NO PLACE TO HIDE: NUCLEAR WEAPONS AND THE COLLAPSE OF HEALTH CARE SYSTEMS

ICAN

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REPORT

International Campaign
to Abolish Nuclear Weapons

icanw.org

ABOUT ICAN AND THE AUTHORS

The International Campaign to Abolish Nuclear Weapons (ICAN) is a global campaign working to mobilize people in all countries to inspire, persuade and pressure their governments to sign and ratify the Treaty on the Prohibition of Nuclear Weapons (TPNW). ICAN is comprised of more than 500 partner organisations in over 100 countries. More information about ICAN can be found at www. icanw.org.

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ABOUT THE UN TREATY ON THE PROHIBITION OF NUCLEAR WEAPONS

On 7 July 2017 – following a decade of advocacy by ICAN and its partners – an overwhelming majority of the world's nations adopted a landmark global agreement to ban nuclear weapons, known officially as the Treaty on the Prohibition of Nuclear Weapons (TPNW). The TPNW prohibits nations from developing, testing, producing, manufacturing, transferring, possessing, stockpiling, using or threatening to use nuclear weapons, or allowing nuclear weapons to be stationed on their territory. It also prohibits them from assisting, encouraging or inducing anyone to engage in any of these activities. A nation that possesses nuclear weapons may join the treaty, so long as it agrees to destroy them in accordance with a legally binding, time-bound plan. Similarly, a nation that hosts another nation's nuclear weapons on its territory may join, so long as it agrees to remove them by a specified deadline. Nations are obliged to provide assistance to all victims of the use and testing of nuclear weapons and to take measures for the remediation of contaminated environments. The preamble acknowledges the harm suffered as a result of nuclear weapons, including the disproportionate impact on women and girls, and on indigenous peoples around the world. The TPNW entered into force on 22 January 2021.

ACKNOWLEDGEMENTS

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ICAN Campaigners, including medical professionals call on their government to join the TPNW
Photo: ICAN | Jessie Boylan, 2021

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Executive Summary

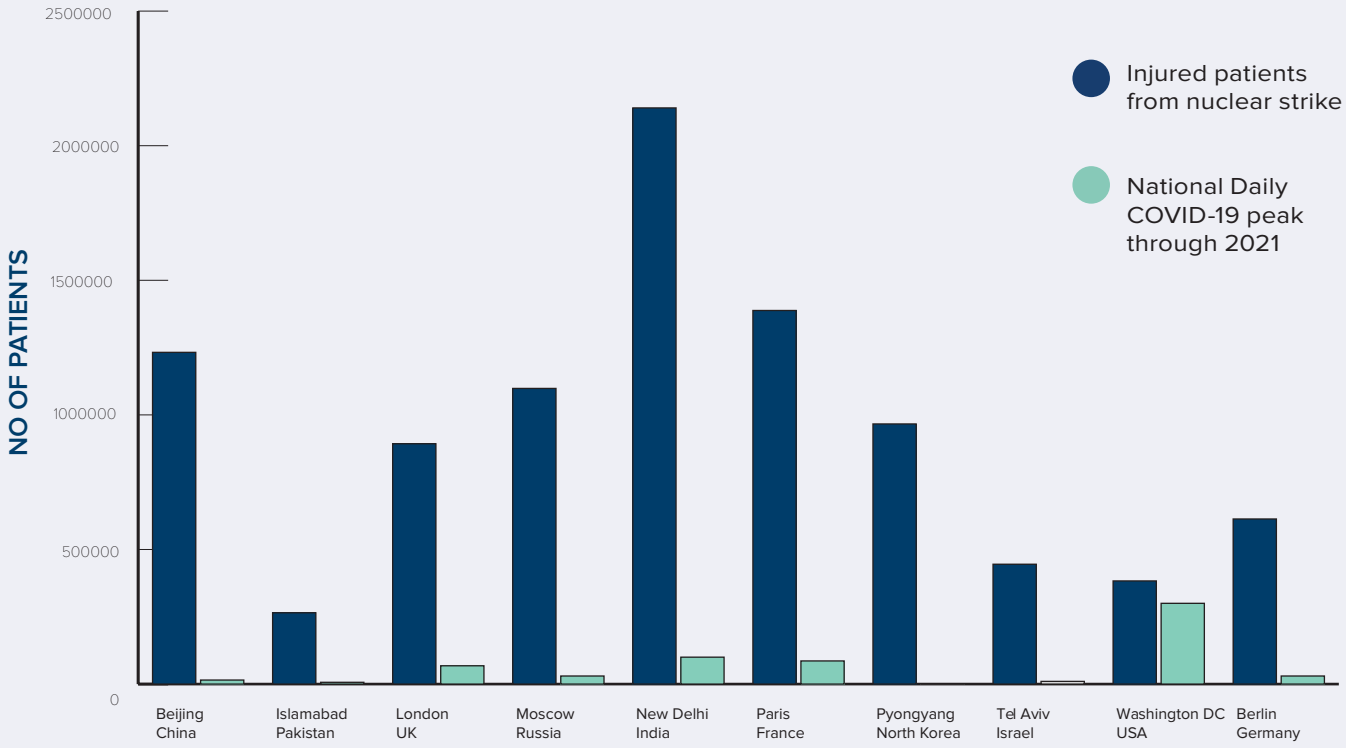
Nuclear-armed states may prepare to use nuclear weapons but they can never adequately prepare for the humanitarian consequences of their use. Examining the existing health infrastructure available to respond to the explosion of a moderately-sized nuclear weapon over nine cities in nuclear-armed states and one non-nuclear armed state's capital makes this point tragically clear. A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, creating an enormous humanitarian catastrophe impossible for any health care system to deal with - one that could potentially lead to the end of civilization as we know it. But if even just one average-sized nuclear weapon were to be detonated over a major city today, the immediate health impact would be disastrous beyond the ability of any nation to effectively respond.

This report uses publicly available information about hospitals, doctors, nurses and the NUKEMAP simulator to evaluate the immediate health response capacity to treat victims of a 100 kiloton airburst nuclear weapon detonation. This NUKEMAP model does not include the impact of mass fire or fallout after a nuclear detonation.

While the consequences of this model varied from city to city based on population density and geographic size, the data is clear: even without calculating for the mass fires or fallout caused by a nuclear blast, none of these cities would have anywhere near the sufficient healthcare capacity to respond to a nuclear explosion over their city. There would not be enough doctors, nurses, hospital beds or intensive care unit (ICU) beds – even assuming that all available medical professionals are adequately trained in emergency medicine and that every bed listed in each of these cities that is not destroyed during the nuclear attack is unoccupied.

Under this scenario in New Delhi, for example, roughly 50,000 beds would have to accommodate more than two and a half million injured people. Several cities lack needed burn beds: Paris has nine; London two.

After the bomb's destruction of medical personnel and infrastructure, cities would be overwhelmed. In Washington D.C., over 500,000 people would be killed or injured by the blast. In Berlin, one-third of hospitals would be destroyed.



ESTIMATED INJURIES PER CITY FROM A SINGLE 100KT NUCLEAR EXPLOSION

- **Washington D.C.**
  383,210 injured
- **London**
  892,760 injured
- **Paris**
  1,387,830 injured
- **Berlin**
  613,320 injured
- **Moscow**
  1,098,310 injured
- **Beijing**
  1,232,310 injured
- **Pyongyang**
  966,390 injured
- **Islamabad**
  264,870 injured
- **New Delhi**
  2,140,370 injured
- **Tel Aviv**
  445,220 injured

Surviving doctors, and other health professionals, many of whom may not have specialized training, would be responsible for treating large numbers of seriously injured patients simultaneously. Many of these victims would have extensive burns which require teams of health professionals to provide the care necessary for survival. In Tel Aviv, each doctor would need to treat 28 patients at once. In Islamabad, every doctor would have to treat 366 people simultaneously. In Pyongyang, it would be 162 people to each doctor.

Any hospitals left standing towards the center of the city, roughly within a 3.2 - 8 km radius from the center, would be working without the technology needed to provide intensive medical care. In this scenario, when a nuclear weapon is detonated at an altitude of 1.45km it would likely generate an electromagnetic pulse with impacts similar to that of a surface burst. This electro-magnetic pulse would disable a lot of important digital equipment within the blast-damage area of the city, including communication equipment, computers , key components in vehicles, and medical devices - further complicating response by emergency and medical personnel in the immediate area. There would be disruptions to the supply of electricity needed to power cardiac monitors, ventilators, computers, X-ray and lab equipment, and also to the critical supply of clean running water and a functioning sewer system. A modern hospital is highly dependent on equipment that requires electricity and the ability to provide intensive care without it would be very limited. Radiation, massive fires and streets blocked with debris would make it difficult, or impossible, to transport patients and equipment to any hospital that was still functioning.

In every city, the number of injured people needing medical assistance would be many times more than the highest daily number of new number of COVID-19 patients in the entire country. In Islamabad, 38 times more people would be injured in one second in one city than tested positive for COVID-19 in the entire country in a day at their peak of the pandemic through 2021. In Tel Aviv, it would be 39 times more people.

No city or health service can be adequately prepared to respond to the medical needs of civilians injured in the first few hours of one nuclear weapon being dropped on one city. The long-term health and environmental consequences of one nuclear detonation, let alone a full blown nuclear war, would be much worse.

All of the countries in this report make this risk more likely to become a reality by possessing or hosting nuclear weapons - but it is the people living in these cities that would pay the ultimate price. To ensure the safety of their citizens, city leaders must call on their country to join the Treaty on the Prohibition of Nuclear Weapons and take these nightmare scenarios off the table for good.

Introduction

Every year, nuclear-armed states and allies participate in training exercises to prepare to launch their nuclear weapons, thousands of which they keep on high alert, ready to launch within minutes. They practice flying the planes that would drop nuclear weapons, they train new personnel, and in some cases, they practice coordinating with supporting countries. They spend billions of dollars each year to build new nuclear weapons, maintain more than 13,000 existing weapons and develop new options for their use. But what they do not prepare for is what comes next, after the bombs are dropped. They do not prepare for the hundreds of thousands of burn victims, for the blasted hospitals, for the injured and dying medical professionals left to treat an entire city. As the International Committee of the Red Cross (ICRC) has warned repeatedly, they cannot prepare to respond to a humanitarian catastrophe on this scale.

After nuclear weapons were dropped over Hiroshima and Nagasaki, the ICRC reported, horror-struck, about the humanitarian tragedy and the decimation of the medical response capacity. About 80% of hospitals were destroyed in Hiroshima and out of 300 doctors, 270 died or were injured; out of 1,780 nurses, 1,654 were killed or injured. Reporting on the conditions at an emergency hospital in Hiroshima, the ICRC's Fritz Bilfinger wrote *"medical equipment was practically nonexistent. The place looked more like a morgue than an emergency hospital."* More than seventy-five years later, there is no indication that cities today would fare any better after a nuclear explosion.

80% of hospitals were destroyed after the atomic bombing of Hiroshima, and those that remained were overwhelmed with burn victims.

Photo: Copyright ICRC archives (ARR), 07/08/1945, World War II. Hiroshima, Hospital II of the Army. victims burned by the atom bomb. V-P-HIST-00261-39

Photo by Toshio Kawamoto, Courtesy of Yoshio Kawamoto Hiroshima Peace Memorial Museum

With overwhelmed hospitals and many of their colleagues dead or injured after a nuclear explosion, each remaining doctor would need to treat dozens or hundreds of patients at once..

Photo: Cedric Fauntleroy | Pexels

If anything, the trauma of overwhelmed hospitals and overburdened doctors and nurses around the world who are struggling to meet the needs of patients during the COVID-19 pandemic shows just how impossible it would be for medical infrastructure to respond to a nuclear weapon detonation. We have witnessed the overrunl morgues and the refrigerated trucks of corpses in hospital parking lots.

Roughly a year into the pandemic, the United States had lost 500,000 citizens who died from the disease. Immediately after a nuclear attack in Washington D.C., under the scenario described in this study, about that many people would be injured or killed instantly, while hospital supplies and medical personnel would be simultaneously drastically reduced and public utility access diminished or non-existent. It took countries around the world months to increase their medical supplies, hospital beds, ICU beds and ventilators to care for the overwhelming number of patients. We know now how unprepared we were for the medical emergency of a pandemic that health experts had warned would happen.

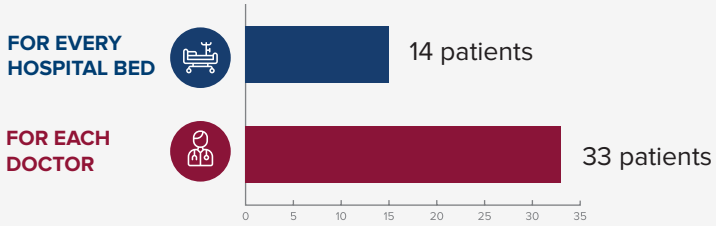
This report examines just the first few hours of a humanitarian catastrophe that would last generations. While this study considers the impact of a single nuclear weapon on a single city, it is almost certain that a nuclear war would involve many weapons targeting many cities in each country, including weapons much more destructive than the one modeled in this study. For more information on our methodology, please see page 31 of this report. Beyond the immediate, local effects of these nuclear explosions, previous research shows even a limited nuclear war would cause worldwide climate disruption, disrupt food production across the planet and lead to a global famine that could put billions of people at risk, even in countries far removed from the actual scene of the war.

Since 1945, medical professionals have warned us about the lack of health capacity to respond to the use of nuclear weapons and fought for their abolition. As long as nuclear weapons exist there is a risk of their use. In 2017, the International Committee of the Red Cross and health professionals around the world supported the adoption of the Treaty on the Prohibition of Nuclear Weapons, the first international legal prohibition on nuclear weapons that provides a pathway towards their total elimination. It is also the first international treaty to require states parties to provide assistance for victims of nuclear weapons use and testing and to begin to remediate contaminated environments. All countries must join this landmark instrument and abolish nuclear weapons to prevent the horrific scenarios described in the following report.

Beijing, China

1.23M

est. injured after one nuclear detonation (100kt) over Tiananmen Square



China possesses about 350 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Beijing today, the immediate health impact would be catastrophic. An estimated 357,810 people could die immediately and another 1,232,310 could be injured. Based on Beijing's 2020 population, about one out of every thirteenth person in Beijing would be injured or killed.

At the reported COVID peak through 2021 in China in February 2020, more than 15,000 new COVID cases were reported in one day in all of the country. After a nuclear attack, about 82 times more people would need medical attention immediately in just one city.

Immediate Health Impacts

380 m

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over Tiananmen Square, that means that parts of the Great Hall of the People and Chairman Mao's Memorial Hall would be engulfed in a nuclear fireball and instantly vaporised.

1.1 km

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. In Beijing, for this bomb dropped on Tiananmen Square, this would include the entrance to the Forbidden City, the National Centre for the Performing Arts, several museums and a middle school.

3.26 km

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In Beijing, this circle includes at least six hospitals: Beijing Friendship Hospital, Beijing Hospital, Beijing Union Hospital, Beijing Hospital of Traditional Chinese Medicine, Beijing Tiantan Hospital and Beijing Tiantan Puhua Hospital, as well as the Forbidden City, the Temple of Eternal Peace and many museums and hotels.

4.38 km

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This zone would include at least three additional hospitals: Peking University First Hospital 1574, Dongzhimen Hospital 574, Xuanwu Hospital 1159, and a number of parks, such as Ritan and Taoranting Park.

9.18 km

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could Beijing respond to a health crisis of this proportion? China has about 198 doctors per 100,000 people and 266 nurses and midwives per 100,000 people which translates to roughly 40,512 doctors and 54,474 nurses and midwives in Beijing. After the explosion, about 37,364 doctors and 50,240 nurses would survive to treat about 1,232,310 injured people. That means every doctor in Beijing would be responsible for treating about 33 people, many with severe injuries, simultaneously.

What about hospital beds? China has 431 hospital beds per 100,000 people meaning there should be roughly 88,194 hospital beds in Beijing.

At least six hospitals with approximately 8,900 beds collectively (Beijing Friendship Hospital has about 1500, Beijing Hospital 1200, Beijing Union Hospital 2000, Capital Medical University, Beijing Hospital of Traditional Chinese Medicine 2500, Beijing Tiantan Hospital 1650 and Beijing Tiantan Puhua Hospital 70) would be destroyed when the blast decimated the hospitals in the city center, leaving less than 80,000 hospital beds in Beijing, some of which would already be occupied, which would be woefully inadequate to accommodate roughly 1.2 million injured people.

A basic investigation to evaluate the burn care system in the country was done in 2014 and the results confirm that the system is not adequate and lacks a great number of trained burn professionals.

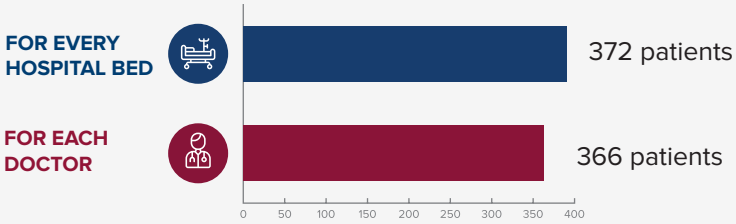
China may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that will result from the use of just one nuclear weapon.

A single nuclear weapon would destroy at least 6 hospitals leaving less than 80,000 beds in the city to accomodate over 1.2M injured.

Islamabad, Pakistan

264,870

est. injured after one nuclear detonation (100kt) over the Prime Minister's Office



Pakistan possesses about 165 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Islamabad today, the immediate health impact would be catastrophic. An estimated 126,240 people could die immediately and another 264,870 could be injured. Based on Islamabad's population of 1.1 million in 2020, about one in three would be injured or killed.

At the reported COVID peak through 2021 on June 13 2020, 6,884 new COVID cases were reported in one day in all of Pakistan. After a nuclear attack, about 38 times more people would need medical attention immediately in just one city.

Immediate Health Impacts

380 m

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb is dropped over the Prime Minister's Office, that means that the Supreme Court, the National Library and Pakistan's Science Foundation would be engulfed in a nuclear fireball and instantly vaporised.

1.1 km

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. In Islamabad, for this bomb dropped on the Prime Minister's Office, this would include the Pakistan Council of National Arts, the National Assembly, the President's House and a number of embassies.

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In Islamabad, this circle includes at least four hospitals as well as hotels, restaurants and a sports stadium.

Pakistan may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This zone would include at least two additional hospitals as well as schools and universities and parks.

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could Islamabad respond to a health crisis of this proportion? Pakistan has about 98 doctors per 100,000 people and 66 nurses and midwives per 100,000 people, which translates to roughly 1,106 doctors and 755 nurses and midwives in Islamabad. If roughly one third of that population is injured or dies from the nuclear explosion, that leaves about 723 doctors and 493 nurses and midwives to treat about 264,870 injured people. That means every doctor in Islamabad would be responsible for treating about 366 people, many with severe injuries, simultaneously.

What about hospital beds? Pakistan has 63 hospital beds per 100,000 people meaning there should be roughly 711 hospital beds in Islamabad. Many beds would of course already be occupied and some destroyed by the blast. The remaining available beds would be woefully inadequate to care for over 250,000 injured people.

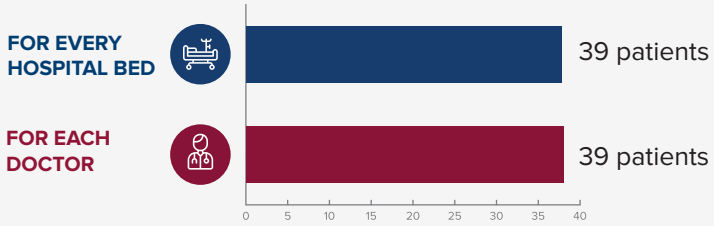
The Pakistan Institute of Medical Sciences in Islamabad has a burn care center that would be located outside the estimated range of physical destruction from the nuclear weapon. The burn care centre has 20 beds - twelve in intensive care units. The centre's website notes that patients are often turned away due to lack of availability of beds, raising questions about if any of these beds would be available to care for the thousands of burn victims following a nuclear explosion. The Islamabad Medical Centre, also located outside the reach of the bomb's destruction, also has a burn centre.

Patients are often turned away from the Pakistan Institute of Medical Science's burn care centre due to lack of availabity of beds. Would any of these beds even be available to care for the thousands of burn victims after a nuclear attack?

London, United Kingdom

892,760

est. injured after one nuclear detonation (100kt) over the Palace of Westminster



The United Kingdom possesses about 225 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over London today, the immediate health impact would be catastrophic. An estimated 258,680 people could die immediately and another 892,760 could be injured. That's about one in eight people in London's 2020 population of around 9.3 million people.

At the reported COVID peak through 2021 on 30 December 2021, 269,521 new COVID cases were reported in one day in all of the United Kingdom. After a nuclear attack, about three times more people would need medical attention immediately in just one city.

Immediate Health Impacts

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Palace of Westminster, not only would the British parliament be engulfed in a nuclear fireball and instantly vaporised, but also the Westminster Abbey, Parliament Square, Big Ben, Westminster Bridge, as well as St Thomas' Hospital.

To a distance of a little over 1 km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. This zone would include 10 Downing Street, Trafalgar Square, and the Ministry of Defence. Several hospitals lie in this zone, such as Gordon Hospital and Evelina London Children's Hospital, as well as Westminster Ambulance station.

Within 3.26 km in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In London, this circle includes the Buckingham Palace, much of Hyde Park, St Paul's Cathedral, Piccadilly Circus, King's College, and many museums and other tourist attractions such as the British museum and the Barbican. Several more hospitals are within this range of the blast, such as University College Hospital, Royal London Hospital, St Bartholomew's Hospital, Guy's and St Thomas' NHS Hospital and London Bridge hospital. Thousands of people will have severe injuries and burns.

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This area includes the Tower of London, Regent's Park, King's Cross/St Pancras and Shoreditch. At least 15 hospitals lie within this zone.

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could London respond to a health crisis of this proportion? London has around 26,209 doctors and around 76,035 nurses and midwives. They would be as affected by the nuclear explosion as everyone else. In the case that one out of eight of the population dies or is injured from the nuclear explosion, that leaves about 22,966 doctors and 66,625 nurses and midwives to treat about 892,760 injured people. That means every doctor in London would be responsible for treating about 39 people, many with severe injuries, simultaneously.

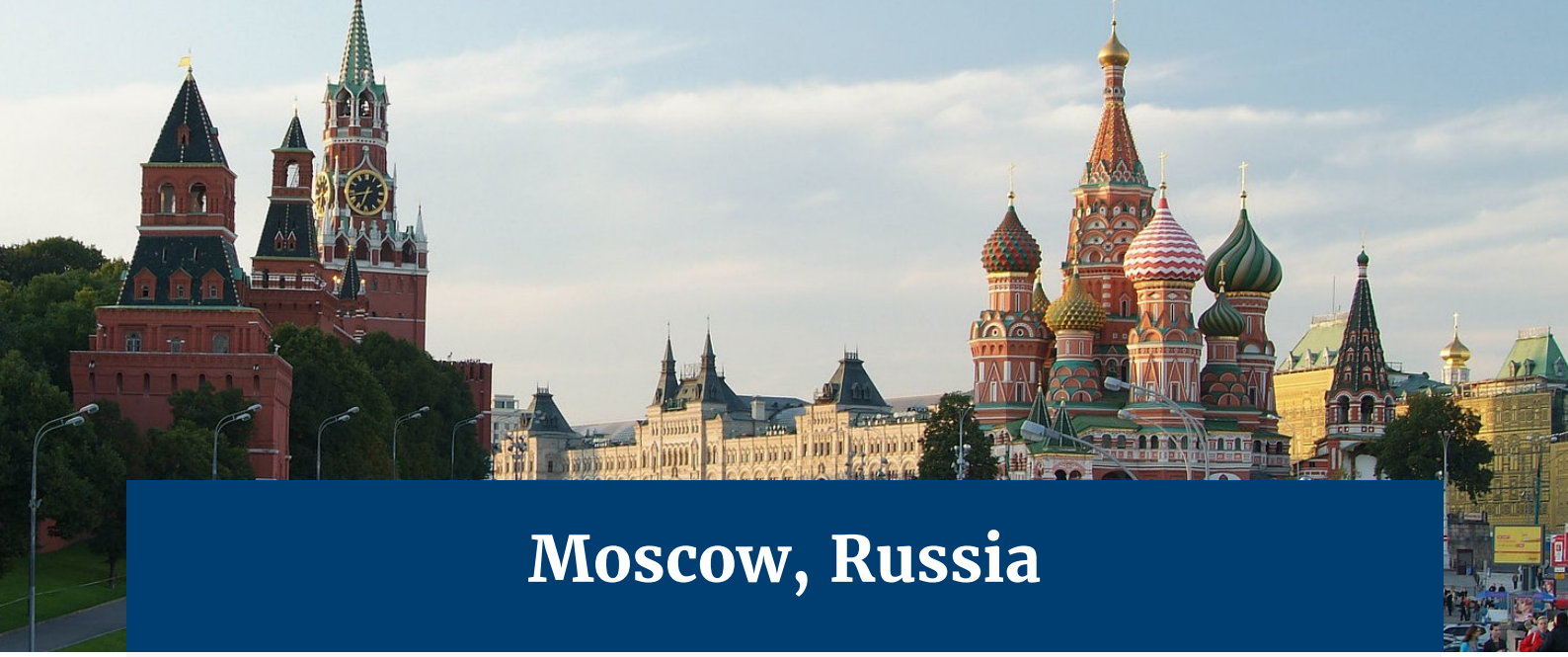
Every doctor in London would be responsible for treating about 39 people simultaneously.

What about hospital beds? There are around 134 hospitals in London, but many of them, the ones closest to the center of the city, would be destroyed by the blast. Thousands of people will have severe injuries and burns. In England, there are about 5,900 ICU beds and five burn centers with around 16 burn beds. In London, there are only two burn beds. But as many hospitals would be destroyed or damaged by the explosion, it would not be possible to use all of these beds.

In London, there are only two burn beds.

The UK has 246 hospital beds per 100,000 people, thus around 22,888 hospital beds in London. Many beds would of course already be occupied and some destroyed by the blast. The remaining available beds would be woefully inadequate to care for nearly 900,000 injured people. There are about 185,129 hospital beds in all of the UK, although of course many of them would already be in use to treat patients suffering from other ailments.

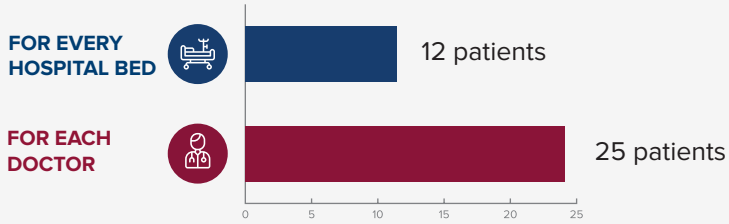
The UK may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.



Moscow, Russia

1.09M

est. injured after one nuclear detonation (100kt) over the Kremlin



Russia possesses about 6,257 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Moscow today, the immediate health impact would be catastrophic. An estimated 251,800 people could die immediately and another 1,098,310 could be injured. Based on Moscow's population of over 12.5 million in 2020, one out of nine people in Moscow would be injured or killed.

At the reported COVID peak through 2021 on 6 November 2021, 63,205 new COVID cases were reported in one day in all of Russia. After a nuclear attack, about 17 times more people would need medical attention immediately in just one city.

Immediate Health Impacts

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Kremlin, that means that the Red Square, Saint Basil's Cathedral and Lenin's Mausoleum would be engulfed in a nuclear fireball and instantly vaporised.

To a distance of a little over 1km ffrom the detonation point the explosion would likely generate a fatal dose of ionising radiation. In Moscow, for this bomb dropped on the Kremlin, this would include libraries, museums and parks, including the Russian State Library, the Bolshoi Theatre and Zaryadye Park.

3.26 km

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In Moscow, this circle includes at least six hospitals as well as Russia's Ministry of Foriegn Affairs, theatres, museums and parks.

4.38 km

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This zone would include at least two additional hospitals.

9.18 km

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse. Within this zone would be the Pediatric Burn Center at Speransky Hospital, one of Russia's largest burn units.

Healthcare Response Capacity

How could Moscow respond to a health crisis of this proportion? Russia has about 401 doctors per 100,000 people and 854 nurses and midwives per 100,000 people, which translates to roughly 50,326 doctors and 107,110 nurses and midwives in Moscow. If 10% of that population is injured or dies from the nuclear explosion, that leaves about 44,907 doctors and 95,577 nurses to treat over 1 million injured people. That means every doctor in Moscow would be responsible for treating about 25 injured people, many with severe injuries, simultaneously.

Every doctor in Moscow would be responsible for treating about 25 injured people simultaneously.

What about hospital beds? Russia has 712 hospital beds per 100,000 people meaning there should be roughly 89,270 beds in Moscow. Of course, many of these beds would already be occupied at the time of a nuclear explosion. At the outbreak of the COVID-19 pandemic, Russia announced it had 40,000 beds in the entire country available for new patients and it wasn't until months later in May 2020 that Russia had 177,000 beds available, 25,000 of them in intensive care. In Moscow specifically in October 2021, there were 15,000 beds available. These available beds would be drastically overwhelmed by more than one million injured people.

The largest burn center in the city would be overwhelmed by hundreds of times more people in a day than it treats in a year.

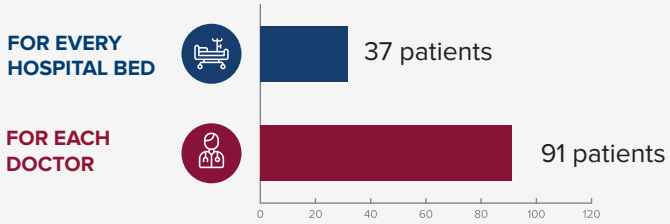
Inozemtsev City Clinical Hospital's Burn Center, which would not be destroyed by the blast, is one of the largest burn care centers in Moscow, treating about 1,500 patients a year. The center would be overwhelmed by hundreds of times more people in a day than it typically treats in a year. The hospital has 86 intensive care unit beds.

Russia may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.

New Delhi, India

2.1M

est. injured after one nuclear detonation (100kt) over Parliament House



India possesses about 150 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over New Delhi today, the immediate health impact would be catastrophic.

An estimated 614,290 people could die immediately and another 2,140,370 could be injured. Based on New Delhi's population of 30.3 million in 2020, about one out of every 11 people in New Delhi would be injured or killed.

At the reported COVID peak through 2021 on 7 May 2021, over 400,000 new COVID cases were reported in one day in all of India. After a nuclear attack, about five times more people would need medical attention immediately in just one city.

Immediate Health Impacts

380 m

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Parliament House, that means that the Parliament complex, the Ministry of Home Affairs and the State Bank of India would be engulfed in a nuclear fireball and instantly vaporised.

1.1 km

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. In New Delhi, for this bomb dropped on the Parliament, this would include the Prime Minister's Office, the Ministry of Defense, the Mughal Gardens and at least one hospital.

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In New Delhi, this circle includes at least fourteen hospitals as well as several embassies, parks, museums and hotels.

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This zone would include at least ten additional hospitals, an airport and the National Zoo.

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could New Delhi respond to a health crisis of this proportion? India has about 86 doctors per 100,000 people and 173 nurses per 100,000 people, which translates to roughly 25,962 doctors and 52,315 nurses in New Delhi. If every 11th person of that population is injured or dies from the nuclear explosion, that leaves about 23,601 doctors and 47,558 nurses to treat about 2,140,370 injured people. That means every doctor in New Delhi would be responsible for treating about 91 people, many with severe injuries, simultaneously.

Every doctor in New Delhi would be responsible for treating about 91 people simultaneously.

What about hospital beds? New Delhi reportedly had 57,194 total hospital beds in 2019. Many beds would of course already be occupied and some destroyed by the blast. The remaining available beds would be woefully inadequate to care for over two million injured people.

The remaining available hospital beds would be woefully inadequate to care for over two million injured people.

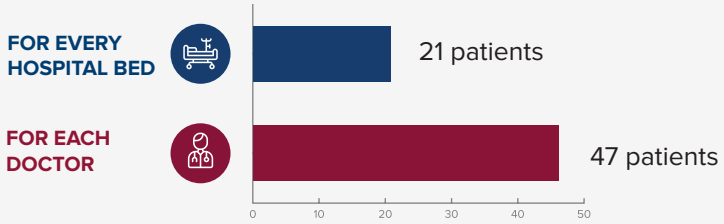
For all of the burn victims, in all of India there are 1,339 burn beds at 67 centres (hospitals with dedicated burn-care units), according to data compiled in 2016 by the National Academy of Burns-India (NABI). This is one of the most comprehensive assessments of the state of burn-care management in India by the academy, which counts 1,200 burn-care professionals as its members. Of the 1,339 beds, 297 are in intensive care units (ICUs) meant exclusively for patients with critical burn injuries. But these beds would not be sufficient to care for the burn victims in New Delhi.

India may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe of the use that would result from just one nuclear weapon.

Paris, France

1.39M

est. injured after one nuclear detonation (100kt) over the Eiffel Tower



France possesses about 290 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Paris today, the immediate health impact would be catastrophic. An estimated 520,330 people could die immediately and another 1,387,830 could be injured. That's nearly one in six people given Paris's population of around 11 million people in 2020.

At the reported COVID peak through 2021 on 31 December 2021, about 204,636 new COVID cases were reported in one day in all of France. After a nuclear attack, about three times more people would need medical attention immediately in just one city.

Immediate Health Impacts

380 m

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Eiffel Tower, the Eiffel Tower and Champ de Mars would be engulfed in a nuclear fireball and instantly vaporized. Everyone within this radius would die instantly.

1.1 km

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. This zone would include Trocadéro, several embassies, museums and other tourist attractions, as well as residential areas.

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction.

Everyone in this zone would be injured, and many would die. In Paris, this circle includes the Assemblée Nationale, the Elysée Palace, Arc de Triomphe, Place de la Concorde, the Ministry of Foreign Affairs, Montparnasse, Jardin des Tuileries, the Louvre, Invalides and parts of Bois de Boulogne. Several hospitals are within this range of the blast, such as Hôpital Necker, Hôpital Européen Georges Pompidou, and Hôpital Vaugirard.

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This area includes Notre Dame, Centre Pompidou and Jardin du Luxembourg, as well as several more hospitals, including La Salpêtrière, Hôpital Hôtel-Dieu, Hôpital Cochin and Hôpital Saint-Louis.

A full 9km from the center of the blast, glass windows can be expected to shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could Paris respond to a health crisis of this proportion? Paris has around 35,995 doctors and around 126,375 nurses and midwives. They would be as affected by the nuclear explosion as everyone else. In the case that one in six of the population dies or is injured from the nuclear explosion, that leaves about 29,761 doctors and 104,487 nurses and midwives to treat more than a million injured people. That means every doctor in Paris would be responsible for treating about 47 people simultaneously.

About 18 times more people would immediately need medical attention in Paris, than at the peak of the COVID-19 pandemic in all of France.

What about hospital beds? There are around 39 hospitals in Paris, but many of them, the ones closest to the center of the city, would be destroyed by the blast. In Paris, there are 416 ICU beds (and in France 8,217 ICU beds) and around 44 burn beds (based on there being four burn beds per million inhabitants in France). But as many hospitals would be destroyed or damaged by the explosion, it would not be possible to use all of these beds.

In Paris, there are 416 ICU beds and around 44 burn beds, but as many hospitals would be destroyed or damaged by the explosion, it would not be possible to use all of these beds.

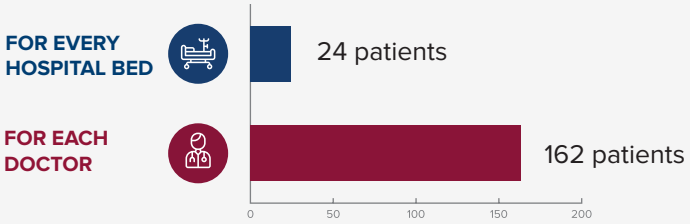
France has 591 hospital beds per 100,000 people, thus around 65,112 hospital beds in Paris. Many beds would of course already be occupied and some destroyed by the blast. The remaining available beds would be woefully inadequate to care for over one million injured people. There are about 397,654 hospital beds in all of France, although of course many of them would already be in use to treat patients suffering from other ailments.

France may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.

Pyongyang, North Korea

966,390

est. injured after one nuclear detonation (100kt) over the Prime Minister's Office



North Korea possesses about 45 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with.

But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Pyongyang today, the immediate health impact would be catastrophic. An estimated 502,040 people could die immediately and another 966,390 could be injured. Based on Pyongyang's population of around 3 million in 2020, about 50% would be injured or killed.

Immediate Health Impacts

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Taedong Gate, that means that the Korean Central History Museum and the Central Committee of the Workers Party of Korea would be engulfed in a nuclear fireball and instantly vaporised.

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. In Pyongyang, for this bomb dropped on Taedong Gate, this would include the schools, theatres, parks, restaurants and an assembly hall.

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In Pyongyang, this circle includes at least six hospitals as well as more restaurants, theatres, universities and sports complexes.

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This zone would include at least one additional hospital, parks and universities.

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could Pyongyang respond to a health crisis of this proportion? North Korea has about 368 doctors per 100,000 people and 445 nurses and midwives per 100,000 people, which translates to roughly 11,361 doctors and 13,721 nurses and midwives in Pyongyang. If 50% of that population is injured or dies from the nuclear explosion, that leaves about 5,952 doctors and 7,189 nurses and midwives to treat about 966,390 injured people. That means every doctor in Pyongyang would be responsible for treating about 162 people, many with severe injuries, simultaneously.

Every doctor in Pyongyang would be responsible for treating about 162 people simultaneously.

What about hospital beds? North Korea has about 1,320 hospital beds per 100,000 people meaning there should be roughly 40,712 beds in Pyongyang. Many beds would of course already be occupied and some destroyed by the blast. The remaining available beds would be woefully inadequate to care for nearly one million injured people.

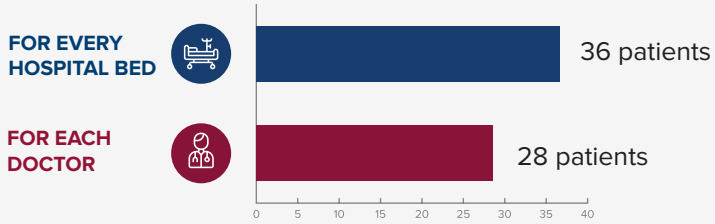
The remaining available hospital beds would be woefully inadequate to care for nearly one million injured people.

North Korea may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.

Tel Aviv, Israel

445,220

est. injured after one nuclear detonation (100kt) over the government centre



Israel does not publicly admit that it has nuclear weapons, but is widely believed to possess about 90 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Tel Aviv today, the immediate health impact would be catastrophic. An estimated 281,130 people would die immediately and another 445,220 would be injured. 726,350 people in total would die or be injured. That's around one in six of the Tel Aviv-Yafo metropolitan region's population of 4.2 million in 2020.

At the reported COVID peak through 2021 on 3 September 2021 11,344 new COVID cases were reported in one day in all of Israel. After a nuclear attack, nearly 39 times more people immediately would need medical attention immediately in just one city.

Immediate Health Impacts

380 m

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Operations Directorate Building in HaKirya, Tel Aviv's government and military centre, that means that in addition to numerous government buildings, the Tel Aviv Museum of Arts, the Tel Aviv Opera, and the Municipal Theatre would be engulfed in a nuclear fireball and instantly vaporised.

1.1 km

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. In Tel Aviv, for this bomb dropped on the government and military centre, this would include the Sourasky Medical Centre - the city's extensive main medical facility and hospital complex, Tel Aviv City Hall and Rabin Square, Tel Aviv City Center/Azrieli Center, and the Lowy Concert Hall.

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In Tel Aviv, this circle includes most of the city's beach front hotel and nightlife area, Hassan Bek Mosque, Tel Aviv Great Synagogue, Biney Yehuda Stadium, Yad Eliyahu Arena, and the Eretz Israel Museum.

A full 9 km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse. At least seven hospitals would be in this zone and would suffer damage to their facilities: Tel HaShomer Hospital and the Sheba Medical Center, Assuta Hospital in Ramat HaHayal, Manayei HaYeshua Medical Center, Rabin Medical Center, Schneider Children's Medical Center, Wolfson Medical Center, and Yehuda Abarbanel Mental Health Center.

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. This zone would include many additional important religious and cultural places like St. Peter's Church, The Sea Mosque, the Arab-Jewish Theatre in Jaffa, and the Labkovsky Center for Jewish Art.

Healthcare Response Capacity

How could Tel Aviv respond to a health crisis of this proportion? Israel has about 462 doctors per 100,000 people and 570 nurses and midwives per 100,000 people, which translates to roughly 19,339 doctors and 23,835 nurses in the Tel Aviv-Yafo metropolitan area. If one in six of the population is injured or dies from the nuclear explosion, that leaves about 19,695 nurses and 15,980 doctors to treat about 445,220 injured people. That means every doctor in Tel Aviv would be responsible for treating about 28 people, many with severe injuries, simultaneously.

What about hospital beds? Israel has 298 hospital beds per 100,000 people meaning there should be roughly 12,461 beds in Tel Aviv-Yafo. Tel Aviv's major hospital centre, the Sourasky Medical Centre, with its trauma centre and four hospitals - Ichilov General Hospital and Ida Sourasky Rehabilitation Center, Lis Maternity Hospital, and Dana Children's Hospital – has 1,171 beds. Though protected against conventional, chemical, and biological attack in an emergency facility opened in 2011, these beds would become unavailable when the blast decimated the city centre. This would leave the remaining hospital beds further from the blast zone, some of which would be usable, but which would be woefully inadequate to accommodate 445,220 injured people.

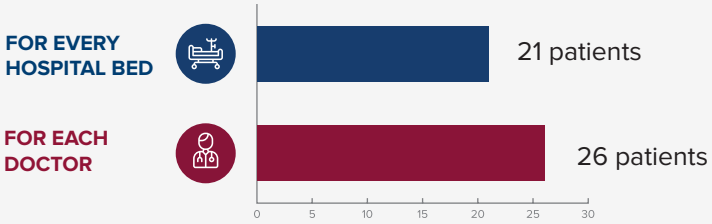
The explosion of a single nuclear weapon would destroy Tel Aviv's Sourasky Medical Centre, the central city's major hospital complex, including its primary trauma centre, injuring or killing many of the nurses and doctors there.

In total, as of 2012, Israel has five burn units with 27 burn beds and 14 intensive care unit beds. One of those five burn units is in the Sourasky Medical Centre, which would be near the centre of destruction and unusable and another unit is in the Sheba Tel HaShomer Hospital in an area that would experience light blast damage. There are about 28,064 hospital beds in all of Israel, which is still only about 6% of the number of beds needed for the number of injured. And many of these beds would already be in use to treat patients suffering from other ailments. Israel may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.

Washington D.C., United States

383,210

est. injured after one nuclear detonation (100kt) over the Capitol



The United States possesses about 5,600 nuclear warheads

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Washington, D.C. today, the immediate health impact would be catastrophic. An estimated 177,650 people could die immediately and another 383,210 could be injured. That's one out of every eleven people based on Washington's metropolitan population of around 6.3 million people in 2020.

At the reported COVID peak through 2021 on 31 December 2021, about 472,163 new COVID cases were reported in one day in the United States. After a nuclear attack, nearly as many people would need medical attention immediately in just one city.

Immediate Health Impacts

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Capitol, the seat of the US Congress would be engulfed in a nuclear fireball and instantly vaporised, together with several museums and monuments. Everyone within this radius would die instantly.

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. In Washington, for this bomb dropped on the Capitol, this would include the Mall, the Supreme Court, the Senate office buildings and all three House office buildings, Democratic National Committee as well as BridgePoint Hospital.

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In Washington, this circle includes the White House, as well as monuments, memorials and museums such as the Washington Monument, Lincoln Memorial, Martin Luther King Memorial and the National Portrait Gallery.

Within 4.38 km, people would suffer third-degree burns on all exposed skin. Technology may be disrupted by an electromagnetic pulse. Several hospitals lie in this zone, such as George Washington University Hospital, Howard University Hospital and MedStar Washington, including the Burn Center at MedStar Washington.

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could Washington respond to a health crisis of this proportion? We estimate Washington has about 16,490 doctors and around 91,843 nurses and midwives. In the case that one in eleven of the population dies or is injured from the nuclear explosion, that leaves 15,025 doctors and 83,684 nurses and midwives. That means every doctor needs to treat 26 people, many with severe injuries, simultaneously.

With one out of eleven of doctors and nurses dead or injured, every remaining doctor would need to treat 26 people simultaneously.

What about hospital beds? There are around 13 hospitals in Washington, but about almost half of those hospitals, the ones closest to the center of the city, would be destroyed by the blast. Thousands of people will have severe injuries and burns. In Washington, there are about 345 ICU beds, and one burn center with a total of 30 burn beds. However, the one burn center would be destroyed or damaged by the explosion.

The remaining available beds would be woefully inadequate to care for over 383,000 injured people.

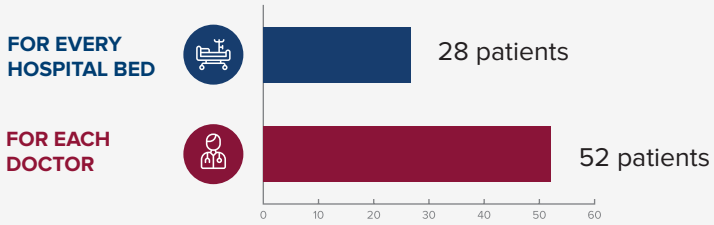
The US has 287 hospital beds per 100,000 people, thus around 18,119 hospital beds in Washington. Many beds would of course already be occupied and some destroyed by the blast. The remaining available beds would be woefully inadequate to care for over 383,000 injured people.

The United States may prepare to use nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.

Berlin, Germany

613,320

est. injured after one nuclear detonation (100kt) over Brandenburg gate



Germany, while not a nuclear-armed state, hosts approximately 20 U.S. nuclear weapons at Buchel Air Base. Although current nuclear targets are not public, during the Cold War, there were several targets for nuclear weapons around Germany, including near its capital, Berlin.

A nuclear war would realistically involve many nuclear weapons targeting many cities in a country, making for an enormous humanitarian catastrophe basically impossible for any health care system to deal with. But even if just one average-sized nuclear weapon (100 kiloton) were to be detonated over Berlin today, the immediate health impact would be catastrophic. An estimated 166,520 people could die immediately and another 613,320 could be injured. That's more than 20% of Berlin's population of 3.5 million in 2020. Roughly one out of five people in Berlin would die instantly or be injured.

At the reported COVID peak through 2021 on 26 November 2021, 76,414 new COVID cases were reported in one day in all of Germany. After a nuclear attack, about eight times more people would need medical attention immediately in just one city.

Immediate Health Impacts

380 m

A fireball would extend out about 380 meters in every direction from the detonation point. If the bomb were dropped over the Brandenburg Gate, that means that the German parliament building (the Bundestag), French and Russian embassies and important memorials, like the Memorial to the Murdered Jews of Europe, would be engulfed in a nuclear fireball and instantly vaporised.

1.1 km

To a distance of a little over 1km from the detonation point the explosion would likely generate a fatal dose of ionising radiation. In Berlin, for this bomb dropped on the Brandenburg gate, this would include the German Chancellery, the Berlin philharmonic, and several other well frequented theaters and museums.

Within 3.26 kilometers in every direction from the center, there would be blast damage, with most residential buildings collapsing, and local fires starting from the destruction. Everyone in this zone would be injured, and many would die. In Berlin, this circle includes the Tiergarten, Bellevue Palace, popular tourist attractions, like Checkpoint Charlie, and several hospitals including Charité – Universitätsmedizin Berlin and Bundeswehrkrankenhaus Berlin.

Within 4.38 km, people would suffer third-degree burns. Technology may be disrupted by an electromagnetic pulse. At least four additional hospitals lie in this zone: Virchow Klinikum, Jüdisches Krankenhaus Berlin, Vivantes Klinikum Am Urban, and St. Joseph Hospital.

A full 9km from the center of the blast, glass windows would shatter, causing additional injuries to anyone in the vicinity and some technology may be disrupted by an electromagnetic pulse.

Healthcare Response Capacity

How could Berlin respond to a health crisis of this proportion? There are around 30 hospitals in Berlin, but about one-third of those hospitals, the ones closest to the center of the city would be destroyed by the blast. Germany has about 425 doctors per 100,000 people and 1,324 nurses per 100,000 people, which translates to roughly 15,134 doctors and 47,144 nurses in Berlin. If 22% of that population is injured or dies from the nuclear explosion, that leaves about 36,823 nurses and 11,821 doctors to treat about 613,320 injured people. That means every doctor in Berlin would be responsible for treating about 52 people, many with severe injuries, simultaneously.

The explosion of a single nuclear weapon would destroy one- third of Berlin's hospitals, leaving more than 20% of nurses and doctors injured or dead.

The 14,720 hospital beds left would be woefully inadequate to accommodate 600,000 injured people.

What about hospital beds? Germany has 800 hospital beds per 100,000 people and there are roughly 22,000 hospital beds in Berlin. If one-third of those were destroyed when the blast decimated the hospitals in the city center, that would leave 14,720 hospital beds, which would be woefully inadequate to accommodate over 600,000 injured people. There are about 688,000 hospital beds in all of Germany, although of course many of them would already be in use to treat patients suffering from other ailments.

Germany may host nuclear weapons but its health care infrastructure is not and cannot be prepared for the humanitarian catastrophe that would result from the use of just one nuclear weapon.

Conclusion

These scenarios paint a bleak and depressing picture. It is clear that there is no mitigation strategy or response capacity that could adequately respond to a nuclear attack on a city: even a single moderately sized bomb over a single city would be a humanitarian catastrophe. In the event of an actual nuclear war, a far greater level of destruction would engulf scores of cities in the countries involved in the conflict, and the global climate disruption would cause famine across the globe claiming victims far removed from the actual scene of the war and posing an existential threat to modern industrial civilization. The only solution is to prevent the risk to any city by eliminating nuclear weapons.

But here is the good news: human beings created nuclear weapons and we have the power to abolish them. The Treaty on the Prohibition of Nuclear Weapons (TPNW) was adopted in 2017 and entered into force in 2021. The TPNW is a landmark agreement supported by the majority of the world's nations to prohibit nuclear weapons and provide a pathway for their elimination. Support for the treaty continues to grow as more countries sign and ratify. Even in countries that have not joined the treaty, such as the ones mentioned in this report, polls show that public opinion supports joining it. Major cities, including Washington D.C., Paris, Berlin and other capitals, have adopted resolutions calling on the federal government to join the treaty. This Nobel-Peace-Prize winning campaign won't stop until the will of the people to eliminate nuclear weapons is respected by the pariah states that cling to their weapons of mass destruction.

As the treaty continues to expand in membership and influence, it will erode the legitimacy a handful of countries still give these weapons of mass destruction until those nations agree to join the right side of history and eliminate the world's worst weapons. Only then, can we put the nightmare scenarios described in this report to bed at last.

Methodology

In this report, ICAN examines the capacity of the health care systems in the nine nuclear-armed states, as well as one country hosting nuclear weapons on its territory, to respond to the consequences of one 100kt nuclear weapon being detonated over one of their cities. As will be further detailed below, the catastrophic impacts described in the report are based on a relatively conservative scenario. They do not include long-term radiation damage, multiple nuclear retaliatory strikes or even the most powerful nuclear weapons in modern arsenals.

We examined available health care infrastructure that could foreseeably be used in the event of a nuclear detonation. The health care capacity data in the report are sourced from publicly available resources, including government data on hospitals and burn care facilities and Nuclear Threat Initiative's Global Health Security 2021 Index. The COVID-19 pandemic data were retrieved from the World Health Organisation COVID-19 dashboard. December 31st 2021 was the last date considered for this report.

We calculated the number of nurses and doctors in each city using the Global Health Security Index Indicator 4.1.1, which lists doctors and nurses and midwives per 100,000 people and by using the population of each city. We found the data for each city's population using the World Population Review's 2020 estimate. We calculated the number of hospital beds in each city using the Global Health Security Index Indicator 4.1.2 which lists the number of hospital beds per 100,000 people and the city's population. We used open source information and government websites to research the number of ICU beds and burn beds. Where possible, we calculated the number of hospitals and hospital beds destroyed by comparing maps of the zones of destruction with hospital locations and by researching the number of beds in each hospital that would be destroyed. We considered that all hospitals within 3.26km from the center of the blast would be destroyed.

The scope of this report is limited to the immediate effects of a nuclear detonation as captured using the NUKEMAP modeling described below. The health consequences of a nuclear weapon detonation would be much more dire over time, when the long-term radiation and psychological effects are included, but for consistency and accuracy, this report limits the temporal scope.

The scenarios of a nuclear bomb detonating over the respective cities were created using NUKEMAP, a digital tool created by Alex Wellerstein, Assistant Professor and the Director of the Science and Technology Studies program at the Stevens Institute of Technology. (Read more about the tool and how it works in the NUKEMAP FAQ.) All of the NUKEMAP calculations were made in February 2021. We used NUKEMAP to assess the number of fatalities and injuries which does not include the impact of mass fire after a nuclear detonation. There are different models to calculate this impact, and uncertainties remain, but using the Postol model, assuming a threshold of 10 cal/cm^2 for mass fires, for a 100kt nuclear weapon, there is a very high probability of injury or death for people within the 4.5 km radius from the detonation center. For airbursts, the type of explosion used in this model, the short term impacts of fallout, as opposed to the radiation which emanates directly from the explosion, are negligible and are not included in the NUKEMAP model.

In this scenario, we detonated the bomb over the center of the city and/or near an important government building. While modern nuclear weapon targets are not public information, de-classified targets from the Cold War indicate that major cities have been the target of nuclear weapons and so it is not unreasonable to conjecture that they may still be targets.

The tool calculates the estimated number of fatalities and injuries from a detonation based on the "ambient population" of an area and the blast effects of the nuclear weapon chosen in the tool. The "ambient population" means the 24-hour average of people in an area, instead of the permanent population living in the area. In the scenarios in the report however, percentages of the city's population that are killed are injured have been calculated based on the permanent population of a city. As the size of the ambient population in relation to the permanent population may vary between cities (depending on factors such as how spread out cities are, how densely populated they are, and the in- and outflow of people living and working in the areas), different cities have varying numbers of fatalities and injuries. In addition, the percentage of a city's population in an attack may vary from one city to another based on how concentrated a city's population is towards the center of the city or how geographically large the city is.

The blast effects are based on the choice of a yield of the nuclear bomb used and whether the detonation is air-burst or ground-burst. In our scenarios we used a yield of 100 kiloton (kt), which is an average size of a nuclear bomb that many nuclear-armed states possess. Most modern nuclear weapons have explosive yields equivalent to at least 100 kt of dynamite - and some are much higher. The bombs dropped on Hiroshima and Nagasaki had the explosive yields of 15kt and 20kt respectively. We also used an air-burst detonation, detonated at an altitude of 1.45km like the nuclear weapon detonated over Hiroshima.

For each country, we chose to only detonate one bomb to show the immediate impact that one nuclear weapon would have. Conceivably, the detonation of one nuclear weapon in a nuclear-armed or nuclear-host state would be accompanied by other nuclear strikes or could trigger a retaliation and escalation of the conflict. However, to simplify the model to be able to replicate it across countries and stay true to the limited temporal scope of the report, we just analyzed the impact of one nuclear detonation.

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