic deaths is unclear. Most recent pandemic/epidemic deaths are due to COVID; and as such, estimates are heavily dependent on the controversial and currently unresolved question of whether COVID was a result of DURC or not. For example, the average estimates of three CE staff (made in mid 2022) suggest a 35% chance that COVID was caused by DURC (20%, 30%, 55%).

### B. Historical analysis of high-risk incidents.

Between 2003 and 2016, there were 21 cases of naturally-emerging “newly identified emerging infections” ([UK government, 2023](#)), and 28 cases of human infections due to “high-risk human-caused pathogen exposure events” ([Manheim and Lewis, 2021](#)). These appear to be in the same order of magnitude; however, it seems more likely that lab infections will be reported and identified (although this depends on the jurisdiction and transparency of the lab). In this timeframe, none of the high risk lab infections led to a serious outbreak; it is very hard to know what to make of this dataset comparison. With very high uncertainty, we think this could suggest that high-risk, naturally emerging infections are 1-50x more common than high-risk lab infections.

### C. Expert forecasts.

Averaged expert estimates suggest that there will be 20 million deaths due to natural pathogens, and 90 million due to engineered pandemics over the next 50 years. ([Ord, 2020](#), [Sandberg and Bostrom, 2008](#), [Marani et al., 2021](#), [Smitham and Glassman, 2021](#), [DCP3, 2017](#), [Fods12, 2020](#)). This statistic should be treated with extreme caution, as

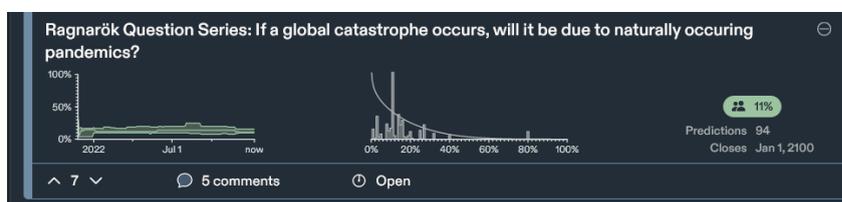
different experts were writing in different contexts. These numbers show that a number of experts are concerned about the small chance of an engineered pandemic event that is many times worse than any natural pandemic event would be.

(Note that this natural versus engineered breakdown is different from our natural versus DURC distinction, as DURC can also lead to risks of pandemics with natural pathogens, e.g., the risk of smallpox escaping from a lab.)

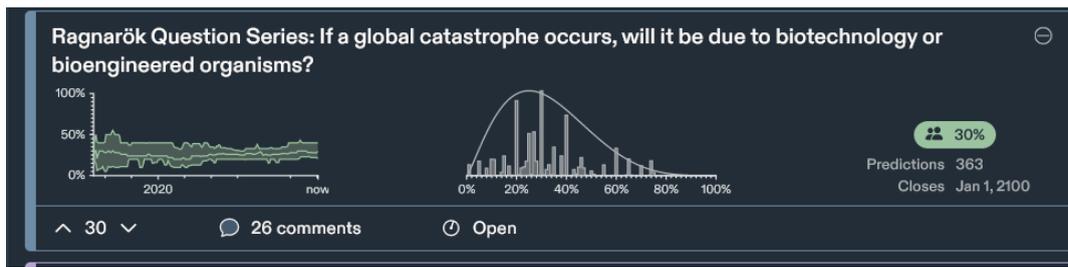
## D. Public forecasts

We are very skeptical of public forecasts made on forecasting platforms in this area, some of which had limited engagement. We did look at such forecasts and they showed the following findings:

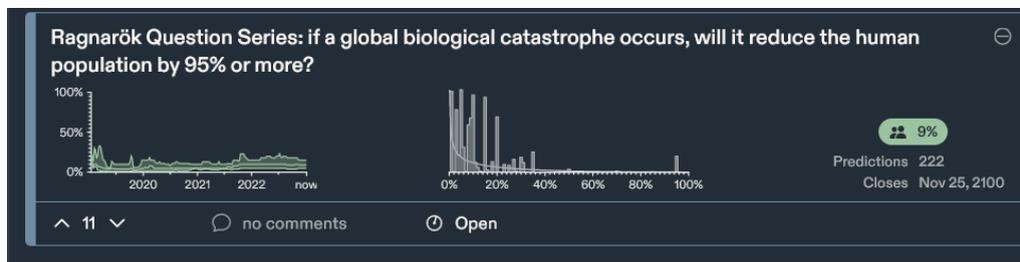
- 1) Forecasters estimate that if a global catastrophe (defined as a 10% decrease in the world population in any period of five years) occurs, the probability of it being due to biotechnology is significantly higher (30%) than that it being caused by a naturally occurring pandemic (11%).
- 2) Forecasters estimated the probability of at least 95% of the population dying from such a catastrophe to be 9%.
- 3) Forecasters estimated the likelihood of a novel pathogen killing over 25 million people between 2022 and 2031 to be 13%.
- 4) According to forecasters, there is a 1-in-3 chance of at least 100 people being infected by synthetic biological weapons by 2030.
- 5) Forecasters expected the number of high-risk laboratory biosecurity incidents between 2022 and 2026 to be ~10.



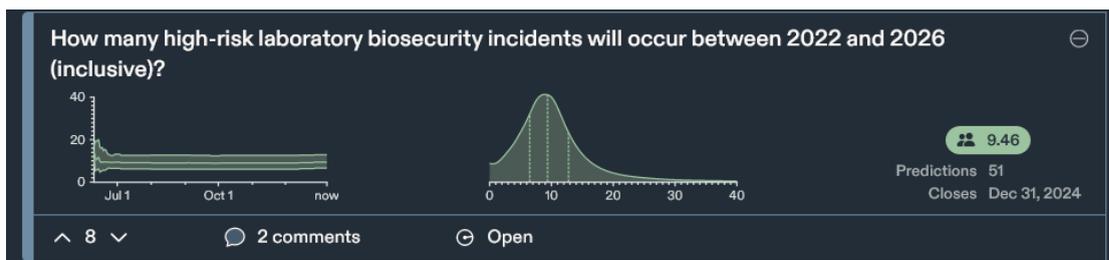
1. <https://www.metaculus.com/questions/8745/gc-caused-by-natural-pandemic-if-gc-oc-curs/> (last accessed on 24/01/2023)



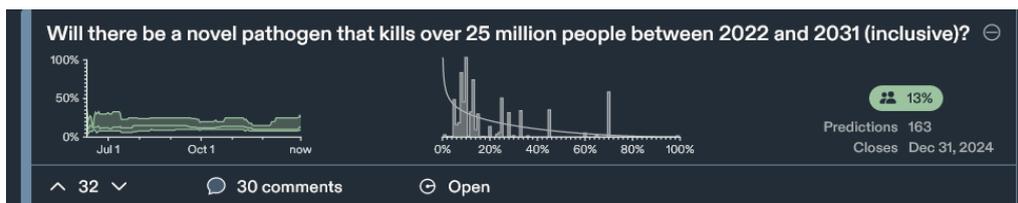
2. <https://www.metaculus.com/questions/1502/ragnar%25C3%25B6k-question-series-if-a-global-catastrophe-occurs-will-it-be-due-to-biotechnology-or-bioengineered-organisms/> (last access on 24/01/2023)



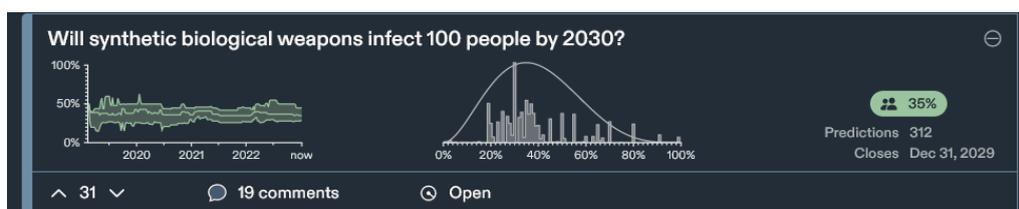
3. <https://www.metaculus.com/questions/2514/ragnar%25C3%25B6k-question-series-if-a-global-biological-catastrophe-occurs-will-it-reduce-the-human-population-by-95-or-more/> (last access on 24/01/2023)



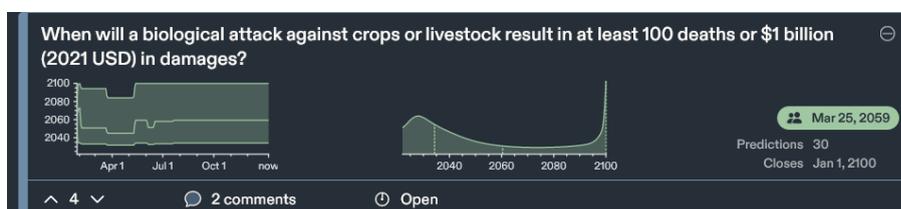
4. <https://www.metaculus.com/questions/11273/number-of-bio-lab-incidents-from-2022-2026/> (last access on 24/01/2023)



5. <https://www.metaculus.com/questions/11164/25m-killed-by-pandemic-2022-to-2031/> (last access on 24/01/2023)



6. <https://www.metaculus.com/questions/2611/will-synthetic-biological-weapons-infect-100-people-by-2030/> (last access on 24/01/2023)



7. <https://www.metaculus.com/questions/9555/date-of-biological-attack-on-agriculture/> (last access on 24/01/2023)

## E. Team estimates.

Early in our research process, the CE research team made best-guess estimates of the % of pandemic deaths over the next 50 years that will result from human accident or misuse. The average estimate of three staff was 60% (50%, 55%, 75%).

Our averaged team estimates suggest we expect the number of total deaths caused by an acute health disaster, such as a pandemic, to be roughly 150 million over the next 50 years- or 3 million per year. Of those, we expect roughly 80 million deaths over the next 50 years (1.6 million a year) to be caused by dangerous research.

We note that our estimates for deaths due to DURC are somewhat based on small chances of very bad catastrophes. That said, we think there is good historical and theoretical evidence to believe that very bad health catastrophes (e.g., more than 10% of the global population dead) are possible, and if they happen they would likely be due to new emerging diseases.

## Conclusion

Overall, the total scale of the biosecurity risk as a result of DURC is clearly difficult to assess. Yet, looking across various sources of evidence, expected future deaths due to DURC seem to be in the same ballpark as deaths from natural pandemics.

Another form of analysis that could be done (but was not done for this report) is trend analysis. [Lentzos, Koblentz and Rodgers, 2022](#), set out the case that long-run trends suggest that risks from DURC are increasing). This could explain why our evidence from forecasters was more likely to suggest there is a high DURC risk than our evidence from historical analysis.

## Scale of DURC

The 21st century has led to more and more actors having access to dangerous and advanced technology, globally. Meanwhile, the emergence and enforcement of proper rules and regulations is lacking - the 2021 Global Health Security (GHS) Report assessed countries on 37 indicators of health security; of these, "Dual-use research and culture of responsible science" was the lowest indicator by some considerable margin (with a score 3.5x lower than the next lowest indicator). Only Armenia, out of 195 countries, scored above 50% (GHS, 2021).

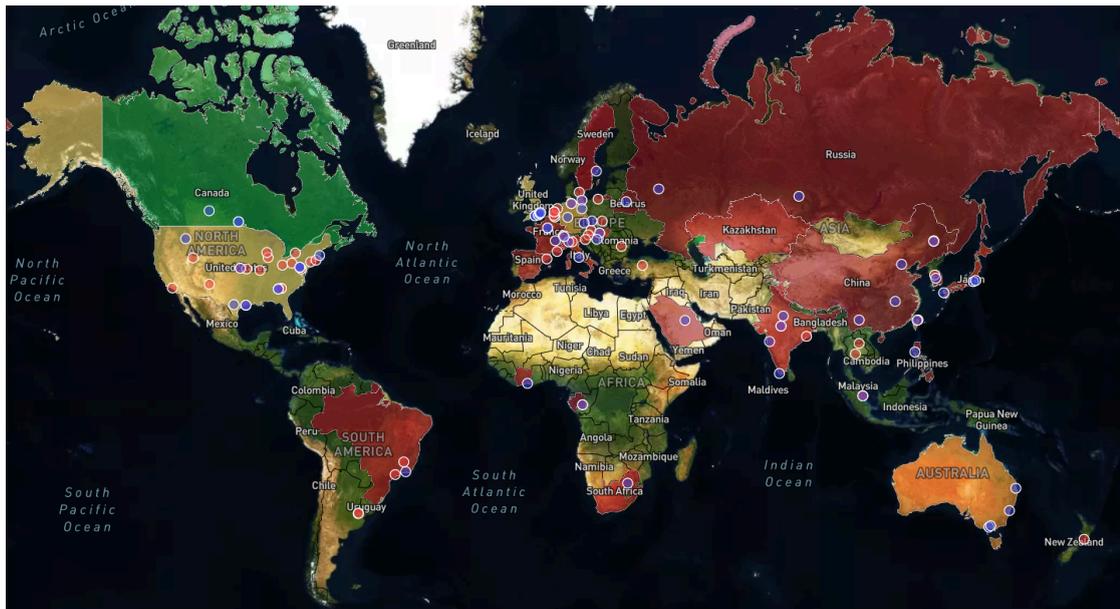


Figure X: Map of BSL-3 and BSL-4 labs around the world and rating of countries on their dual-use policies (red = low score) ([Global Biolabs](#))

## Debates on DURC

There is a divide in the academic community around the dangers arising from DURC. There have been extensive debates about what is and what isn't dual-use research of concern. In the early 2010s there was a notable split in the academic community, formed around the question of a moratorium for gain-of-function research. Opponents ([Casadevall and Imperiale, 2014](#)) and supporters ([Nature 2003](#)) of the moratorium split into two rivaling groups: the "Scientists for Science" (SFS) and the "Cambridge Working Group" (CWG). A debate between proponents and opponents can be found in [Duprex et al., 2014](#) published in "Nature".

There have also been ongoing debates around the issue of publishing research, weighing the value of freedom of information against the risk of information hazards ([Relman, 2014](#)) unintentionally "arming" malevolent actors.

More recently, the conversation has shifted focus onto enhanced potential pandemic pathogen (ePPP) research.

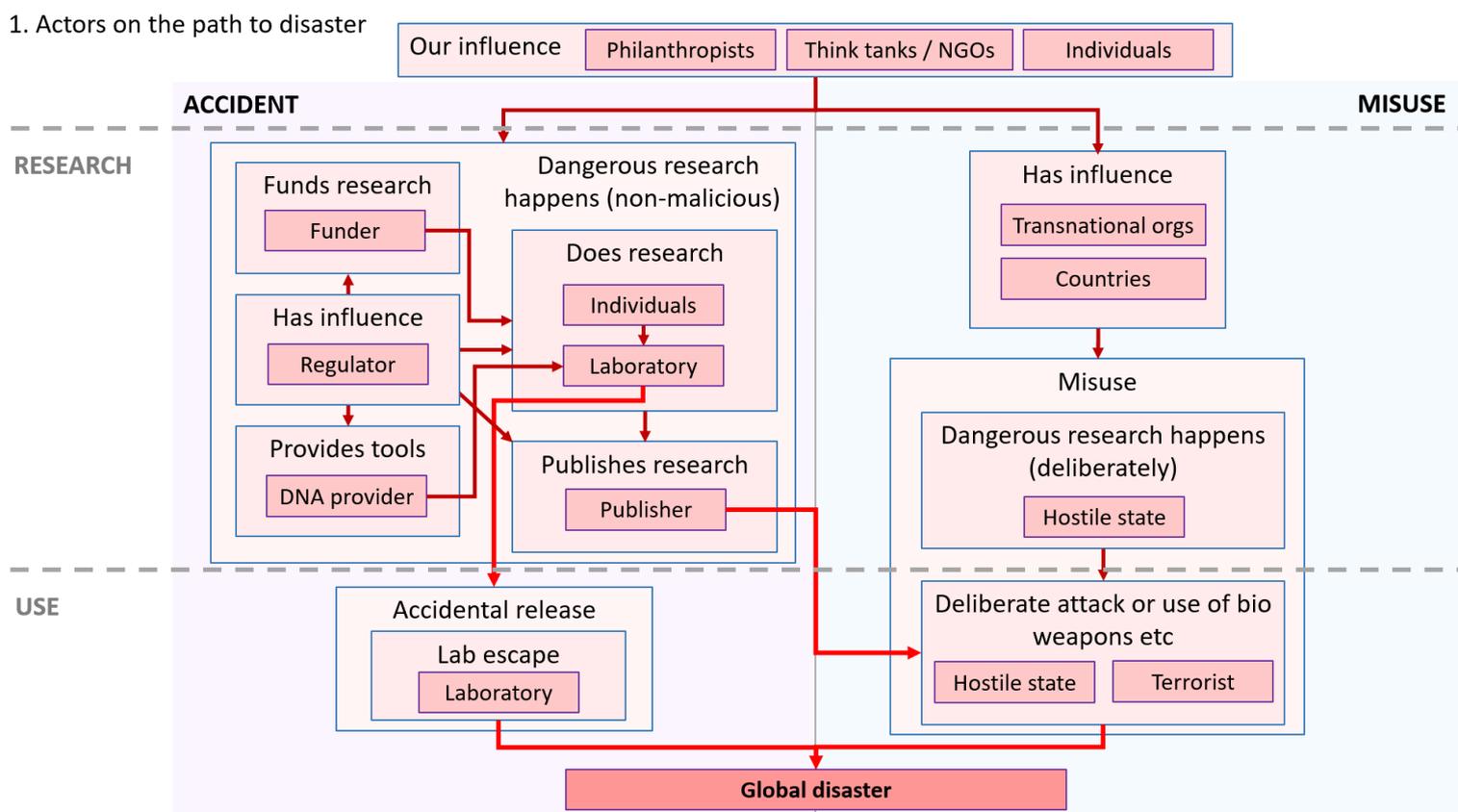
For the most part, CE staff are convinced that the risk of conducting and publishing dangerous research is significant, and lean towards safety on these debates. These debates and academic splits highlight that a new charity would very likely face challenges here. In particular, it may be challenging to precisely define what constitutes DURC, and to provide sufficient guidance to decision makers to strike the right balance between risk and reward for all stakeholders.

There is also an ongoing debate in the US about the origins of COVID. The topic has become very highly politicized, and is often connected to allegations about specific US political figures. New charities should be aware that anyone even suggesting that COVID may have been the result of DURC will lose political credibility among factions in the US.

### 3 Strategic considerations

## Mapping the ways that DURC could cause harm

To understand this space, we mapped out the various paths by which DURC could cause harm, and the key actors on the path to a potential disaster:



## Biosafety (accident risks) compared to biosecurity (misuse risks)

As previously mentioned, we can distinguish between biosafety (preventing the unintentional accidental spread of dangerous pathogens by those working with biological materials, e.g., through lab leaks) and biosecurity (preventing the intentional and malicious misuse of biotechnology for nefarious purposes).

We carried out some analysis on the scale of the biosafety and biosecurity risks. This is set out below in the [Annex: Biosafety and biosecurity](#). Our assessment suggests that incidents arising from biosafety failures (e.g. accidental pathogen releases) are likely to be more common, while instances arising from biosecurity failures (i.e. deliberate

pathogen releases), although less likely, have the potential to dwarf the impact of biosafety events by several orders of magnitude.

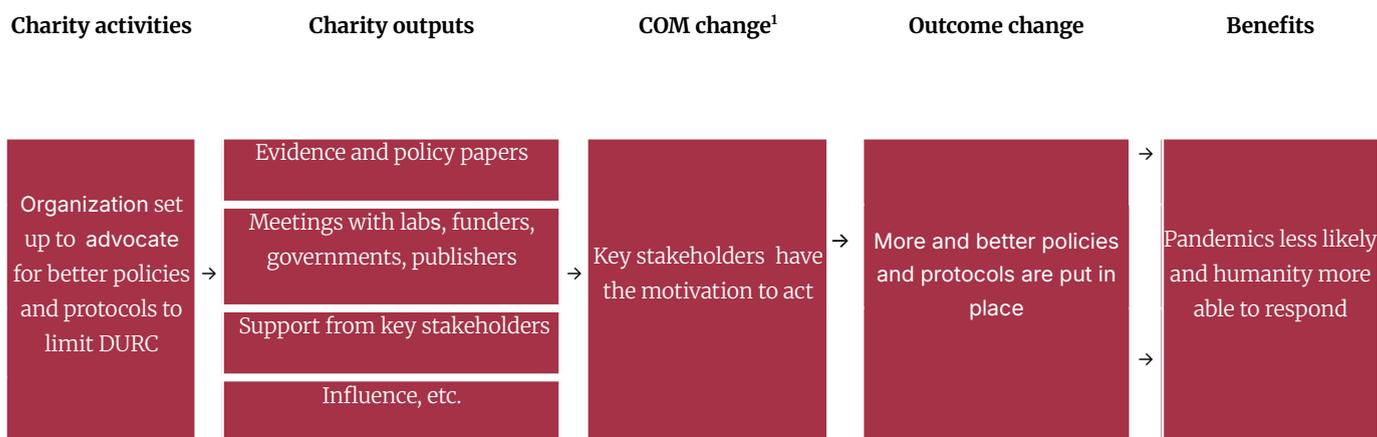
We also assessed the tractability of a new charity working on biosafety or biosecurity. We are skeptical of the tractability of biosecurity work for a new charity, we think it would be especially challenging to work on interventions focused on directly stopping hostile actors. Debates on biosecurity have historically been more divisive, and it has been harder to form a consensus on these issues, especially internationally. Additionally, there is a larger community of academics and researchers who focus on biosafety, whose expertise can be utilized by a future charity.

Finally we considered the quality of evidence for these two areas. There is considerably less historical evidence for biosecurity events than for biosafety events, which makes it hard to judge the effectiveness of biosecurity interventions.

We came away from this analysis with the heuristic that the best opportunities for impact for a new small charity are to focus on the interventions that address both biosecurity and biosafety risks, for example by limiting the amount of DURC that happens in the first place. Our approaches section (section 4 below) focuses on biosafety interventions, or interventions that can affect both biosecurity and biosafety.

## Theory of change and key assumptions

Below is the theory of change for advocating for better policies and protocols to limit DURC. We consider the necessary activities and outputs by the advocacy organization, and the required behavior change from stakeholders funding, conducting and overseeing research with dual-use potential. We also highlight the key assumptions being made in this theory of change. The theory of change for this intervention could be as follows:



The key assumptions, corresponding to each step (i.e., "→") in the theory of change, are:



Scale: key uncertainty, high uncertainty, some uncertainty, low uncertainty, un concerning

<sup>1</sup> COM refers to the capability, motivation, and opportunity for change from the COM-B model for behavior change ([The Decision Lab, 2021](#)).

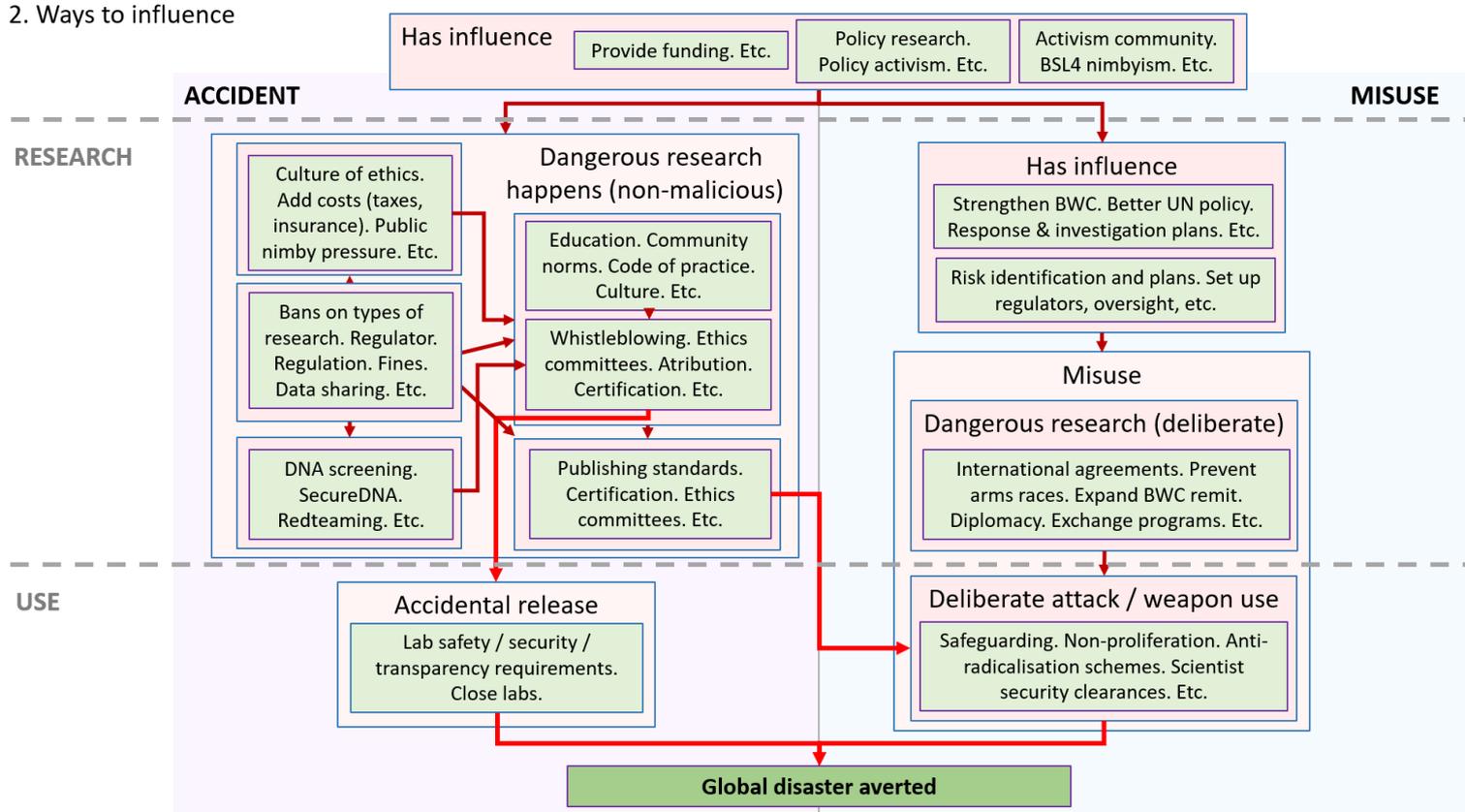
We outline our reasoning about key uncertainties in this theory of change in the [Evidence on crucial considerations](#) section of this report. Our theory of change for this intervention is comparatively broad; in the next section, we will analyze different approaches and policies that this organization could focus on.

## 4 Approaches

In this section, we considered specific policies and approaches that this organization could focus on. We focused on advocacy approaches to limit DURC (other paths to reducing DURC risks, such as differential technology development (Sandbrink et al., 2022), are considered in other reports).

Our first step was to expand on our map of how DURC could cause real-world harm, with the various actions that could be taken to address the risk at each stage:

### 2. Ways to influence



This generated a long list of ideas. Based on our case study analysis (see the evidence section below), expert opinions and on our strategic analysis (above), we identified five key approaches we were most excited about for a new charity.

Our second step was to compare our top options. This comparison is shown in the table below, followed by a write up of the top ideas from the table

Approach	Who's affected?	ToC	Scale	Tractability	Ability to avoid Risk of harm	Neglectedness
<b>Advocate for stricter government regulation</b>	Labs / Researchers	Lobbying → new standardize rules and regulations in this space → following rules and assessing risks becomes more common → less DURC	<b>High</b> <ul style="list-style-type: none"> <li>Affects all research</li> <li>Potential to spread globally</li> </ul>	<b>Low</b> <ul style="list-style-type: none"> <li>"All-or-nothing" - only has any impact if 100% successful</li> <li>Low feedback loops</li> <li>If academic community does not approve change might be unenforceable or quickly reversed</li> </ul>	<b>Low</b> <ul style="list-style-type: none"> <li>Risk of backlash from academic community, could be seen as an attempt to restrict academic freedom</li> <li>Risk of politicization</li> <li>Risk of driving dangerous research underground or overseas (e.g. <a href="#">EcoHealth case (Eban, 2022)</a>)</li> </ul>	<b>High</b> <ul style="list-style-type: none"> <li>GSH scores very low across the globe</li> <li>Repeated calls for standardized procedures etc. in academic papers</li> <li>Few actors focus on systemic change</li> </ul>
<b>Engage universities to install stricter standards (e.g., on ethics committees)</b>	Researchers at universities	Advocacy → Academics and universities have stricter → researchers adapt → less DURC	<b>Medium</b> <ul style="list-style-type: none"> <li>Not all research takes place in universities, but there is a chance of spillover</li> <li>Unequal distribution of dangerous research over universities</li> <li>Hard to target as many universities</li> </ul>	<b>High</b> <ul style="list-style-type: none"> <li>Some promising case studies, but also cases where it failed</li> <li>More targeted advocacy/lobbying possible</li> <li>Universities as "hubs of innovation"</li> <li>Some chance of refusal from academic community if seen as outsiders coming in with advice</li> </ul>	<b>Medium</b> <ul style="list-style-type: none"> <li>Risk of backlash from academic community from perceived attempt to restrict academic freedom</li> <li>Could push research and researchers to universities that are less safety conscious and have less restrictions</li> </ul>	<b>Medium</b> <ul style="list-style-type: none"> <li>Some work and suggestions on this already (e.g. see <a href="#">Resnik, 2010</a>)</li> <li>See section below "Neglectedness"</li> <li>More neglected at smaller universities, but also less relevant there</li> </ul>
<b>Working with publishers to establish stricter guidelines around publishing DURC</b>	Publishers, researchers	Stricter guidelines for publishing DURC → becomes less attractive to researchers → less DURC	<b>Medium</b> <ul style="list-style-type: none"> <li>Not all research has publication as its primary purpose, especially in biotech</li> <li>Doesn't capture open access and preprint</li> </ul>	<b>Low</b> <ul style="list-style-type: none"> <li>Requires buy in from many publishers (replaceability)</li> <li>Goes against incentives inside the academic community</li> </ul>	<b>Medium</b> <ul style="list-style-type: none"> <li>Could be seen as an attempt to restrict academic freedom</li> <li>Researchers moving to journals with less restrictions</li> <li>Risk of driving dangerous research underground</li> </ul>	<b>High</b> <ul style="list-style-type: none"> <li>Journals often lack shared guidelines</li> <li>There are few actors advising journals / advocating for change in this space</li> <li>More neglected for less important journals, but which contribute less to the risk</li> </ul>

<p><b>Improving funders's capability to assess risks</b></p>	<p>Funders, researchers by extension</p>	<p>Funder have increased capability of assessing risks → risky research receives less funding → less DURC</p>	<p><b>High</b></p> <ul style="list-style-type: none"> <li>• All research needs funding</li> <li>• Large variety of funders with different interests and incentives makes targeted outreach difficult</li> </ul>	<p><b>Medium</b></p> <ul style="list-style-type: none"> <li>• Case study: US moratorium gain-of-function was funding-based</li> <li>• Difficulty: requires a lot of funders, otherwise: replaceable</li> <li>• Funders have their own ideas about what's a good use of their money</li> </ul>	<p><b>High</b></p> <ul style="list-style-type: none"> <li>• Unlikely to cause backlash or unintended negative consequences</li> <li>• Very small risk of increasing likelihood of DURC by making funders more "bullish" on DURC (negligible)</li> </ul>	<p><b>High</b></p> <ul style="list-style-type: none"> <li>• Very few funders have expertise in DURC</li> <li>• Few agencies that funders can go to for reliable, unbiased advice</li> <li>• Although some guidelines exist (see <a href="#">Nuclear Threat Initiative, 2021</a>).</li> </ul>
<p><b>Provide guidance for new BSL-4 and BSL-3 labs</b></p>	<p>New labs, potentially governments of these countries</p>	<p>Better safety protocols and procedures → less lab leaks (but not necessarily less DURC?)</p>	<p><b>Medium</b></p> <ul style="list-style-type: none"> <li>• This would ignore existing labs but many countries are scaling fast</li> </ul>	<p><b>High</b></p> <ul style="list-style-type: none"> <li>• New labs are more likely to accept advice</li> <li>• This takes some of the work away from these new labs</li> <li>• Could give them credibility when "certified"</li> </ul>	<p><b>High</b></p> <ul style="list-style-type: none"> <li>• Unlikely to cause backlash or unintended negative consequences</li> <li>• Could be interpreted as "meddling" in other countries affairs → risk of politicization</li> </ul>	<p><b>Medium</b></p> <ul style="list-style-type: none"> <li>• Labs are only built when massive grants etc. are approved, so they likely already have guidelines and procedures</li> <li>• No other actor we are aware of does this</li> <li>• Developing countries can rely less on domestic actors/governmental agencies</li> </ul>

## A. Advocacy for stricter standards from within the academic community

### Theory of Change

The charity will engage with academics to make the case for more caution around DURC. It will drive measurable impact through providing guidance, advocacy and consulting to academic institutions- especially, but not limited to, University Ethics Committees (UECs). The institutions will adapt these recommendations, and include them in their guidelines for researchers operating under these restrictions.

Researchers will adapt to these norms and procedures. Less dangerous research will be conducted.

### Scale

Medium – Most research takes place in academic institutions, although this somewhat varies when it comes to highly specialized units like BSL-4 labs. In these units: 60% are government-run public health institutions, less than 17% are university labs, a little over 18% are biodefense-related institutions, and only two are fully privately owned ([Global Biolabs](#)). However, even the government-run labs rely heavily on input and expertise, as well as recruitment, from the academic community. Finally, there is a significant chance of spillover when standards and regulations are adopted by actors outside of the academic community.

### Tractability

High – There is a significant amount of evidence for the possibility of institutional change and transformation in the academic community. Some authors have argued that changes at the UECs level are insufficient to initiate the change needed to ensure safety ([Salloch, 2018](#), [Kolstoe 2021](#), [Resnik, 2010](#)). However our review of the evidence suggests that support and involvement from the academic community has often been a driving force in questioning and reforming norms and procedures. While it's not the only factor, this support has been beneficial in mobilizing broader movements towards change. See our later section on [Evidence](#) for details.

### Ability to avoid Risk of Harm

Medium – The risk of harm is relatively low. The main way we could see this approach backfiring is when the aforementioned advocacy is perceived by the academic community as an intrusion, and as an attempt to restrict their academic freedom. In the past (see our section on [Evidence](#)), this has sometimes led to researchers and/or publishers doubling down on their commitment to conduct and/or publish a specific type of research.

Furthermore, there have been cases of researchers moving to a different university or country to be able to conduct their research without limitations or oversight. While we do not expect this to happen on a massive scale, we have reason to believe that it is not an anomaly either. This would only be counterfactually negative if the place they moved to had less regulations than the university of origin did before the intervention.

### **Neglectedness**

Medium – Our impression is that this approach is somewhat neglected. While there is some work on self-regulation from within academia ([Resnik, 2010](#)), we have not found much evidence of other actors pursuing the goal of changing the standards in academic communities. Additionally, previous attempts of this kind have often narrowly focused on specific types of research, such as high-risk gain-of-function research ([Shinomiya et al., 2022](#)), and there may be "low-hanging fruit" when it comes to other types of dangerous research.

## **B. Improving funders' ability and willingness to assess risks associated with research**

### **Theory of Change**

The charity will collaborate with funders to improve their capacity to evaluate the risks and the benefits associated with dual-use research of concern. Given this increased capacity, funders will be less likely to fund needlessly dangerous research.

Researchers will be less likely to conduct or propose dangerous research, given the new funding landscape. As a result, less dual-use research will be conducted.

### **Scale**

High – The overall scale of this intervention is high, since almost all research relies on external funders. However, in order to reap the benefits of this intervention, a critical mass of funders would need to be convinced to introduce or make relevant changes to their risk-assessments. This is further complicated by the fact that the funding landscape is diverse. For drug research, "governments and non-profit organizations together account for a quarter of the funding of all drug research worldwide. Large biopharmaceutical companies finance about two-thirds, and venture capital funds invest the remaining ten percent." ([Government of the Netherlands, 2022](#)). In the US, the government funds the large majority of research (82 % vs. 11% privately funded research, ([Gorman, 2021](#))). These numbers differ in the field of pharmaceutical research, which, at least in the UK, is predominantly privately funded ([Haves, 2022](#)). An investigation of the leading producers of viral infectious disease and clinical

research showed that out of 24,197 publications, only 2,313 received federal funding, which equates to less than 10% ([Sandbrink et al., 2021](#)).

Presumably, different funders have different interests and incentives, which a charity would have to take into consideration.

### **Tractability**

Medium – The US moratorium on gain-of-function research is a prominent example of funding-based restrictions on dangerous research. There is robust evidence suggesting that changes in the funding landscape influence the amount of research that is conducted. With that being said, the tractability might be diminished by the risk of leakage, where researchers migrate to a country where funding is more easily acquired.

### **Risk of Harm**

Low – We estimate the risk of harm caused by an intervention of this kind to be low. While it is possible that some funders reject the advice given by the charity, it is very unlikely that they will fund more dangerous research as a consequence of this rejection, compared to the counterfactual of having had no intervention. There is a small risk of politicization, although this is not specific to this approach.

### **Neglectedness**

High – The neglectedness of this approach is high. Adequate and thorough risk-assessments remain a rarity in funding decisions for research, and there are few actors in this space providing the expertise and the trustworthiness of a well-staffed charity. We are only aware of a few initiatives to provide guidelines and recommendations to funders, outside of the input given by governments, like the Nuclear Threat Initiative ([Nuclear Threat Initiative, 2021](#)) and the Visibility Initiative for Responsible Science ([Stanford University](#)). Governmental entities are also routinely involved in the biosafety committees of academic institutions which are responsible for risk-benefit assessments. This points to a higher degree of neglectedness in the private sector, compared to research that is subject to government oversight.

## **C. Providing guidance for newly established BSL-3 and BSL-4 labs**

### **Theory of Change**

The charity provides guidance for new BSL-4 labs in low-and middle-income countries. The advice could be based on, and modeled after, best-practices and standards from countries where an established track record of this work exists-like the US or the UK. These labs establish, implement and enforce stricter safety protocols.

Their likelihood of being the cause of a lab leak decreases. Less lab leaks happen, in expectation.

### **Scale**

Medium – The scale of this approach largely depends on future developments in the biotech sphere. While this intervention would exclude all existing labs, many developing countries are scaling fast, with six planned labs in India and 15 in Russia ([Mallapaty, 2022](#)). However, some countries would be difficult to work in, which reduces the total number of labs that a charity could target. That said, countries that have just started to build these labs are in higher need, and would probably be more willing to accept outside advice.

### **Tractability**

High (but uncertain) – The tractability of this intervention is high, if one assumes that at least some facilities are interested in a charity's advice and consulting. Because the labs are new, there are often no old protocols that need to be changed, and there is more room for establishing rules and procedures, as well as funding for adequate materials and machinery. However, we have a moderately high amount of uncertainty about these claims, given there is no real track record of charities advising new biolabs.

### **Ability to avoid Risk of Harm**

High – We haven't found any evidence suggesting that this approach is likely to cause direct harm. It is possible that some countries might react negatively to such a proposal, and it is important to acknowledge that this is a highly-regulated field, often with relevance to national security. The success of this intervention therefore hinges on government acceptance/buy-in.

### **Neglectedness**

Medium – We think this is a fairly neglected idea, given that actors from the industry have no real incentive to provide this kind of advice and support. Expertise around biosecurity and biosafety in these countries is expected to be less available. On the other hand, labs that are planned will have already gone through extensive procedures regarding safety protocols, which would decrease the demand for this service. In this case, a charity could shift to providing capacity support to countries that are in the process of planning to build new labs; this would be more speculative, but might provide more leverage/room for advocacy earlier in the chain. It is also important to acknowledge that even when labs can not draw from a large amount of resources from

their respective national governments, there are often respected international players, like the WHO, that can step in.

## 5 Evidence

In order to be able to judge the importance, tractability and neglectedness of the aforementioned approaches, we relied on a holistic approach. Building on the evidence already in the report so far, we also collected evidence from case studies (both bio-specific as well as non-bio cases with applicability to our object of inquiry), and literature reviews looking into key uncertainties and expert opinions. The following section summarizes the results and evaluates the evidence base for this intervention. Unlike other CE reports, we were unable to largely draw from systematic reviews and meta-analyses, given the scarcity of a solid track record and research history in this burgeoning field.

### Case studies

This section of the report is a summary of the inferences and conclusions that can be drawn from case studies. The full case studies can be found below in the [Annex: Case studies](#). They include:

- Genetic modification
- Animal testing
- Human cloning
- Biological weapons
- Bioterrorism
- Stem cell research
- Human testing
- Gain-of-function research
- Recombinant DNA

We also looked at a few non-bio examples:

- Fracking
- CFCs (ozone depletion)
- Nuclear

## Conclusions from Case Studies

- 1) Public condemnation and/or stigmatization has been a key factor of success in the past. These cases seem to rely on the ability of the public to perceive a risk as an actual and immediate threat. Often, there were cataclysmic events that the public could point to as a cautionary tale, which is significantly more difficult in the case of abstract or theoretical future threats – but this is not always the case, for example on human cloning there were no clear past threat to point to. The case of GMOs is an example of public protest and consumer demand sparking changes on an institutional level, although it is important to note that the fears around GMOs were not necessarily entirely justified.
- 2) Academics play a pivotal role in initiating, implementing AND maintaining changes in regulation. They have an advantage over the public when it comes to their degree of information, and they often hold the power to resist government regulations or recommendations. Key regulations in the past have often been sparked by voluntary self-imposed restrictions that preceded them. On the other hand, researchers have an interest in conducting DURC, and receiving funding and recognition for it, creating a system of misaligned incentives that might be hard to correct for.
- 3) Policy makers have been the drivers of change in cases where national security was of importance, and when regulating dangerous research was in their own interest. Where matters of national concern were less evident, or where it was actually in the interest of a country NOT to impose stricter rules, it was academics who first voiced concerns.
- 4) Cooperation between researchers and funders/regulators seems crucial for long-term success in preventing dangerous research. Previous cases suggest that this significantly limits the risk of politicization and backsliding when the electoral landscape changes, and it decreases actions like journals publishing things “because they can”, simply to insist on their right to academic freedom and self-governance. Our case studies further suggest that voluntary moratoriums increase the chances of later acceptance of governmental oversight and regulation.

From these findings, we can infer the best strategies a charity in this field might pursue.

Firstly, it is important to note that the path through public protest and outrage will likely not be feasible given the considerable risk of information hazards (although this might depend on the kind of DURC to some degree).

Therefore, **our current best guess is that a promising way to affect change would be to target the academic community, with the goal of bringing them to institute more voluntary moratoriums.** This would include academic publishers and funders, as well as researchers themselves. This matches one of the top ideas identified in the section above.

An alternative path to achieving a reduction of DURC would be to encourage the aforementioned cooperation and communication between researchers and policymakers, aiming for more regulation (and adherence to it) by attempting to align incentives and motivations to create a less adversarial conversation space. This would also seem relevant given the findings of [section 3](#) where we point out that there is often a lack of information and/or consensus about DURC.

Regarding tractability of initiating reforms in the research community, there is a solid evidence base for institutional changes in the academic landscape:

- As early as 1999, there has been a “guidebook” for how to bring about change in universities ([Eckel et al, 1999](#)). A more recent version would be [Kezar \(2020\)](#).
- Student protests have often been a preferred mean of inspiring and initiating institutional transformation ([Ferguson \(2017\)](#) gives an overview of their role in affecting change)
- There is a list of academic reform initiatives ([Wikipedia, 2023](#)), mainly outlining examples from the US-American context
- [Resnik](#) provides a timeline of Research Ethics in the Academic Community that lists important events and developments in the past

An example case of institutional reform in the academic community in recent times was the introduction of a university sustainability ranking; which, according to [QS \(2023\)](#), was inspired by the demand of students. Academics subsequently joined forces and called for “Business School Rankings for the 21st century” ([GMAC, 2022](#)). In this case the effectiveness of the student protests appears to have rested on their ability to garner public support and build strategic alliances ([Porta et al., 2021](#)). In a similar fashion, the Open Access Movement started in 2001 as a small movement at a conference (kickstarted by researchers, publishers and activists), where a declaration was published that sparked a widespread debate about publishing practices in the academic world ([Walley, 2020](#)).

Additional case studies include, but aren’t limited to:

- Students protesting for better pay and improved working conditions (UK)

- Academics protesting against pension cuts (UK)
- The “Joint commitment for action on inclusion and diversity in publishing” ([RSC](#))

One important caveat to this is that student protests can sometimes result in backlash from the wider public, as could be seen in the past decade, especially around concerns of “cancel culture”. Here, protests have sometimes even triggered backsliding, which would be a risk worth considering.

## Evidence on crucial considerations

### A] What is the value of DURC that might be prevented by this intervention?

**Our overall view is that, given the limited track record of DURC, there is a strong case for limiting DURC, even when accounting for the value of the positive research outputs.**

Proponents of DURC highlight the potential insights researchers might gain by conducting dual-use research: “The three specific benefits [...] are early warning of future threats, data to improve prevention and reduction of these threats, and inputs for advance preparation of responses for unexpected outbreaks of unknown diseases.” ([Jonas, Seifman, 2019](#))

While the track record for this type of research is limited, Fauci reports on the following previous successes: “For example, basic research on the molecular structure of the influenza virus has led to advances in the development of improved influenza vaccines [...] In addition, knowledge of a particular genetic mutation or set of mutations that facilitates influenza transmission in humans may be crucial for use in global surveillance of emerging pandemic influenza viruses.” ([National Institutes of Health, 2012](#)) Similarly, the USAID claims that the knowledge acquired by these programs is “used by scientists to develop broadly protective vaccines and medicines, critical tools to have available for when/if a new coronavirus causes an outbreak in the future.” ([Piper, 2022](#))

In spite of these suggested benefits, it appears that there is little evidence of DURC having had a positive effect on our ability to prevent or contain biothreats. Matthew Yglesias goes as far as to say that DURC “has failed to generate anything of value” ([Yglesias, 2022](#)).

A further point of contention is the cost-effectiveness of DURC. The program “Deep Vzn” cost 125 million USD, while the “Global Virome Project” has a cost that lies

somewhere between 1 and 4 billion USD, and has been likened to “looking for a needle in a haystack” ([Piper, 2022](#)). However, other experts have suggested that these endeavors could be cost-effective if successful ([Jonas, Seifman, 2019](#)).

## B] Is this plausible for a charity to tackle?

**We think there is sufficient evidence that non-profits can play a role in this debate, although it might not be easy and a new non-profit might have to pivot and adjust strategy in order to succeed.**

Even if there was conclusive evidence that the problem is high in scale, neglected, and the theory of change is solid, there is a question as to whether a charity is the right entity to bring about this change. Crucially, there is a lack of evidence in regards to charities affecting this type of systemic and long-lasting change in the biosecurity and biosafety space.

Turning first to charities and their success in related fields, the “Center for Responsible Shale Development” is a nonprofit that has successfully advocated against the practice of fracking by creating a certification process in cooperation with third-party auditors, which helped them to get buy-in from industrial companies ([Wikipedia](#)). In a tangentially related field (animal testing), charities like “[Cruelty Free International](#)” or the “[Humane Society](#)” have successfully advocated for institutional change (see their successes and achievements here: [Cruelty Free International](#), [Humane Society of the United States, 2019](#)).

Moving on to existing organizations in the biosafety and biosecurity space, the most notable examples of actors with significant outputs are the Cambridge Working Group, which successfully advocated for a moratorium on gain-of-function research ([Lipsitch, Inglesby, 2014](#)), the Nuclear Threat Initiative ([NTI](#)), and the International Federation of Biosafety Associations ([IFBA](#)). The Centre for Long-Term Resilience ([CLTR](#)) has previously engaged in similar work and could serve as an example for a young and new organization in this space, although the degree of their success so far is unclear.

On a broader level, a review of the literature on NGOs and their influence on biosafety and biosecurity has yielded moderate evidence on their tractability in affecting institutional change and transformation.<sup>2</sup> More specifically, NGOs have been credited with having a significant impact on the Cartagena Biosafety Protocol ([UNEP](#)) by the UNEP Convention on Biological Diversity:

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<sup>2</sup> [This chapter](#) (pp 48–64 of [Arts and Mack, 2003](#)) outlines the strategies and the influence of NGOs in the biosafety space between 1992 and 2005.

"They were particularly able to influence policy outcomes by lobbying government delegates, by co-operating with developing countries and by mobilizing public pressure. With regard to the time frame of the biosafety negotiations, ENGOs [environmental NGOs] succeeded in exercising most of their influence in the so-called 'pre-negotiation' phase." ([Arts and Mack, 2003](#))

Other experts have described a variety of advantages that NGOs have when advocating for progress with regards to global health security ([Health Security Partners, 2015](#)):

- Better understanding of the communities they work in
- Ability to adapt their message to specific conditions and audiences in their place of operation, and to communicate these to political decision-makers
- Power to establish relationships with local institutions that government agencies may not have
- Ability to cultivate trust, ensuring the support of local stakeholders

We feel the need to emphasize that some of our uncertainties about the ability of a charity to address this problem are not inherent to its nature as a nonprofit, but rather related to any organization's ability to produce relevant and timely research outputs on this topic. Even domain experts have repeatedly mentioned to us that the definitions of DURC often remain murky, and that figuring out appropriate steps in the regulative and legislative process is very difficult. While part of this may be the result of this field still being in its infancy, we do expect this to be a challenge for a charity in this field. However, we remain positive to some degree that the process of figuring out whether a charity can usefully engage with the academic community or produce policy outputs has reasonably short and direct feedback loops, allowing for a new charity in this field to quickly adjust and course-correct if it turned out that its approaches were too difficult- or simply not effective.

### **C] Can researchers who have previously worked on DURC easily pivot to adjacent careers / research areas?**

**Our overall impression is that while the desired outcome of limiting the amount of dual-use research of concern will likely impact some researchers' careers, we do not expect this to be a problem at scale.** Generally, we observe that it is common for people in the life sciences to transition to industry jobs (pharmaceutical industries, data science, public health, etc.). If they are entirely committed to conducting "wet lab" research in a more heavily regulated academic environment, the pivot might be more difficult- given how specialized and compartmentalized science often is and how

it often requires multiple steps (often totaling up to years and decades) to develop and establish expert status in a domain. There might also be a resistance from academics to losing seniority by switching their research focus. In the wake of the past gain-of-function moratorium, it was noted that some researchers struggled to “find other things to do” ([Kaiser, 2022](#)). These effects might be even worse if policy changes are temporary or uncertain (as moratoria often are), creating a lack of clarity around future career trajectories. This could pose some barrier to a charity acting in this space.

Experts we interviewed saw this as less of a concern, given a general optimism about researchers' ability to find other (if less prestigious/newsworthy) topics of inquiry. In some cases, the changes initiated by a charity might not even require a complete shift in research focus, but simply one in methodology, which would make adoption easier and reduce the overall friction caused by legislative or institutional changes. Additionally, experts noted that researchers in the biotechnology field often have a myriad of career opportunities to choose from, making them less dependent on a single job which might fall victim to the changes we outline above.

## Expert opinion

### Summary of expert views

Generally speaking, the experts we have talked to were reasonably excited about the idea of reducing the amount of DURC. They emphasized a need to work on this pressing problem, and offered their own ideas about how this could work. They were less optimistic about the tractability of a charity in this field.

The experts we interviewed have identified “funding” and “publishing” as the key levers on the path to impact with regards to limiting DURC. However, they were also quick to note that publishing follows its own incentives, and experts agreed there is some risk of leakage if the charity fails to achieve a tipping point where most publishers agree on policies. However, one expert pointed out that he thinks it is unlikely that differing norms would create a “race to the bottom”, mostly because individual researchers are unlikely to relocate to be able to pursue research or receive funding. Restricting opportunities to publish further includes the possibility that dangerous research will keep being conducted in the short-term, before the changes result in a change of incentive structures and subsequent behavioral change in the long-term. Breaching of scientific autonomy was also named as a potential barrier to the funding-oriented approach. Institutional Review Boards were also mentioned as potential places to intervene and advocate for more restrictions of DURC, for example by having the requirement for more and better risk assessments. Increasing the

accountability of labs through legal mechanisms was also brought up as an idea in this context, which could also be achieved by audits and enforcements, conducted by a certification entity. Such an approach seems promising because there is some evidence that most lab leaks are caused by failing to adhere to safety procedures (Wurtz, 2016). Another idea one of the experts was excited by was the creation of an organization that works as a trusted information broker which brings together the different actors and stakeholders in this space.

Experts we talked to disagreed on whether our main focus should be on biosafety or biosecurity. While biosecurity seems to be the bigger existential risk (see also [Section 3](#) above), biosafety was identified by one of the experts as an area with both a track record and some low-hanging fruit. With regards to the geographical focus, experts interviewed by CE recommended focusing on the EU and the US, for the simple reason that these are the countries where most DURC is conducted.

Apart from the aforementioned concerns about scientific freedom, the risk of politicization was brought up as a potential barrier. Moreover, there remains some difficulty in defining what DURC is. Lastly, with regards to the implementation and the talent that would be needed for a charity of this kind, experts have pointed out the necessity of having people who have an in-depth background in this field and in this line of work, both in terms of their technical expertise as well as their exposure to policy interventions. This would either take the form of having co-founders with degrees in relevant disciplines (virology, biosafety or medicine), or having a team with expertise and experience in the public health sector. They would also need to be able to work well with other organizations in this space, and create and maintain sustainable and reliable partnerships.

## Experts talked to

We would like express our thanks to the following experts for their views:

- Jonas Sandbrink – University of Oxford
- Greg Koblentz – George Mason University
- Staff at Nucleic Acid Observatory
- Other

## 6 Cost-effectiveness estimate

We carried out a very rough cost-effectiveness analysis. We did not put much weight on this analysis, as it is based on a lot of speculative assumptions. The model can be found [here](#).

The model suggested that this charity would save a life for every \$30 spent.

We note that a few rough alternative approaches suggested an order of magnitude less cost-effectiveness, suggesting about \$340 per life saved.

## 7 Geographic assessment

The high degree of need and room for improvement globally is demonstrated by the formerly mentioned [Global Health Security Index \(2023\)](#) scores; which, except for a few select cases, are low for most countries across the globe. Therefore, what played a bigger role in our investigation was the scale of the problem in each country respectively, which we approximated by looking at the number of BSL-4 labs. Our assessment was further informed by GHS scores on specific indicators, especially the score on dual-use research. Our complete geographical assessment can be found [here](#).

From the shortlist that emerged from this analysis, we proceeded to eliminate countries that would be very difficult to operate in, namely China, North Korea, and the United States. This decision necessarily reduces the potential impact of the charity, given the fact that dangerous research is not just more prevalent in these countries, but pandemics are also arguably more likely to emerge from a country with less regulations and restrictions, given the higher neglectedness of policy change in these countries. Nonetheless, we estimate the tractability of work in these countries to be significantly lower, to a point where we think it is more likely that effective change can be advocated for in other countries. While China and North Korea might be an obvious choice to exclude for geopolitical and security reasons, we also decided to recommend that a new charity does not focus on the United States. Although the US plays a leading role in bioresearch and has an unproportionately high number of labs, our impression after talking to various experts was that there was a higher risk of politicization in the US than other jurisdictions. We also concluded that it would be more difficult for a charity to effect meaningful changes in the US. (We note that it is possible the political situation and attitude to DURC in the US might change between now and when founders come to start this intervention; if there is evidence of political shifts, they may want to reconsider the US as an option.)

There remain countries which have a comparatively large amount of research labs, and should have some willingness to accept the advice and consultation of a new charity. The United Kingdom, Germany, France, Japan and India all have very low scores on the dual-use specific indicators of the GHS. Based on its historical track record, the European Union in general appears to be more open to regulating biotechnology and research in this space. This might help a charity get their policies implemented and embedded in binding legislation.

In addition to this, and depending on the approach chosen by the charity, we identified some low-and middle-income countries (Brazil, Philippines, Russia, Singapore, India and Kazakhstan) that are currently scaling the amount of their biological research

facilities. This makes them more important countries to work on; simultaneously increasing the likelihood of a charity's advice and input being valued and implemented, and making use of a "window of opportunity" where rules and regulations are still malleable.

Finally, a successful charity would not be limited to their first country of operation; through first successes they might strengthen their external credibility enough to expand to geographical areas we have decided not to recommend (China, US, etc.)

## 8 Implementation

In this section, we outline the specific requirements of the intervention regarding its implementation. We consider talent, access, funding, scalability, neglectedness, and externalities.

### Talent

We believe this intervention would heavily benefit from a specific skill set and professional background. This intervention could therefore be bottlenecked by access to talent. Experts have repeatedly mentioned to us that credibility is crucial when looking to influence the biosafety sector. We expect an ideal co-founding team to consist of people with an academic or medical background, ideally paired with experience in the policy, consulting or advocacy sector. Apart from being good negotiators, the team will have to build, scale and maintain sustainable alliances with key actors in the biosafety and biosecurity space. Doing so will likely require years of experience and a solid track record, which precludes a majority of previous participants of the program. Targeted outreach might be needed. Familiarity with regional conditions matters less, although advocacy in some countries could be easier or more difficult depending on the charity's team's nationalities, as this would influence how they are perceived externally.

### Access

Similarly, we expect access to key decision-makers to present a difficulty. For academia, it is possible that there is a lack of appreciation for "outsiders" coming in and proposing changes. It appears crucial for the charity to be perceived as an international, neutral, nonpartisan actor; although, even if that is achieved, access to some countries like China/Russia/North Korea is near-impossible- which limits the range of possible options. That said, emerging countries might be in higher need of external consultation and advice, which could facilitate access.

One way a charity might work to increase its access would be to forge strategic alliances with established and reputable actors in the field. These could be academic institutions, think tanks or leading researchers. This would help strengthen their credibility (which, in turn would alleviate the need to find externally credible talent) and facilitate access. It might also help in acquiring bigger grants and improve the charity's ability to raise funds, which we turn to next.

## Funding

There has been a sharp increase in funding for projects in the biosecurity and biosafety space, including measures for the prevention and the preparedness for pandemics. Big philanthropic organizations like Open Philanthropy have previously funded similar projects, although it is important to note that most of these projects had some track record and/or founders and staff with a lot of experience. A new charity would likely need to establish this kind of track record first, before being considered by major funders. This presents a problem, since unlike other interventions in the global health and development space, it is more difficult to show results and early successes on a smaller scale, given the long timelines and uncertain feedback loops. Other funders from the effective altruism/ longtermism community might be more open to funding speculative projects and new charities like this one.

If framed as a global health security issue, a successful charity might be able to attract funding from entities like the CDC, WHO, the Gates Foundation or USAID.

Finally, it is possible that the Covid pandemic opened a “window” for these opportunities, which might close soon after the threat of pandemics is less publicly discussed. If that was to happen, the amount of potential funders would decrease from including traditional and big philanthropic organizations (the Gates Foundation, Open Philanthropy, etc.) to a narrower subset of effective altruism-aligned funders.

## Scalability

The number of labs conducting dual-use research of concern presents a natural ceiling to the scalability of this intervention, although a successful charity might pivot to other variants of dangerous research if it successfully accomplished its goals with regards to dual-use research of concern. Moreover, there is a growing number of BSL-4 labs and the investments in biotechnology and associated research labs are rising rapidly, which suggests additional room for growth. Nonetheless, we do not expect that this charity could absorb huge amounts of funding while staying highly cost-effective, since there are diminishing returns to hiring additional staff or targeting new labs or universities. (Our impression is that targeting universities would be an approach that would scale more easily than targeting funders or governments, or specific labs or individual researchers.)

## Neglectedness

Generally speaking, our review of existing actors in this space suggests that the neglectedness of this idea is high.

There is only a small number of established actors (like the Nuclear Threat Initiative - [NTI](#)) that have done extensive work on this, and there is a small chance that these would effectively crowd out smaller and newer charities with less experience. Unlike interventions in the global health and development space, there is often no need for a second advisor or consultant, which might limit the scalability of the intervention.

Further, we find that most activity is based in North America:

- The National Institutes of Health (NIH) has a [DURC committee](#)
- There is a [United States Government Policy for Oversight of Life Sciences Dual Use Research of Concern](#), which includes a [Companion Guide](#) <sup>3</sup>
- The Federation of American Scientists (FAS) has a [set of educational resources and training slides](#) on DURC
- Health Security Partners have published [this informational guide](#) for scientists
- Biosecurity Central has developed additional [training material](#)
- [This program](#) by the Collaborative Institutional Training Initiative (CITI) offers a training program on US DURC policy (target group: biosafety officers, IBC members, researchers)
- Next Generation Global Health Security Network ([GHSA NextGen](#))
- [Scientist Working Group on Chemical and Biological Security, Center for Arms Control & Non-Proliferation, USA](#) (Greg Koblentz, one of our interviewees)

On an international level, we have found the following organizations and institutions:

- The International Working Group on Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences has published a [self-assessment framework](#) which “intends to provide a measure of the organizational culture of biosafety, biosecurity, and responsible conduct to aid

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<sup>3</sup> However, the scope of these federal policies is limited by nature: “Those conducting research at institutions that do not receive federal funds (whether in private industry, in the “Do-It-Yourself” community, in other nations, etc.) are not bound by these policies” ([Source](#)). Note also, this may change between when the report was written and when this charity is founded.

in the process of enhancing such culture at the local level through baseline and periodic assessments.”

- The formerly mentioned [Cambridge Working Group](#) “advocates for all work involving potential pandemic pathogens to be halted until a quantitative and objective assessment of the risks has been undertaken” ([Source](#)). This group is not currently active.
- There’s the [IFBA](#), which is a global community (not-for-profit)
  - ❖ Main activities:
    - developing biosafety and biosecurity strategies and guidelines
    - advancing biorisk management practices & procedures
    - and certifying the competency of biosafety professionals in the safe and secure handling of infectious disease agents
- Biosafety Association for Central Asia and Caucasus ([BACAC](#))
- [Biosecure](#) Ltd, UK (previously funded by OpenPhil to work on research for a campaign against bioweapons)
- Foundation for the Development of Biotechnology and Genetics ‘[POLBIOGEN](#)’, Poland
- International Network of Engineers and Scientists for Global Responsibility ([INES](#))

Our overall impression is that there is a heavy focus on governmental institutions, particularly in the US. Experts have mentioned to us that they see an ability to move fast as a bottleneck for governments which might be alleviated by a new actor in this space. In summary, neglectedness appears to be a very specific factor, which turns out to be more or less relevant with regards to the legal status of the actor and their geographical focus.

## Risks

There are risks of undertaking work in this space:

- **Information hazard risks.** This is where talking about an issue makes it more likely to happen (for a classification of information hazards, see [Bostrom, 2011](#)). A new charity working in this space would want to work in a way that minimizes this risk. There is a limited amount of research on how to protect against

information hazards ([Lewis et al., 2019](#)). Our case studies suggest public engagement for research bans are often crucial. It is possible that just engaging academics might not be sufficient to drive change, yet engaging the public poses risks of information hazards. However, experts indicated that public support and engagement might be less critical than it was for the case studies we looked at. We also expect there are ways to engage the public that minimize these risks. Our overall view is that while information hazards should be considered when evaluating approaches and strategies, they do not in themselves present an insurmountable challenge which would lead us to advise against this idea.

- **Politicization risks.** The quality of debates can become very poor if a topic becomes politicized, as has happened to climate change in a number of countries. Advocacy work has a risk of increasing politicization. (It should be noted that a well-run charity here may be able to be net risk-reducing by controlling the debate, rather than net risk-increasing). The degree of politicization will further depend on the charity's strategy and their potential alliances with other actors in this field.

There are several risks of being successful at driving change in this space, including:

- **Leakage.** There is a risk of driving research underground, or to countries where regulations are less restrictive but lab leaks are more likely.
- **"lack-of-info-hazards"** which can apply to publication restrictions as competing actors fail to get a good sense of each other's knowledge which creates an incentive to escalate "arms race" dynamics in the biotechnology sector ([Lewis et al., 2019](#)).

We do not think that these risks are sufficient to not act in this space, but any new organization in this space should be aware of these risks (and other potential risks not listed here).

## Externalities

There are negative externalities of successfully driving change in this space, including:

- **Reducing research.** The limiting of useful dual-use research could negatively impact the world by preventing access to the potential benefits of that research.
- **Restriction on academic freedom.** This could have downstream negative effects.

## Summary

In summary, our overall view is that there are a number of concerns in regards to the implementation of this charity. We expect the biggest challenge to be the recruitment of highly qualified and externally credible talent, and closely related to this, the overall limited access to funding sources. Both of these, in turn, will have an impact on this charity's ability to access key pressure points. Furthermore, we would want founders of this charity to be keenly aware of the risks associated with this idea, and set up mechanisms to mitigate these as much as possible. While none of these concerns are an insurmountable barrier by themselves, in conjunction they might reduce the overall odds of success.

## 10 Conclusion

Overall, **we recommend this idea for a new Charity Entrepreneurship charity.**

## Annex: Biosafety and biosecurity

This section compares the scale of biosafety and biosecurity risks in terms of frequency and potential impact.

### Biosafety

**Frequency.** The key biosafety risk is laboratory-acquired infections (LAIs), which are relatively common. The first documented case happened in 1885 ([Petts et al, 2021](#)). Between 1930 and 1978, there were around 4,000 of these incidents which resulted in 168 deaths. In the following 20 years, 1,267 overt infections were revealed, which caused 22 deaths (Fleming,Hunt, 2000).<sup>4</sup> Based on historical incident data, we should expect “a laboratory acquired infection every three to 8.5 years” from influenza and coronaviruses laboratories in the USA, with 0.4% of these infections leading to a global pandemic. (Gryphon Scientific, 2015). [Manheim and Lewis \(2021\)](#) compiled a list of high-risk, human-caused pathogen exposure events from 1975-2016. From this list of 71 cases, 5 were grouped as “intentional” and 65 as “Accidental”.

**Potential impact.** The total potential impact of the biosecurity risk is difficult to predict, and estimates will be heavily dependent on the unresolved question whether COVID was a result of DURC or not. Comparing the data on lab leaks with data on emerging natural pandemics we think that the total potential impact of a lab-leak-caused pandemic is likely in the same ballpark, although perhaps somewhat lower than the risk of natural pandemics, so most causes causing very few deaths but a small chance of an incident leading to 100,000 deaths.

Furthermore, some have pointed out that there may be additional negative consequences of DURC, such as eroding trust in science and research (Gryphon Scientific, 2016), for example reducing the willingness of patients and subjects to participate in medical research. However, the impact of such changes in societal attitudes is much harder to measure and assess accurately.

**Room for improvement.** There is evidence that governments are underinvesting in biosafety preparedness. In the 2019 GHS Report, 66% of investigated countries scored in the bottom tier for indicators related to biosafety (GHS, 2019). Unfortunately, the same is true for biosecurity, which will be covered in the next section.

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<sup>4</sup> It's important to note that these are just the reported cases, and we expect there to be a larger number of undocumented LAIs.

## Biosecurity

**Frequency.** There is a long history of deliberate use of disease in warfare. According to Hittite texts from 1500-1200 BCE, tularemia sufferers were deliberately driven into enemy lands to spread disease ([Wikipedia](#)). [Millett and Snyder-Beattie \(2017\)](#) made expected likelihood estimates of a man-made pandemic, based on historical trends. They extrapolated their data to conclude that there is a 0.016% to 0.8% chance of a man-made pandemic each year (0.8%-33% over 50 years). [Manheim and Lewis \(2021\)](#) compiled a list of high-risk, human-caused pathogen exposure events from 1975-2016. From this list of 71 cases, 5 were grouped as "intentional" and 65 as "Accidental".

**Potential impact.** Biosecurity risks are particularly large in scale, as humans have the ability to engineer pathogens that are worse than naturally occurring ones. Engineered pathogens might exhibit combinations of lethality and transmissibility that surpass the levels that would normally present a natural barrier to a pandemic. Researchers have claimed that anthropogenic risks far outweigh those that come from a natural disease ([Snyder-Beattie et al., 2019](#)). [Millett and Snyder-Beattie \(2017\)](#) flag that estimates of expected deaths from a man-made pandemic vary significantly from 4-80 million (for lab outbreaks of influenza) to 1 billion.

However, such historical analysis neglects the transformative changes that arise from the increased availability of biotechnology. There are a number of non-state actors that could reasonably pose a threat in the future. While the few cults that seek to "destroy the world to save it" ([Lifton, 2007](#)) have been responsible for only a low number of incidents in the past, the increased accessibility of biotechnology might change this. Esvelt ([Esvelt, 2022](#)) notes that non-state actors, like terrorists, might even have a stronger incentive to instrumentalize biotechnology and bioweapons for their nefarious goals than state actors, and given that "[t]he world has never faced non-state actors capable of killing millions" ([Esvelt, 2022](#)), we lack the necessary preparedness.

**Hostile state risk Vs terrorism risk.** The historical analysis suggests that government-sanctioned dangerous research is likely a bigger threat than bioterrorism. Historically, most research into engineering deadly diseases was conducted around times of war and conflict. [Millett and Snyder-Beattie \(2017\)](#) find only evidence of isolated incidents (fatalities of <10) for bioterrorism and biocrimes, but evidence for events and disasters (fatalities between 10 - 100,000) for biological warfare. They predict one bioterrorism incident per year to result in up to tens of deaths for bioterrorism, but a 10% chance of a biological warfare incident per year, with an impact ranging between tens to thousands of fatalities. One conclusion from this is that the scale of this problem is partly dependent on developments around the odds of global-power conflict.

**Room for improvement.** Countries have yet to introduce adequate policies, rules and regulations to address biosecurity risks. In the Global Health Security Report from 2021, “178 countries score below 50 out of 100 points for biosecurity measures” ([Global Health Security Index, 2023](#)).

## Conclusion

Our assessment suggests that incidents arising from biosafety failures (e.g. accidental pathogen releases) are likely to be more common, while instances arising from biosecurity failures (i.e. deliberate pathogen releases), although less likely, have the potential to dwarf the impact of biosafety events by several orders of magnitude.

## Annex: Case Studies

### Bio Case Studies

Looking at previous scenarios in which (allegedly) dangerous research was opposed, slowed down, or stopped entirely, we identified nine relevant case studies with explicit relevance to biotechnology or biological research. The high-level conclusions we drew from these case studies can be found in the [Evidence](#) section above.

### GMOs

The history of banning GMOs starts in Europe, where the BSE disease sparked consumer anxiety about the safety of certain food products. European NGOs like Greenpeace International and Friends of the Earth International then initiated and led widespread mass protests against GMOs.

"The campaigns these organizations have been conducting for almost 2 decades now have been remarkably successful, particularly in blocking the planting of GMO food crops. GMO wheat, GMO rice, GMO potato, and nearly all GMO fruits and vegetables have been blocked from commercial planting, even in the United States. GMO food animals and GMO fish have also been kept entirely off the market." ([Paarlberg, 2014](#))

What's particularly interesting and relevant for potential future charity founders is why many of these products got pulled off the shelf:

"GMO potato was actually grown on 25,000 acres in the United States and widely consumed between 1999–2001, but cultivation was then voluntarily suspended when food service chains told farmers they did not want to be accused by activists of selling GMO French fries." ([Paarlberg, 2014](#)).

It therefore appears as if fear of backlash and public condemnation, as well as the profit motive, were pivotal in driving the success of the anti-GMO campaign. The same seems to apply to Europe, where the movement started: "European supermarket chains then began removing known GM products from their shelves to avoid being targeted by activist demonstrations." ([Paarlberg, 2014](#)) Lawmakers wanted to re-install a sense of security<sup>5</sup> around food products, which paved the way for international legislation, which then spilled over into other countries around the globe. To date, 26 countries have banned GMOs and 64 countries require specific labeling ([World Population Review](#)).

Timeline ([Wikipedia](#)):

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<sup>5</sup> [Bonny \(2003\)](#) attempts to explain where the doubts of Europeans might come from in the first place.

- 1994-2004: EU moratorium on approval of "new foods"
- 2005: Hungary announces a ban on importing and planting of genetically modified maize seeds, which was subsequently authorized by the EU.
- 2009: German Federal Minister Ilse Aigner announces an immediate halt to cultivation and marketing of MON810 maize under the safeguard clause
- 2010: Bulgaria imposes a complete ban on genetically modified crop growing either commercially or for trials.
- 2013: Poland's government places a ban on Monsanto's GM corn, MON 810.
- 2015: Germany, Poland, France, Scotland and several other member states opted out of cultivating GMO crops in their territory

Recently, this trend of increased regulation and public calls for bans has shifted. A Eurobarometer survey has indicated that "level of concern" about genetically engineered food in Europe has decreased significantly, from 69% in 2010 to 27% in 2019. ([ISAAA 2023](#))

### Animal Testing for Cosmetics

The European ban on Animal Testing for the purpose of developing and producing cosmetics has been another field where Europe led the field:

"The first ban came in 2004, which prohibited the testing of finished cosmetic products on animals. Subsequently, the ban on testing ingredients used in cosmetics products for the purpose of proving compliance with Cosmetics Regulation was implemented in 2009. Nevertheless, it was allowed to test on animals substances considered as carcinogenic, mutagenic, or toxic for reproduction until 2013." ([COSLAW](#))

While the US has yet to introduce similar legislation (in spite of actors like the Humane Society still campaigning for it ([Humane Society of the United States](#))), the European Union was able to introduce this ban due to the large base of public support from within the citizenry.

"According to a Eurobarometer survey in 2016, 90% of people in the EU agree that it is important to establish high animal welfare standards that are recognised across the world, while 89% say that the EU should do more to promote greater awareness of the importance of animal welfare internationally." ([European Parliament, 2018](#))

These findings were confirmed recently when an ECI (European Citizen Initiative) reached over 1 million signatures ([Humane Society International, 2022](#)).<sup>6</sup> Problems that the campaigners encountered repeatedly were delays, and the continued existence of loopholes that the manufacturing companies made use of. ([Cater, 2021](#))

In this case, although there were some early companies who deliberately stopped using animals for their tests, consumer demand wasn't enough to stop animal testing—as the US proves. Rather, it was the collective demands for legislation that was then met which brought about the change. However, it's important to note that the repeated delays point to a significant amount of resistance and power of the companies that didn't have proper alternatives.

**Timeline ([European Animal Research Association](#)):**

- 1993: ban on the sale of animal tested cosmetic products (with a 1998 deadline)
- 1997: ban was delayed until 2000 due to a lack of alternative methods
- 2000: ban was delayed until 2002 due to a lack of alternative methods
- 2003: new amendment (including ingredients and the marketing for said products etc.) for a ban with a deadline in 2013
- 2004: ban comes into force
- 2009: ban is implemented (with exceptions for human health issues/toxicity)
- 2013: ban comes into full effect, sales now illegal

## Human Cloning

Human cloning is an interesting case to consider because there is no consensus on its legality. Around 70 countries have made it illegal ([Cohen, 2015](#)), although some allow versions of it (including the European Union). There are no federal laws against it in the US, after the Bush administration failed to pass a law that would've restricted government funding. The fact that some countries do not ban it could partly be explained by a relatively unsuccessful attempt at global governance:

“In 2005, the United Nations adopted its Declaration on Human Cloning to try to deal with the issue. The declaration is ambiguously worded, prohibiting “all forms of human cloning inasmuch as they are incompatible with human dignity and the protection of human life”. It received only ambivalent support from UN member states.” ([Langlois, 2017](#))

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<sup>6</sup> A list of countries with similar legislation can be found [here \(Wikipedia\)](#) to get a better sense of how successful these campaigns were.

At the same time, calls for an international moratorium go back as far as 2001 ([Mayor, 2001](#)). Progress on this issue seems to have mostly been driven by bioethicists within governments and institutions, not so much as a reaction to public outrage or bottom-up campaigns. Other notable opponents of human cloning were religious groups and affiliated political parties. In the UK, change was also called for from within academia. ([Schoon, 1998](#))

### Biological Weapons Convention

Negotiations for the ban on biological weapons were in part a reaction to a historical event - the Vietnam war- which the US became infamous for by using Agent Orange, a chemical herbicide, as a weapon.

Although only entering into force by 1975, it builds on a long history of attempts to regulate biological and chemical warfare; most notably, the Geneva Protocol, although experts are quick to note that the Geneva Protocol was deficient in its scope and ability to bind relevant powers:

“In 1925, the signing of the Geneva Protocol banned the use of both chemical and bacteriological weapons. As a party to the treaty, but with a biological weapons programme already in place, France formally reserved a crucial exception: the right to arm itself for retaliation in kind, that is, to prepare to strike back with germ weapons should it be attacked first. This exception shifted the international norm from a total ban to a “no first use” policy, which later allowed other signatories, notably the UK and the Soviet Union, to justify their offensive programmes in the name of defence. [...] The USA, meanwhile, pursued its own course. With a Senate aggressively lobbied by the Army Chemical Corps and industry, the country failed to ratify the 1925 Geneva Protocol, thus keeping open its chemical options.” ([Guillemin, 2006](#))

Nonetheless, the Geneva Protocol played a key role in shaping and influencing the creation of the BWC. This is one of the central findings of a recent three-year project by researchers at UCL, who investigated the conditions of the BWC coming into existence ([UCL, 2017a](#)). Other results of the Final Report ([UCL, 2017b](#)) include the finding that the consultation of experts with different backgrounds (scientific, legal and diplomatic) was crucial, and that it was important that the BWC started as a British treaty, which was initiated in the United Kingdom to birth a “British success story”, and it was only afterwards that it became a global endeavor. Britain’s main contribution was the separation of chemical and biological weapons: “The UK submitted a working paper, which proposed to separate consideration of biological weapons from chemical weapons and to concentrate first on the former.” ([Guillemin, 2006](#)) This is, to some degree, contradicted by the UCL Research Group’s finding that the BWC benefitted from the fact that chemical and biological weapons were often not considered separately. This helped to garner public support, since chemical weapons like teargas

were more widely known. Researchers also stressed the importance of the civil society:

“Civil society played an important educational and advocacy type role. It pushed for CBW disarmament and engaged the public, drawing on individuals with technical and legal knowledge. Press reporting of CBW issues and disarmament was fairly regular, although not front page news necessarily. Likewise, specialist civil society organisations like the Bernal Peace Library held meetings and some local and regional organisations, like the British Council of Churches, maintained an interest in disarmament.” ([UCL, 2017b](#))

A detailed timeline from the UCL Research Project was also created, which summarizes the events leading up to the BWC ([Balmer et al, 2015](#)).

The Future of Life Institute (and VOX media, by covering the event ([Piper, 2019](#))) has recently brought attention to the role that individuals play in bringing about crucial change that shapes the trajectory of humanity - one of them, the third prizewinner after Arkhipov and Petrov, was Mathew Meselson, an academic. Meselson recalls: “I decided I should go around and talk to people, [...] and convince them that this was a dumb thing to be doing. And also it would be necessary to convince at least part of the public.” He also went on to write to different science writers at American newspapers, went on TV and radio and prepared for debates with proponents of bioweapons. He also managed to convince “thousands of scientists to sign a petition against biological weapons”. ([Piper, 2019](#))

It should be noted that the BWC has repeatedly been criticized for having loopholes ([WARPP 2013](#)) and the fact that no regular checks are taking place ([Samore, 2021](#)).

### Bioterrorism

We’ve found two pieces of evidence in the area of bioterrorism for/against the power of publishers to prevent the proliferation of dangerous research.

One of the most well-known cases was the publishing of a paper on toxins in mill ([Check, 2005](#)), which was published even though the Department of Health and Human Services (DHSS) wrote [a letter](#) asking the journal not to publish it ([Simonson, 2005](#)).

However, there is also evidence for the successful prevention of publishing dangerous research:

“In contrast, the Journal of Infectious Diseases decided in 2014 to redact information on key gene sequences from two manuscripts on the molecular characterization of a novel Clostridium botulinum toxin, following consultation between editors, authors, and

various U.S. government agencies (57, 58), while another journal previously rejected manuscripts on smallpox and anthrax out of security concerns (59)." ([Monrad 2021](#))

### Stem Cell Research

Stem Cell Research was highly politicized with strong religious opposition to it from many Christian groups ([Rosentiel, 2008](#)) (note that Islam does not condemn stem cell research due to its view of the beginning of life ([Office of the Mufti, Islamic Religious Council of Singapore](#))). This explains why one of the most notable attempts to restrict this potentially dangerous form of research came from the US, initiated by then president Bush, who restricted federal funding in 2001.

In spite of what one might think, this was NOT an example of successful funding restrictions: "[I]n 2004 the California state government stepped in to fund stem cell research while this research also continued in other countries." ([Sandbrink et al., 2022](#)) This is an example of leakage in policy interventions, where if the decision not to fund or publish dangerous research is not unanimous/consensual, researchers will simply pivot and find alternative funding sources or publishing channels. However, in the absence of a control group, it is difficult to say whether the federal funding restrictions have at least slowed stem cell research pursuits down. Bush was supported by a number of religious organizations and members of the clergy ([O'Brien, 2009](#)). Bush's successor, Barack Obama, supported stem cell research, and to this date it is not banned. This case might present an example of why issues with a high degree of politicization and polarization have a smaller chance of bringing about lasting social or legislative change.

### Human Testing

Resnik ([Resnik, 2013](#)) reports on "[a]n example of not-so-successful self-regulation" when referring to the case of attempts to regulate and prevent research involving human subjects. In the case of Germany, the horrors of what happened during World War II created the need for legislation, which prompted the drafting of the Nuremberg Code, "the world's first ethical guidelines for research with human subjects" ([Resnik, 2013](#)). However, Resnik notes that this provided an ethical, but not a legal, standard. Over in the United States, it was the Tuskegee syphilis study which served as a starting point for governmental entities to initiate processes of legislation and regulation.

These cases are interesting because they show how slow change can be; but at the same time, it is an issue where significant and lasting progress was eventually made, resulting in the eradication of questionable human testing practices in the 21st century. Though one should be cautious to make inferences based on a single case study, it could be interesting to explore whether there is a relationship between how long it took

to bring about change and how long it then lasted. While Resnik identifies it as an “unsuccessful example of self-regulation”, the recent interest in human challenge trials and the willingness of people to participate in these experiments might point to the importance of informed consent, which, once it can be established with a reasonable degree of certainty, functions as a “permit-giver” to human testing. This case also confirms Egeland’s hypothesis ([Egeland, 2022](#)) that some type of condemnation and stigmatization is needed- which in the case of human testing, was provided by the experiments during Nazi Germany (and war times in general). There was a concrete historical precedent, rather than vague and uncertain fears about potential future mishaps. With the Tuskegee experiments, we have an analogous incident in the United States.

### Moratorium on Gain-of-Function Research

The US moratorium on Gain-of-Function research is one of the more well known cases of restrictions on potentially dangerous research.

In 2011, researchers Fouchier and Kawaoka submitted two papers to Nature and Science, respectively, which contained information about the potential alteration of avian influenza viruses, which had implications for human transmissibility. The journals then asked for a review by the National Science Advisory Board for Biosecurity (NSABB).<sup>7</sup> A 60-day voluntary moratorium on animal gain of function-research was introduced by researchers themselves, although the papers went on to be published. The voluntary moratorium was extended to a year. In 2013, this moratorium was lifted when DURC policies were put forth. ([Shinomiya et al., 2022](#))

One year later, in 2014, “the Obama administration imposed a moratorium on new federal funding for research that could make influenza, MERS, or SARS viruses more virulent or transmissible, while a review took place.”([Eban, 2022](#)) However, in hindsight, this moratorium was deficient in that it provided a variety of loopholes that could be exploited.

The moratorium was lifted in 2017 and followed by the HHS P3CO Framework ([US Department of Health and Human Services, 2021](#)), which relies on a safety review by

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<sup>7</sup> This close cooperation between publishers and federal authorities has not always been the norm, as Resnik (Resnik, 2013) describes: “The US Department of Health and Human Services (DHHS) asked the editors of the Proceedings of the National Academy of Sciences (PNAS) not to publish the paper on contaminating the US milk supply, also mentioned earlier. The editors of PNAS met with DHHS representatives prior to publication to discuss the benefits and risks of public dissemination of the findings. The Department of Homeland Security (DHS) asked the NSABB to review the paper on reconstructing the 1918 pandemic influenza virus prior to publication in Science. Although the NSABB voted unanimously in favor of publication, the editor of Science publicly stated he would have ignored the NSABB’s recommendations if had been against publication.”

the agency that is funding the research. More recently, the Covid pandemic and its uncertain origins have re-ignited the debates around gain-of-function research.

### Recombinant DNA (Asilomar)

The case of recombinant DNA has been held up as a prime example of self-regulation emerging from the academic community itself:

“One of the best examples of successful self-regulation would be the management of the risks related to recombinant DNA. In the early 1970s, scientists began to conduct experiments involving the transfer of DNA to micro-organisms. The public became gravely concerned about the threat of ‘superbugs’ escaping from the laboratory and causing a modern plague.” ([Resnik, 2013](#))

However, it wasn't just the public that was concerned- scientists and researchers were the driving force behind introducing rules and regulations for recombinant DNA research. At the Asilomar conference of 1975, they discussed the risks and issued recommendations in regards to biosafety procedures, as well as calling for a voluntary moratorium on particularly risky experiments. Only a year later, the first set of official guidelines were published. ([Resnik, 2013](#)). Notably, these guidelines technically only applied to NIH-funded research, but have “spilled over” into the work of other researchers as a result of them becoming a common standard. To this day, the safety standards around recombinant DNA remain high and well-respected.

### Non-Bio Case Studies

Although less directly relevant to biological DURC we also looked at three other examples of attempts to ban activities that we felt we could learn from:

#### Fracking

Opposition to fracking took on different forms in different countries. In the UK, it originated as a largely grassroots movement which organized protests and civil unrest ([Wikipedia](#)), a few examples of which can be found at [Woolley \(2019\)](#). However, it is very difficult to say which of these actions, if any, have resulted in legislative action.

In the US, the movement against fracking was kickstarted by a documentary, which initiated the formation of a protest movement and community organizing. Communities petitioned against fracking, which was successful in many communities and in the state of New York. Some of these successes have been accelerated by the public support of celebrities.

[Mazur \(2018\)](#) argues that the movement depends heavily on media coverage and the “hotness” of the issue, and that it might eventually die out if this wanes. These concerns are somewhat corroborated by the UK's recent decision ([Sandle et al., 2022](#))

to re-consider fracking in the face of an energy crisis, sparked by the Ukraine-Russia conflict. This would suggest that a sudden change in economic priorities outweighs the concerns of the citizenry, making their protest and involvement less effective.

### Ozone Depletion

The Montreal protocol is widely seen as one of the paragons of environmental protection, since it successfully and effectively banned ozone-depleting substances. Remarkable is the speed at which this took place: From the confirmation of the ozone depletion theory, which resulted from the discovery of a hole in the ozone layer over Antarctica in 1985, it took only two years to pass the Montreal Protocol, which banned ozone-depleting substances. It also “removed the incentive to continue developing technologies reliant upon ozone-depleting substances and produced a new incentive to develop substitute technologies”, thereby reducing the global consumption of these substances by 98.5% between 1986 and 2018. ([Sandbrink et al., 2022](#)) “Today, the use of CFCs is outlawed by 197 countries around the world and scientists concur that the ozone layer is slowly recovering as a result. [...] It is the only global treaty to achieve universal ratification of 197 countries, and has achieved a compliance rate of 98%.” ([Rapid Transition Alliance, 2019](#))

### How was this achieved?

A couple of critical elements contributed to the outstanding effectiveness the campaign against against ozone-depleting substances ([Rapid Transition Alliance, 2019](#)):

- The Montreal Protocol managed to bind not just signing parties, but introduced incentives to sign up by banning the trade of certain substances with non-signatories.
- The issue was publicized and politicized by campaigns<sup>8</sup> originating from civil society, including consumer boycotts which radically changed markets and thereby reduced incentives for companies to maintain the ongoing use of ozone-depleting substances.
- Instead of simply lobbying against something, Greenpeace actually developed a prototype for a fridge that worked without the harmful substances they advocated against, showing to the industry and the public what was possible.

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<sup>8</sup> It has been reported that McDonalds removed these substances from its packaging as a reaction to “a flood of letters from school children” ([Rapid Transition Alliance, 2019](#)).

## Nuclear Weapons research

The nonproliferation agreements of the 20th and 21st century indicate that nuclear disarmament presents a role model case for international cooperation on limiting the use and exploration of dangerous technology. From forming a commission as a first attempt of institutionalization in 1946 by the UN, nuclear disarmament has accelerated rapidly in the years that followed; birthing, amongst other agreements, the following multilateral treaties:

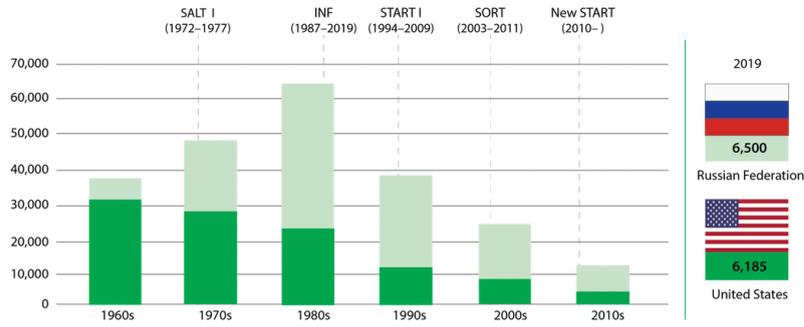
“[T]he Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the Treaty Banning Nuclear Weapon Tests In The Atmosphere, In Outer Space And Under Water, also known as the Partial Test Ban Treaty (PTBT), the Comprehensive Nuclear-Test-Ban Treaty (CTBT), which was signed in 1996 but has yet to enter into force, and the Treaty on the Prohibition of Nuclear Weapons (TPNW), which will enter into force on 22 January 2021.” ([Office for Disarmament Affairs](#))

Aside from the UN, the IAEA has been an important actor in bringing about this change.

The incentives for countries to sign on to these treaties seems pretty straightforward, since their interest in survival and flourishing of their own population is dependent on physical security and can be jeopardized- even by conflicts that do not immediately concern them. Other authors ([Egeland 2022](#)) have argued that the willingness of different countries and their political parties is insufficient for change, and that historical analogies suggest that stigmatization and contestation of the practice is an additional and necessary requirement for change to happen, and that “periods of wider political upheaval can offer windows of opportunity to overturn the nuclear status quo.” It is notable, for instance, that both the US and the Soviet Union were interested in brokering a deal, in spite of vast disagreements on almost any other political and economical issue. This further indicates that the primary driver is self-interest. It’s also an example of global powers leading the way, with smaller states signing onto it afterwards.

Non-governmental actors and an active civic society can work as supporters and accelerators, but appear to be less influential and relevant in actually affecting change, although one organization, the “International Campaign to Abolish Nuclear Weapons” ([ICAN](#)) has been awarded the Nobel Peace Prize in 2017 for their nuclear disarmament efforts.

## Nuclear Weapons



(Office for Disarmament Affairs)

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