## DA – Bioterror

#### Terrorism is gradually rising; Large terrorists groups are taking control worldwide.

Portfield 20 Carlie Portfield, 25 November 2020, <https://www.forbes.com/sites/carlieporterfield/2020/11/25/terrorism-deaths-decline-worldwide-but-far-right-attacks-are-on-the-rise/?sh=65556e673687>

While terrorism-related deaths have fallen for a fifth straight year, researchers at the Institute of Economics and Peace warn that far-right attacks are on the rise in many countries, up 250% over the past five years in North America, western Europe and Oceania.

According to the latest [Global Terrorism Index](https://www.visionofhumanity.org/wp-content/uploads/2020/11/GTI-2020-web-1.pdf), deaths from terrorism fell 59%, to 13,826 deaths in 2019, compared to five years before—however, it still remains a problem across the world, with 63 countries in 2019 recording at least one death from a terrorist attack, according to the report.

Some 96% of deaths occurred in countries with active conflicts, with Afghanistan, Iraq, Nigeria, Syria and Somalia being the hardest-hit nations.

However, the researchers noted far-right attacks are increasing in the West, where the number of such incidents hit 49 in 2019, compared to just one in 2010.

The study called the rise in terrorist attacks committed in the name of far-right politics “one of the [more worrying trends](https://www.visionofhumanity.org/wp-content/uploads/2020/11/GTI-2020-web-1.pdf) in the last five years,” though the number of incidents still remains lower than other types of terrorism.

#### Terrorist Groups are expressing interest in CRISPR technology; the AFF reducing patents would allow for more accessibility for the CRISPR weapons.

Acharya 17 Amrit P. Acharya, Arabinda Acharya, 1 June 2017, https://www.foreignaffairs.com/articles/world/2017-06-01/cyberterrorism-and-biotechnology

For years, the international community has grappled with the threat of chemical, biological, radiological, and nuclear terrorism. And although al Qaeda and [the Islamic State (ISIS)](https://www.foreignaffairs.com/tags/isis) have demonstrated interest in and some capability to develop and use such weapons, there have been no successful mass casualty terrorist attacks involving them. Attempted attacks involving radiological dispersal devices or chemical and biological means have either failed or had a very limited impact. Experts such as [John Parachini](http://www.tandfonline.com/doi/abs/10.1162/016366003322387091), [Jeffrey Bale and Gary Ackerman](https://www.amazon.com/WMD-Terrorism-Science-Policy-Choices/dp/B008SMIO5A/ref=sr_1_2?s=books&ie=UTF8&qid=1496247705&sr=1-2&keywords=WMD+Terrorism%3A+Science+and+Policy+Choices), [Adam Dolnik](https://www.amazon.com/Understanding-Terrorist-Innovation-Technology-Tactics/dp/0415545161), and [Rajesh Basrur and Mallika Joseph](http://www.centrovolta.it/landau/content/binary/Basrur-Mallika%20S.A.%20case%20study%202007%20revised.pdf) argue that the reason is terrorists’ inability to weaponize chemical, biological, radiological, or nuclear material. Others, including Brian Michael Jenkins, believe that the [lack of mass causality attacks](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjCm7_oxJrUAhXrxYMKHWrvDlEQFggoMAA&url=http%3A%2F%2Fwww.rand.org%2Fcontent%2Fdam%2Frand%2Fpubs%2Fmonographs%2F2006%2FRAND_MG454.pdf&usg=AFQjCNEmUWLBJzpz5G1ieoUMLghqTp) also has to do with self-restraint: perpetrators might not be able to control the consequences of such an attack. It could end up harming the members of the communities that the terrorists are purportedly fighting for [and could therefore be counterproductive](https://www.amazon.com/Ten-Years-After-Rethinking-Routledge/dp/0415625874).

#### CRISPR can be used for bioterror weapons. This cannot happen in the SQuo right now, but the passage of the Aff can allow for this.

Revill 17 James Revill, 31 August 2017, <https://phys.org/news/2017-08-crispr-biological-weapon.html>,

Concerns are also mounting that gene editing could be used in the development of biological weapons. In 2016, [Bill Gates remarked](https://www.theguardian.com/technology/2017/feb/18/bill-gates-warns-tens-of-millions-could-be-killed-by-bio-terrorism) that "the next epidemic could originate on the computer screen of a terrorist intent on using genetic engineering to create a synthetic version of the smallpox virus". More recently, in July 2017, John Sotos, of Intel Health & Life Sciences, stated that [gene editing](https://phys.org/tags/gene+editing/) research could "[open up the potential for bioweapons of unimaginable destructive potential](https://www.theguardian.com/science/2017/jul/31/bioweapons-cancer-moonshot-gene-editing)".

An annual [worldwide threat assessment report](https://www.technologyreview.com/s/600774/top-us-intelligence-official-calls-gene-editing-a-wmd-threat/) of the US intelligence community in February 2016 argued that the broad availability and low cost of the basic ingredients of technologies like CRISPR makes it particularly concerning.

However, one has to be careful with the hype surrounding new technologies and, at present, the security implications of CRISPR are [probably modest](https://www.labor-spiez.ch/pdf/en/Report_on_the_second_workshop-5-9_September_2016.pdf). There are easier, cruder methods of creating terror. CRISPR would only get aspiring biological terrorists so far. Other steps, such as growing and disseminating biological weapons agents, would typically be required for it to become an effective [weapon](https://phys.org/tags/weapon/). This would require additional skills and places CRISPR-based biological weapons beyond the reach of most terrorist groups. At least for the time being

This does not mean that the hostile exploitation of CRISPR by non-state actors can be ignored. Nor can one [can] ignore the [likely role](https://www.labor-spiez.ch/pdf/en/Report_on_the_second_workshop-5-9_September_2016.pdf) of CRISPR in any future state biological weapons programme.

#### Bioterror leads to extinction

Walsh 20--Bryan Walsh, Bryan Walsh is the Future Correspondent for Axios. He coverse merging technology and the trends shaping geopolitics, work, warfare and more. "The coronavirus pandemic reawakens bioweapon fears," Axios, 5-14-2020,[https://www.axios.com/coronavirus](https://www.dropbox.com/referrer_cleansing_redirect?hmac=KwT0YysdBXmZwDniIilUboNpJFpFTUZ3ONTrejPg5rs%3D&url=https%3A%2F%2Fwww.axios.com%2Fcoronavirus)-pandemic-pathogen-bioweapon-45417c86-52aa-41b1-8a99-44a6e597d3a8.html, accessed 9-7-2020]

The coronavirus pandemic reawakens bioweapon fears The immense human and economic toll of the COVID-19 pandemic only underscores the threat posed by pathogens that could be deliberately engineered and released. Why it matters: New technology like gene editing and DNA synthesis has made the creation of more virulent pathogens easier. Yet security and regulation efforts haven't kept pace with the science. What's happening: Despite some claims by the White House, overwhelming scientific evidence indicates that the novel coronavirus was not accidentally released from a lab or deliberately engineered, but naturally spilled over from an animal source. That doesn't mean the threat from bioweapons isn't dire. Along with AI, engineered pandemics are widely considered the biggest existential risk facing humanity. That's in part because a pathogen could be engineered in a lab for maximum contagiousness and virulence, well beyond what would arise through natural selection. Case in point: a 2018 pandemics emulation put on by the Johns Hopkins Center for Health Security featured a fictional engineered virus called Clade X that combined the contagiousness of the common cold with the virulence of the real-life Nipah virus, which has a mortality rate of 40-75%. The resulting simulated global outbreak killed 150 million people. COVID-19 isn't anywhere near that fatal, but the pandemic has shown the vulnerability of the U.S. and the world to biological threats both natural and manmade. "Potential adversaries are of course seeing the same things we’re seeing," says Richard Pilch of the Middlebury Institute of International Studies. "Anyone looking for a radical leveling approach—whether a state actor like North Korea or a motivated terrorist organization—may be influenced by COVID-19toconsiderpursuing a biological weapons capability. "Background: Bioweapons were officially banned by the Biological Weapons Convention in 1975, though North Korea is suspected of maintaining an offensive bioweapons program. A particular concern about biowarfare and bioterror, though, is that many of the tools and methods that could be used to create a weaponized virus are largely indistinguishable from those used in the course of legitimate scientific research. This makes biotechnology "dual-use"—and that much more difficult to safely regulate without cutting off research that could be vitally important. While earlier bioweapons fears focused on the possibility that a state or terror group could try to weaponize a known dangerous agent like smallpox—which would require somehow obtaining restricted pathogens—new technology means that someone could obtain the genetic sequence of a germ online and synthesize it in the lab. "If you've been trained in a relevant technical discipline, that means you can make almost any potentially harmful agent that you're aware of," says Kevin Esvelt, a biologist at the MIT Media Lab and a member of the CDC's Biological Agent Containment Working Group. That would include the novel coronavirus that causes COVID-19, which was recently synthesized from its genetic sequence in a study published in Nature. How it works: Currently, synthetic DNA is ordered through commercial suppliers. But while most suppliers screen DNA orders for the sequences of dangerous pathogens, they're not required to—and not all do, which means safety efforts are "incomplete ,inaccurate, and insecure," says Esvelt. Screening efforts that look for the genetic sequences of known pathogens also wouldn't necessarily be able to detect when synthetic DNA was being used to make something entirely novel and dangerous. In the near future, desktop DNA synthesizers maybe able to generate synthetic DNA in the lab, cutting out the need for commercial suppliers—and potential security screenings.The democratization of biotechnology could unleash a wave of creativity and innovation, just as the democratization of personal computing did. But it also increases the number of people who could potentially make a dangerous engineered virus, whether deliberately.

## CP – WHO

#### Counterplan Text: The member nations of the World Trade Organization should enter a state of consultation with the World Health Organization, then go from there as to the reduction of intellectual property protections.

#### WHO pushes the idea – it supports striving for more affordable medicine and limiting TRIPS.

WHO 05 -- WHO Drug Information Vol 19, No. 3, 2005, https://www.who.int/medicines/areas/policy/AccesstoMedicinesIPP.pdf

Public health principles, in the context of access to medicines, are supported by a range of national and international legal and policy instruments, including the Constitution of the World Health Organization (WHO). From a human rights perspective, implementation of intellectual property rules should be governed by those principles which support public health goals and access to medicines, thus ensuring:

• a rapid and effective response to public health needs and crises;

• supply of quality medicines at affordable prices;

• effective competition through a multiplicity of potential suppliers;

• the provision for a wide range of pharmaceuticals to meet the basic health needs of the population; and

• equality of opportunities for countries in need, irrespective of their membership in the WTO, level of technological capacity, or lack of manufacturing capacity.

In 2001, World Trade Organization (WTO) members drew up the Doha Declaration to clarify ambiguities between the need for governments to apply the principles of public health and the terms of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). In particular, concerns had been growing that patent rules[TRIPS] might restrict access to affordable medicines for populations in developing countries in their efforts to control diseases of public health importance, such as HIV, tuberculosis and malaria. Although the impact of intellectual property on access to affordable medicines predated the TRIPS Agreement, the impending expiry of deadlines for implementing the TRIPS Agreement by developing countries has added impetus to the debate.

#### Consultation displays strong leadership among member states which are key to increasing WHO legitimacy

Gostin et al 15 [(Lawrence O., Linda D. & Timothy J. O’Neill Professor of Global Health Law at Georgetown University, Faculty Director of the O’Neill Institute for National & Global Health Law, Director of the World Health Organization Collaborating Center on Public Health Law & Human Rights, JD from Duke University) “The Normative Authority of the World Health Organization,” Georgetown University Law Center, 5/2/2015]

Members want the WHO to exert leadership, harmonize disparate activities, and set priorities. Yet they resist intrusions into their sovereignty, and want to exert control. In other words, ‘everyone desires coordination, but no one wants to be coordinated.’ States often ardently defend their geostrategic interests. As the Indonesian virus-sharing episode illustrates, the WHO is pulled between power blocs, with North America and Europe (the primary funders) on one side and emerging economies such as Brazil, China, and India on the other. An inherent tension exists between richer ‘net contributor’ states and poorer ‘net recipient’ states, with the former seeking smaller WHO budgets and the latter larger budgets.

Overall, national politics drive self-interest, with states resisting externally imposed obligations for funding and action. Some political leaders express antipathy to, even distrust of, UN institutions, viewing them as bureaucratic and inefficient. In this political environment, it is unsurprising that members fail to act as shareholders. Ebola placed into stark relief the failure of the international community to increase capacities as required by the IHR. Guinea, Liberia and Sierra Leone had some of the world's weakest health systems, with little capacity to either monitor or respond to the Ebola epidemic.20 This caused enormous suffering in West Africa and placed countries throughout the region e and the world e at risk. Member states should recognize that the health of their citizens depends on strengthening others' capacity. The WHO has a central role in creating systems to facilitate and encourage such cooperation.

The WHO cannot succeed unless members act as shareholders, foregoing a measure of sovereignty for the global common good. It is in all states' interests to have a strong global health leader, safeguarding health security, building health systems, and reducing health inequalities. But that will not happen unless members fund the Organization generously, grant it authority and flexibility, and hold it accountable.

#### WHO diplomacy is critical to solve disease prevention –only international organization that can spread information, refine global public health, and facilitate public-private sector cooperation.

Murtugudde 20 [(Raghu, professor of atmospheric and oceanic science at the University of Maryland, PhD in mechanical engineering from Columbia University) “Why We Need the World Health Organization Now More Than Ever,” Science, 4/19/2020]

WHO continues to play an indispensable role during the current COVID-19 outbreak itself. In November 2018, the US National Academies of Sciences, Engineering and Medicine organised a workshop to explore lessons from past influenza outbreaks and so develop recommendations for pandemic preparedness for 2030. The salient findings serve well to underscore the critical role of WHO for humankind.

The world’s influenza burden has only increased in the last two decades, a period in which there have also been 30 new zoonotic diseases. A warming world with increasing humidity, lost habitats and industrial livestock/poultry farming has many opportunities for pathogens to move from animals and birds to humans. Increasing global connectivity simply catalyses this process, as much as it catalyses economic growth.

WHO coordinates health research, clinical trials, drug safety, vaccine development, surveillance, virus sharing, etc. The importance of WHO’s work on immunisation across the globe, especially with HIV, can hardly be overstated. It has a rich track record of collaborating with private-sector organisations to advance [R+D] research and development of health solutions and improving their access in the global south.

It discharges its duties while maintaining a dynamic equilibrium between such diverse and powerful forces as national securities, economic interests, human rights and ethics. COVID-19 has highlighted how political calculations can hamper data-sharing and mitigation efforts within and across national borders, and WHO often simply becomes a convenient political scapegoat in such situations.

[IHR] International Health Regulations, a 2005 agreement between 196 countries to work together for global health security, focuses on detection, assessment and reporting of public health events, and also includes non-pharmaceutical interventions such as travel and trade restrictions. WHO coordinates and helps build capacity to implement IHR.

#### WHO diplomacy solves for any disease impacts or any great power conflict.

Murphy 20 [(Chris, U.S. senator from Connecticut serving on the U.S. Senate Foreign Relations Committee) “The Answer is to Empower, Not Attack, the World Health Organization,” War on the Rocks, 4/21/2020]

The World Health Organization is critical to stopping disease outbreaks and strengthening public health systems in developing countries, where COVID-19 is starting to appear. Yemen announced its first infection earlier this month, and other countries in Africa, Asia and the Middle East are at severe risk. Millions of refugees rely on the World Health Organization for their health care, and millions of children rely on the WHO and UNICEF to access vaccines.

The World Health Organization is not perfect, but its team of doctors and public health experts have had major successes. Their most impressive claim to fame is the eradication of smallpox – no small feat. More recently, the World Health Organization has led an effort to rid the world of two of the three strains of polio, and they are close to completing the trifecta.

These investments are not just the right thing to do; they benefit the United States. Improving health outcomes abroad provides greater political and economic stability, increasing demand for U.S. exports. And, as we are all learning now, it is in America’s national security interest for countries to effectively detect and respond to potential pandemics before they reach our shores.

As the United States looks to develop a new global system of pandemic prevention, there is absolutely no way to do that job without the World Health Organization. Uniquely, it puts traditional adversaries – like Russia and the United States, India and Pakistan, or Iran and Saudi Arabia – all around the same big table to take on global health challenges. It has relationships with the public health leaders of every nation, decades of experience in tackling viruses and diseases, and the ability to bring countries together to tackle big projects. This ability to bridge divides and work across borders cannot be torn down and recreated – not in today’s environment of major power competition – and so there is simply no way to build an effective international anti-pandemic infrastructure without the World Health Organization at the center.

## CP – Med Prof

**Counterplan Text; Developing Countries of the WTO ought to increase trained medical professionals in their countries, and increase medicinal educational facilities**.

#### The real problem in developing countries allowing for disease to spread is the lack of trained medical professionals.

Ezell and Cory 19 Stephen Ezell (vice president of global innovation policy at the Information Technology and Innovation Foundation; founder of Peer Insight, an innovation research and consulting firm) and Nigel Cory (associate director covering trade policy at the Information Technology and Innovation Foundation; formerly a researcher in the South‑ east Asia Program at the Center for Strategic and International Studies and worked for eight years in Australia’s Department of Foreign Affairs and Trade). “The Way For‑ ward for Intellectual Property Internationally.” Information Technology & Innovation Foundation. 25 April 2019.

https://itif.org/publications/2019/04/25/way‑forward‑ intellectual‑property‑internationally

Many opponents of robust IPR rights view them as antithetical to the interests of developing countries in terms of access to medicines or the provision of national health care services. Yet the reality is that stronger IPR rights in developing nations actually unleash the power of developing‑country innovators to contribute to solving health challenges both in their own nations and across the global economy. First, opponents of IP fail to recognize that intellectual property rights matter for health care innovation in emerging economies. An Information Technology and Innovation Foundation (ITIF) and George Mason University Center for Intellectual Property Protection report, “How Innovators Are Solving Global Health Challenges,” provides 25 case studies that show innovators in developing countries relying on IP to invent and bring solutions to market.57 The 25 case studies revealed a number of key themes, including that there is opportunity in adapting health care interventions for developing‑country environments where resources and infrastructure are scarce, and that local innovation and IP can contribute substantially toward providing both affordable and robust tests for diagnosing diseases and affordable interventions to meet basic needs in challenging environments. Second, opponents of IP tend to ignore broader systemic issues that contribute to poor health care outcomes in developing countries. While cost is a central factor for poli‑ cymakers in all countries, given resource scarcity, these trade‑offs are not unique to health. The greater the resource scarcity, the greater the need for innovation. One of the biggest challenges policymakers and innovators in developing countries confront again and again is scarcity—in access to trained professionals, in transportation, and in other infrastructure. For example, reports estimate that as many as 1 billion people lack access to essential health care because of a shortage of trained health professionals.58 A 2014 World Health Organization study estimated a shortage of 7 million public health care workers, with that number expected to rise to 13 million by 2035.59 More than 80 countries currently fail to meet the basic threshold of 23 skilled health professionals per 10,000 citizens. The challenge is even more daunting when it comes to specialists. For instance, Cameroon has fewer than 50 cardiologists supporting a population of over 23 million citizens.61 And Ethiopia, a country of some 90 million residents, is served by a single radiation‑treatment center located in the capital of Addis Ababa.62 In other instances, individuals lack access to essential medicines, with cost being a relatively small part of the problem. For instance, in 2014, researchers at the University of Utrecht in the Netherlands found that, on average, essential medicines are available in public‑sector facilities in developing countries only 40 percent of the time.63 Again, the cost of medicines is far from the most serious problem in the provision of health care services in developing nations. Indeed, the vast majority of drugs—at least 95 percent—on the World Health Organization’s Essential Medicines list are off‑patent, and thus potentially available in generic versions.64 The problem, in much larger part, stems from countries’ underdeveloped health systems and the fact that many people live in rural areas far from care. Stronger IP rights create an environment wherein entrepreneurs can innovate to meet health challenges in their own nations, the benefits thereof spilling over to benefit the entire international community.

#### Improving medicinal education and increasing doctors goes to improve underdeveloped health systems.

Quartz 15, Published October 15, 2015Last updated on October 22, 2015, <https://qz.com/520230/africa-has-about-one-doctor-for-every-5000-people/>

**In 2013, sub-Saharan Africa had a** deficit of an estimated 1.8 million health workers**, according to a**[**WHO report**](http://bit.ly/1GeIGPX)**—this deficit is projected to rise to 4.3 million by 2035. There are a**[**number of reasons**](http://bit.ly/1LmfPGh)**for the shortfall, including a lack of funding for education and training, international migration and career changes among health workers, illness, premature retirement, and even premature deaths.**

**But** one reason is particularly glaring: The inadequacy of the region’s current healthcare education system**. Currently, there are only 170 medical schools serving the 47 countries of sub-Saharan Africa. Of those countries,**[**6 have no medical schools, and 20 have only one medical school**](http://bit.ly/1GeIMXU)**.**

**Beyond the shortage of available health workers there is also a problem of** access**, with significant**[**disparities between urban and rural areas**](http://bit.ly/1LmfV0C)**. At the top, a small**[**minority receives care**](http://bit.ly/1QwF5x9)**that rivals that of higher income countries, and a somewhat larger minority of urban dwellers enjoys access to hospital care. But because the majority of rural communities lack both health workers and infrastructure, many patients bypass essential primary or preventative care. If they’re able to pay for it, rural residents may attempt access care at hospitals. But without a comprehensive primary care infrastructure, many must rely on local chemists or traditional healers.**

Even where health workers are available, facilities can be short-staffed, with poor continuing-education training **and few opportunities for professional development. “The workload is too much. We have many patients and staff is not enough. The equipment is not adequate. There are no materials to work with,” says one midwife in a functional primary care facility in Nigeria. She went on “These make us want to transfer to a hospital where they have more staff.”**

But the same problems affect hospitals in urban areas. According to Dr. Remi Oyedeji, a specialist working in a Nigerian hospital: “The poor state of the primary care centers puts a heavy burden on the specialist facilities.” He added, “The bulk of patients are seen at specialist hospitals, which leaves patients who really need specialist attention without the timely care they need.”

**Clearly, revamping these systems so they might sufficiently cover the growing demands of universal primary care, a**[**goal of many countries**](http://bit.ly/1Lmg04z)**in the region, is a tall order.** Improving the quality of health care will not only require efforts to improve the overall number of health workers, but also **strategic action dedicated to improving distribution channels, infrastructure, and** bolstering continuing-education**.**

**These challenges are now receiving more attention, with**[**plans to improve**](http://bit.ly/1Lc2xys)**the governance and education of human resources for health organizations at national and sub-regional levels. As part of that effort, in February 2015 General Electric was selected by the Kenyan government to serve as a key technology partner in the massive healthcare transformation for Kenya and East Africa. GE plans to launch the new Kenyan GE Healthcare Skills and Training Institute, which will offer biomedical and clinical applications training courses and, at a later date, leadership, technical and clinical education courses. It expects to train over 1,000 healthcare professionals over the next 3 years.**

#### **Counterplan solves; more preventative doctors in the workforce saves many lives**.

Bloor et all 06 [Karen Bloor](https://www.ncbi.nlm.nih.gov/pubmed/?term=Bloor%20K%5BAuthor%5D&cauthor=true&cauthor_uid=16738369), [Vivien Hendry](https://www.ncbi.nlm.nih.gov/pubmed/?term=Hendry%20V%5BAuthor%5D&cauthor=true&cauthor_uid=16738369), and [Alan Maynard](https://www.ncbi.nlm.nih.gov/pubmed/?term=Maynard%20A%5BAuthor%5D&cauthor=true&cauthor_uid=16738369), [J R Soc Med.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1472715/) 2006 Jun; 99(6): 281–287.

doi: [10.1258/jrsm.99.6.281](https://dx.doi.org/10.1258%2Fjrsm.99.6.281)

Cross-national data has also explored this issue. One study[19](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1472715/#ref19) explored mortality rates across 21 OECD countries from 1970-1995, considering health status as explained by medical care inputs, medical care institutions, public health interventions and background variables. The number of doctors per 1000 population was used as a proxy for medical care inputs, and found to be strongly and significantly associated with premature mortality. When holding other factors constant, a 10% increase in doctors could result in a 4% reduction in premature mortality in women and 3% in men. Another international study[20](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1472715/#ref20) found that doctors, nurses and midwives together significantly lower maternal, infant and under-5 mortality after controlling for other variables. Disaggregated analysis found doctors were still significant, although nurses and midwives were not. These analyses must however be interpreted cautiously. Large-scale cross-country population studies may oversimplify complex variations, and are only as good as the data on which they rest.

In summary, evidence suggests that improvements in patient outcomes may be made through increasing the supply of doctors and other staff, but the optimal doctor:population ratio is still unclear. Without this information, it is difficult to determine the appropriate medical school intake. Research demonstrating associations between nurse staffing and mortality[21](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1472715/#ref21) has led in California to a state-wide nurse-bed ratio since January 2005. This strong policy effect, vigorously advocated by researchers, should be supplemented with time series evidence on whether returns to investment in higher staffing ratios are increasing, constant or decreasing.[22](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1472715/#ref22) In some poorly staffed hospitals, investment in both doctors and nurses could potentially improve patient outcomes. However, where do diminishing returns set in, and what are the substitution possibilities between nurses and doctors.