Climate change and gastroenterology: from the frontline

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INTRODUCTION

Despite contributing minimally to global greenhouse gas emissions,[1] Pacific Island nations are at the frontline of climate change impacts.[2] Their heightened vulnerability stems from their geographical dispersal across the expansive Pacific Ocean, which leaves them encircled by vast bodies of water. This unique geological position subjects these island communities to climate-related threats, including rising sea levels, coastline erosion, ocean acidification, loss of biodiversity, food and water insecurities and extreme weather events, jeopardising their existence and way of life.

Pacific Island countries (PICs) and territories

Oceania comprises Australia, New Zealand and the PICs and territories (see figure 1). The three ethnogeographic regions (Melanesia, Micronesia and Polynesia) form the PICs. Of these, 13 are sovereign nations, while others maintain unique political associations with France, New Zealand and the USA.

The self-governing nations have almost 13 million people but only about 2.7 million live on the smaller islands.[3]

They are classified as low-income and middle-income countries.[3] These include the Federated States of Micronesia, Fiji, Kiribati, the Republic of the Marshall Islands (RMI), Nauru, Papua New Guinea, Samoa, the Solomon Islands, Tonga, Tuvalu and Vanuatu. Each country boasts a unique blend of culture, tradition, history and political systems.

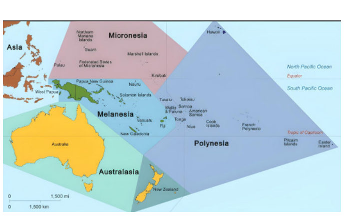

Figure 1 Map of Oceania (Source: map-oceania-05.gif (720×410) (globalsecurity.org).

Rising sea levels and coastal erosions

As Earth becomes warmer due to climate change, sea levels rise via two main mechanisms: expanding heated seawater and melting ice sheets and glaciers.[2]

Because some PICs are low-lying atolls, they face the potential existential threat of vanishing underwater with rising sea levels. The countries with the most significant threat of 'sinking' first are Tuvalu, Kiribati and the Republic of the Marshall Islands. Their highest elevations vary from atoll to atoll, but, generally, they are mostly under 5 m above sea level. The only bridge, which is the highest peak (<10 m above sea level) in Majuro, Republic of the Marshall Islands, is shown in figure 2.

Ocean acidification and coral reef degradation

A significant proportion of carbon dioxide emissions is also absorbed by the oceans, rendering them more acidic.[4] Coral reefs provide habitat for many fish and sea creatures, encouraging biodiversity. The acidification of the ocean causes coral bleaching, their eventual demise[2 4] and the loss of biodiversity.

Extreme weather conditions

PICs are prone to extreme weather events, which have become more common and intense.

Just in the last decade, a series of cyclones have hit the South Pacific with great devastation that has resulted in the loss of lives, displacement of homes, overcrowding at evacuation centres, mental and physical stress and food and water insecurity.

Because frequent extreme weather conditions cause devastation and damage, these PICs face many challenges in building infrastructure resilience.

Ocean gyres and plastics

Gyres, also called ocean garbage patches, are large systems of rotating ocean surface currents. The largest is the Great Pacific Garbage Patch,[5] which is estimated to be about 1.6 million sq. km,[5] or twice the size of the total land mass of

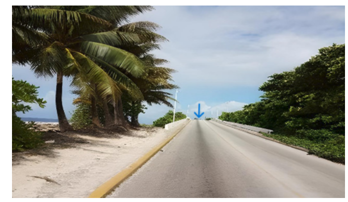

Figure 2 Bridge in Majuro, Republic of the Marshall Islands. The highest point (blue arrow) is less than 10 m above sea level. (Photo: Mai Ling Perman).

the PICs. These ocean patches consist of marine debris, mostly plastic waste.[5]

Apart from the obvious unsightly marine pollution and potential health implications of microplastics ending up in fish and seafood,[6] the relationship between climate change and plastics involves greenhouse gas emissions. Manufacturing plastics produces billions of tons of greenhouse gases.[7] Moreover, over 95% of plastics are discarded after a single use.[8]

King tides and waste

Ocean tides, the rhythmic rise and fall of sea level, are a result of gravitational forces exerted by the moon, the sun and the rotation of the earth.[9] These tidal movements follow a regular and predictable pattern as the moon rotates in its orbit around the earth, and the earth rotates in its orbit around the sun.

With its strong gravitational pull, the moon is the primary driver of tides. When the moon aligns with the sun and the earth, the gravitational pull is most substantial, creating more extensive tidal ranges during the new and full moons, called spring tides.[9]

The sun exerts its maximum gravitational force when the earth is closest to it, which occurs annually on 2 January.[9]

The term 'king tide', originating in Oceania, describes unusually high spring tides. This unique tidal event occurs when the sun, moon and earth align at perigee (when the moon is closest to the earth) and at perihelion (when the earth is closest to the sun).[10] King tides can be highly destructive, leading to coastal inundation and flooding. The local weather and oceanic conditions can amplify the impact

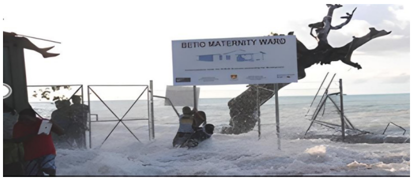

Figure 3 Betio Hospital, Kiribati, during a king tide. (Source: https://www.abc.net.au/news/2016-05-06/fundraiser-launched-to-save-flooded-maternity-ward in-kiribati/7389670).

of king tides, making them a potentially hazardous natural occurrence.

Waste management poses a significant challenge, particularly on low-lying small islands. Landfills, a common practice, are not immune to the forces of nature. Given the limited land mass of atolls, landfills are often in close proximity to the coastal area. With rising sea levels and the regular occurrence of king tides, coastal areas and landfills, where most plastics end up, can be inundated and washed into the Pacific Ocean, underscoring the urgency for sustainable waste disposal methods.

Infrastructure constraints

A study examining the vulnerability of hospital infrastructure in the PICs reveals that 58% of the 76 hospitals in these regions are within 300 m of hydrological threats like the coastline or river.[11] The most vulnerable meet specific criteria: they are less than 100 m from a hydrological threat, have an elevation below 10 m above sea level and cater to over 30% of the country's population.[11]

The 10 most vulnerable hospitals identified are in Kiribati, Palau, the Solomon Islands, Tokelau, RMI and Tuvalu. They serve 50%–100% of their total population.[11] The harsh reality of such threats is depicted in figure 3. It shows Betio hospital, a mere 5 m from the coastline, during one of the king tides in Kiribati.

Airports in the PICs present a unique landscape. Some airports feature expansive runways that occupy a considerable land area (figure 4), while others are located on the periphery of the main island, connected by causeways (figure 5). Regardless of their specific layout, these airports are also near hydrological threats.

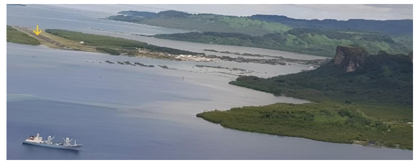

Figure 5 Pohnpei airport, Federated States of Micronesia. The runway (yellow arrow) is within metres from the coast.

The reliance on overseas vendors for significant medical supplies introduces a potential vulnerability in the healthcare system. In the event of damage to the airports, there is a risk of supply shortages, leading to extended waiting periods for essential medical supplies to arrive via sea. This scenario underscores the critical importance of disaster preparedness and resilience planning in ensuring the continuity of healthcare services and the availability of vital medical resources in the face of logistical challenges posed by disruptions to airport operations.

Climate change, impact on digestive health and sustainability

PICs are at the frontline of climate change. Coastal inundations, seawater intrusion from rising sea levels and flooding have negatively affected food and water security in these vulnerable nations time and time again. Furthermore, in places like Fiji, disease outbreaks, such as typhoid and diarrhoeal diseases, become frequent due to overcrowding and poor sanitation in evacuation centres following disasters.

PICs heavily depend on donations of endoscopic consumables to support their healthcare systems. Though they are mostly plastics, the scarcity of their supply has prompted health professionals to adopt a mindful approach towards their usage. In response to the shortage, healthcare providers in these nations are focusing on strategies such as reducing, reusing, recycling and re-evaluating the necessity of these consumables in clinical cases.

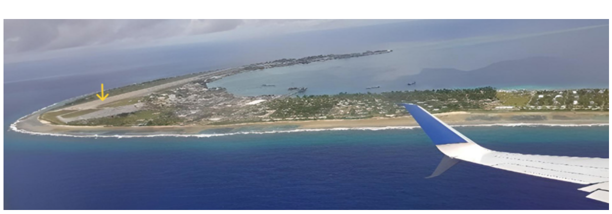

Figure 4 Kwajelein airport, Republic of the Marshall Islands. The runway (yellow arrow) occupies a large land area and is near the coastline. (Photo: Mai Ling Perman).

As per sustainability practices, some measures undertaken are as follow:

1. Donated items should be pre-screened for usefulness before shipment to avoid the potential 'dumping' of other irrelevant consumables.
2. Balloon dilators may be reused on the same patient at another time.
3. Left-over variceal banders may be reused on the same patient later.
4. Variceal banding is prioritised for secondary prevention only.
5. Unused left-over variceal banders may be used as haemorrhoidal banders.
6. Consumables can still be used beyond their expiration date.

By adopting these practices, healthcare providers in the PICs are demonstrating a commitment to sustainability and resourcefulness in the face of limited supplies, ensuring the efficient and effective utilisation of essential medical equipment to meet the healthcare needs of their communities.

Conclusion

Despite contributing minimally to greenhouse gases, PICs are disproportionately affected by the impacts of climate change. They are on the front lines of this global crisis, facing the most severe consequences, such as rising sea levels and extreme weather events. The accelerated pace of global warming poses significant public health risks and existential threats to these vulnerable nations, highlighting the urgent need for international cooperation and support to mitigate these challenges and ensure the survival of these communities.

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