Children's health and the ocean: a planetary connection

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INTRODUCTION

Human health and well-being, even the health of people who live far from the sea, depend on the health of the ocean. The ocean holds 97% of the world's water and generates more than half of atmospheric oxygen. It absorbs more than 90% of excess heat nearly one-third of carbon dioxide (CO_2) emissions and thus slows climate change.[1] It is the principal source of food and nutrition for 40% of the world's population, including 2 billion children. It is the origin of multiple essential medicines. Interactions with the ocean, coasts and salt marshes—'blue spaces'—benefit our physical social development and spiritual well-being.

Pand equitably protected, the ocean has the potential to yield even greater benefits in the years ahead: sustainable sources of food, biotechnology, medicines and energy that could safeguard human health and well-being far into the future.

Today, however, the anth4opogenic planetary challenges of climate change, pollution and biodiversity loss threaten ocean health and the health and well-being of diverse communities, in particular Indigenous communities, children and youth.[2] To alert paediatricians to these growing hazards, we explore the intricate links between ocean health and human health; and we highlight the urgent need for paediatricians and other healthcare providers to advocate for policies that will preserve the ocean, protect health and advance the principles and practices of Planetary Health.

RISKS TO OCEAN HEALTH

Climate change threatens ocean health through multiple mechanisms. Increasing emissions of CO_2, methane and other greenhouse gases cause global warming and drive rising sea surface temperatures. In turn, this disrupts marine ecosystems, accelerates the spread of harmful pathogens and reduces fish stocks.[1] Increasing CO_2 absorption acidifies the ocean which dissolves corals, shellfish and the calcium-containing micro-organisms at the base of the food web that sustains all life in the sea. Hurricanes, cyclones and coastal storms, intensified by the increased energy of a warming ocean, damage marine habitats and destroy coastal communities. Melting polar ice caps and the thermal expansion of warming water cause sea level rise, resulting in coastal erosion, habitat loss, inundation of low-lying cities, and the obliteration of island nations and their inhabitants.[1]

Pollution exacerbates these challenges. Each year, an estimated 10–12 million tons of plastic waste enters the ocean, where it entangles turtles, kills seabirds and breaks down into microplastic and nanoplastic particles that disrupt ecosystems and enter the food chain.[3] Chemical pollutants from agricultural runoff, industrial discharges and oil spills introduce pesticides, heavy metals and hydrocarbons into marine environments, further compromising ecosystem health.

Coastal pollution from sewage and agricultural runoff results in eutrophication, oxygen-depleted 'dead zones' and increased frequency of harmful algal blooms (red and brown tides) that release potent natural toxins and kill millions of fish and cause human illness.[1] Global shipping plays a significant role in marine pollution, emitting sulphur dioxide, nitrogen oxides and particulate matter into air and water.[3]

Biodiversity loss is a critical threat driven by pollution, sea surface warming, unsustainable fishing practices and habitat destruction.[4] Industrial fishing depletes fish populations, destroys marine ecosystems and can cause starvation in coastal communities that depend on the sea. Bycatch, the unintentional capture of non-target species, contributes to ecosystem imbalances and species extinction. Habitat destruction from unreturned coastal development, poorly controlled urbanisation, badly designed infrastructure and dredging destroys critical climate buffers such as mangroves, seagrass beds and coral reefs.[3] These coastal microenvironments are essential for marine biodiversity and ecosystem resilience, as well as for the protection of coastal communities against the ravages of a rising sea.

PLANETARY HEALTH

Over the past decade, Planetary Health has emerged as an interdisciplinary framework that studies how anthropogenic transformations in Earth's natural systems (ie, ocean degradation) can alter human health and well-being.[5] Using this framework, we detail the underlying drivers, proximate causes, mediating factors and health impacts that are associated with the deterioration of the health of the ocean (figure 1).

OCEAN HEALTH AND CHILDREN'S WELL-BEING

A healthy ocean promotes children's health and development in multiple ways. It provides nutritious seafood rich in protein, essential minerals and key micronutrients such as omega-3 fatty acids that promote brain development, enhance cognitive function, improve memory retention, concentration and learning abilities. Clean, unpolluted coastal environments encourage vigorous physical play such as swimming, surfing and beach sports. These activities build children's fitness, motor skill development, balance and coordination, while also supporting mental health and resilience building. Healthy ocean ecosystems further protect children by buffering coastal communities against violent storms, reducing erosion, and minimising flood damage.

THE SOCIAL BENEFITS OF OCEAN HEALTH

Coastal communities, including Indigenous communities, often maintain strong cultural ties to the ocean. Maritime traditions, fishing practices and community celebrations centred on the sea play significant roles in shaping a community's sense of identity and social cohesion. These connections provide children with a rich cultural heritage, instilling respect for nature, stewardship of marine resources, and a deep appreciation for coastal environments.

Access to healthy coastal environments and sustainable seafood resources reduces socioeconomic disparities in coastal communities. Policies and initiatives that prioritise ocean health and environmental justice ensure that all communities have equitable access to clean and safe environments free from pollution and degradation.

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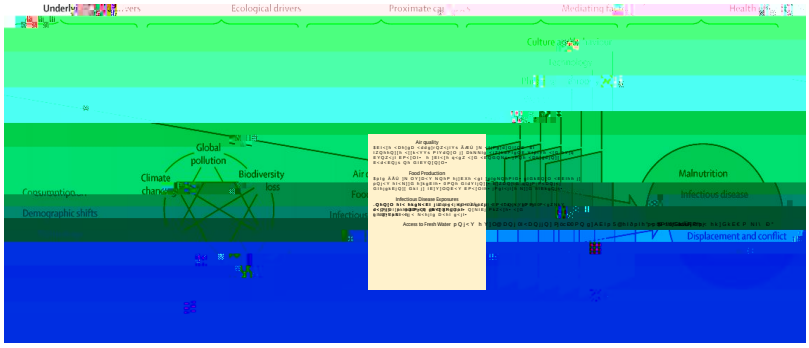

Healthy ocean ecosystems are dynamic educational resources for children and their communities, enabling them to learn about marine biodiversity, ecological systems and sustainable practices. Hands-on experiences in coastal environments create opportunities for exploration and discovery. These experiences develop children's curiosity, critical thinking and problem-solving abilities as they engage with marine life, coastal habitats and environmental challenges. Educational programmes focused on ocean health (eg, participating in beach cleanups and advocating for sustainable fishing practices) equip children with knowledge, confidence and skills that will enable them to become informed advocates for marine conservation and to become good stewards of the environment in their communities and beyond.

CONCLUSIONS

Humanity cannot thrive when the sea is polluted, acidified, overheated, depleted of oxygen and empty of fish. Protecting the ocean for the sake of human health will require strong national and international policies that are guided by good science and heed the voices of vulnerable communities. It will require collaborative action within and across national boundaries to protect, restore and sustainably manage ocean biodiversity. It will require that nations honour the commitments of global laws, treaties, conventions and guidelines designed to slow climate change and curb pollution, including the Paris Climate Agreement, the COP28 and COP16 outcomes, and the UN Global Plastics Treaty. It will necessitate building global partnerships and promoting a greater focus on equity and the protection of human rights for all people, including the right to health and the right to a healthy environment.

Because we paediatricians are trusted leaders, who are seen as credible advocates for children even in today's polarised world, we are in a strong position to make the case that protection of the ocean is essential: not only because it will preserve marine ecosystems, save whales and protect beaches, but because it will protect the health of all people, and especially the world's children, now and into the future.

We must engage the voices of children and youth to speak jointly and argue persuasively for the need to: reduce fossil fuel combustion to slow global warming; reduce chemical pollution and curb plastic production to safeguard children's brains, hearts, lungs and reproductive organs; protect coastlines against shortsighted development; and end unsustainable, industrial ocean fishing. Protection of the ocean is not merely a 'green' concern. It is not conditioned by politics. It is essential for the health of all children and humanity.

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