

Global Medical Supply Inequities

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The global issue of medical supply inequity exists as some countries have excess medical supplies, which leads to large amounts of medical supply waste resulting in both economical and environmental harm. However, many countries face the opposite issue and instead have a shortage of necessary, life-saving medical supplies. The duality of the issue is a harsh and widespread reality throughout the world. For example, the United States generates about 4.7 million pounds of medical waste yearly (Zygourakis et al., 2015; Thiel et al., 2020). In contrast, India, especially during the COVID-19 epidemic, faced a massive shortage of essential equipment like N-95 respirators, face shields, as well as ventilators. To reduce the worldwide inequities that arise due to the imbalance of medical supplies, Blueprints for Pangaea (B4P), a medical surplus recovery organization was founded. B4P, headquartered at the University of Michigan in Ann Arbor, redistributes unused medical supplies to places in need both locally and internationally, effectively reducing medical supply inequities one shipment at a time. This paper aims to explore the key components and global dynamics contributing to medical waste and to consider B4P as a potential model for addressing this problem.

Keywords

healthcare • sustainability • medical waste • nonprofit • equitable • resources • medical devices

Introduction

Medical supply waste is defined as the disposal of unutilized tools and equipment by hospitals and healthcare facilities. Currently, managing medical supply waste is an urgent issue in the field of

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healthcare, yet it lacks adequate recognition. The problem prevails in both developed countries that contribute to the waste of functional materials, and in underdeveloped countries where disparities are evident with the lack of access to basic life-saving supplies. Inadequate access to medical supplies serves as a major barrier to achieving quality healthcare in low and middle-income countries, as it prevents proper interventions needed to diagnose and rehabilitate patients. The World Health Organization (WHO) approximates that 50–80% of medical equipment and supplies in developing countries are not functional, which presents a major hurdle in competent healthcare practice, and heightens negative medical outcomes for even basic illnesses (Moyimane et al., 2017).

On the other hand, healthcare facilities in developed countries, such as the United States, are often in possession of excess supplies and equipment. This results in a large portion of these unused resources to be discarded in landfills. The unnecessary disposal of these resources can be classified as medical supply waste. Medical supply surpluses are often generated as a consequence of healthcare facilities ordering more supplies than needed, resulting in an excess inventory (Khan, 2023). In 2015, a study of 58 neurological procedures conducted at the University of California, San Francisco (UCSF) Medical Center found that 13% of surgical supplies went unused and were discarded - contributing to the estimated 4.7 million pounds of medical waste that United States hospitals alone generate yearly (Zygourakis et al., 2015; Thiel et al., 2020). Consider the UCSF Medical Center, for example, where one of the most discarded supplies was “surgifoam”, a sponge used to control bleeding, valued at nearly \$4000 per sponge (Healthcare Finance News, 2016). Such disposals can add up to \$765 billion dollars per year (Mirza, 2017). It is also important to consider the environmental impacts of this medical supply waste, especially as these resources gradually saturate landfills across the globe. The United States healthcare system is the second largest industrial contributor to landfill waste, and such waste emits sufficient pollutants and greenhouse gasses that negatively influence community health (Association, 2022). A global issue of medical supply inequity exists as there is a stark contrast between the surplus of medical resources some countries have, while others face medical supply shortages; Blueprints for Pangaea, a medical supply recovery organization, aims to address these inequities through the redistribution of unused medical supplies.

Case Study: Comparing Medical Supply Excess and Need

In order to contextualize the impact that excess medical supplies and corresponding supply waste have had, it is important to examine both ends of the spectrum: countries with a medical supply surplus and countries facing extreme medical supply shortages. Consider how India, for example, dealt with an extensive medical supply shortage during the COVID-19 pandemic. During India's first wave (March 2020 - Nov. 2020; peak occurring in ~Sept. 2020) and second wave (Feb. 2021 - May 2021; peak occurring in ~April 2021) there were extreme medical supply shortages observed throughout the country (Natarajan & Prasad, 2021). Initial reports of a lack of basic medical supplies came during the early days of India's first wave, when hospitals recorded complete stockouts of N95 respirators (Ray, 2020). However, the reports concerning a lack of available respirators were soon trumped by the extreme shortage of ventilators, oxygen concentrators, and additional supplies essential for keeping infected and deteriorating patients alive (Sarfranz et al., 2022). An oxygen concentrator is a device designed to assist patients with taking in oxygen, while a ventilator is a life-support machine that breathes for patients who cannot on their own. A lack of life-sustaining supplies such as oxygen concentrators and ventilators was observed during India's second wave, and

as a result healthcare workers were often put into an impossible position to decide which patient received life-support and which patient did not (Kapoor et al., 2023). As such, many obstacles faced by India during the COVID-19 pandemic have been emphasized by abrupt equipment shortages. A survey-based study from 2020 was distributed to board-certified physicians providing care to critically ill patients at Indian hospitals, which included 481 hospitals in phase one (March 25, 2020 - April 6, 2020) and 320 hospitals in phase two (April 20 2020 - April 30, 2020), and found that 71% of respondents were “unaware of their personal protective equipment stock or [knew] that their current stock would not last [over] a week” (Haji et al., 2020). The same study also found that only 17% of respondents from phase one reported “having enough [personal protective equipment] stock to manage (Haji et al., 2020). It is clear that India, along with many other developing countries, faced significant challenges regarding patient and provider care during the COVID-19 pandemic that were brought upon due to a lack of basic supplies. While more developed countries also faced shortages in medical supplies during this time period, medical facilities in these regions had the opportunity to purchase and acquire higher amounts of supplies earlier, which alleviated some of the consequences and pressures they faced during the pandemic.

It is valuable to identify the existence of these supply shortages, as they directly impact both patient care and healthcare workers’ health. There is a strong relationship observed between the acceleration of disease and the number of infectious patients seeking both care and testing (Bhattacharya et al., 2020). In the case of SARS-CoV-2 (an acute respiratory syndrome that causes COVID-19), virus transmission is observed mainly through airborne particles (CDC, 2020). Thus, with the drastic increase in the number of individuals seeking healthcare during COVID-19, there was an adjacent increase in need for personal protective equipment (PPE) to prevent the spread of infection among patients (Bhattacharya et al., 2020). For context, PPE is a broad term that encapsulates any specialized equipment or clothing that is worn by an employee (most often healthcare workers) to protect themselves against infection (Personal Protective Equipment (PPE) for Infection Control, 2023). Furthermore, maintaining optimal PPE levels is also identified as a key to minimizing COVID-19 infection in healthcare workers (Haji et al., 2020). Common PPE utilized by healthcare staff during the COVID-19 pandemic includes gloves, surgical face masks, goggles, gowns, face shields, air-purifying respirators (removing contaminants such as gasses, vapors, or aerosols from the air often through the use of filters or cartridges), and N95 respirators (respiratory protective device characterized by a close facial fit and capacity for filtration of airborne particles).

On the opposite end of the issue, there are a plethora of healthcare facilities that dispose of usable equipment every year, and partake in exacerbating the effects of medical supply waste. Products most often disposed of include unopened clinical kits, leftover materials from post-surgical procedures, and surplus hospital equipment (Atasu et al., 2017). Waste generation is commonly observed in more developed nations, primarily because they have access to a reliable inventory of medical equipment and a larger budget. Therefore, countries in this category can purchase and receive the newest medical supplies to replace existing supplies with much greater ease than India, for example. Consider the United States, a country that massively contributes to medical supply waste. In 2014, a study conducted by a research team at Johns Hopkins discovered that healthcare facilities within the United States dispose of ~5.9 million tons of “reusable medical products” every year (Atasu et al., 2017). More specifically, a further report utilized data from this study to determine that major hospitals of the United States dispose of unused operating room surgical supplies worth \$15.4 million per year (Wan et al., 2014). It is important to establish that these supplies are wasted through disposal, as they have potential to be effectively salvaged and utilized to ease supply

shortages in areas of need. Although many types of medical supplies are disposed of out of necessity (expiration dates, quality assurance, regulatory requirements), there is a massive amount of supplies wasted when it could be allocated towards relieving shortages in underdeveloped nations (Atasu et al., 2017). The United States is a prime example of this, and it is valuable to acknowledge the persistence and wide-range of this issue, in hopes of addressing the medical supply waste and aiding in the recovery of unused supplies.

A Potential Solution for Reducing Healthcare Inequities: Blueprints for Pangaea

The massive waste of medical supplies has prevailed as a lesser-recognized public health issue for years, and there are a limited number of individuals and organizations dedicated towards addressing this global issue. With knowledge of the disparities created by medical supply waste in mind, Blueprints for Pangaea (B4P), a 501(c)(3) not-for-profit medical surplus recovery organization, was founded in 2013 to provide sustainable solutions targeting inefficient health care resource distribution (Blueprints for Pangaea, n.d.). B4P operates through a current network of nine united university chapters, and the organization's headquarters resides at the University of Michigan. B4P partners with US hospitals, healthcare facilities, and suppliers to reallocate excess, unused medical supplies that would otherwise be discarded to various countries and areas of need internationally (Blueprints for Pangaea, n.d.). As a whole, Blueprints for Pangaea strives to alleviate health inequities and address the problem of medical supply wastage by redistributing surplus medical resources from areas of surplus to those in need.

B4P uses a comprehensive model in order to handle and execute shipments locally and internationally. By collaborating with various healthcare partners, the organization receives excess medical supplies and equipment, which are then stored in a designated warehouse. Specifically, in Ann Arbor, B4P's largest medical supply donor is Michigan Medicine (hospital system located in Ann Arbor, MI). Many of B4P's recipient organizations include local organizations like Hope Clinic, the Shelter Association of Washtenaw County, student run free clinics at the University of Michigan and Wayne State University, along with many other partner organizations. B4P's most recent local shipment was conducted with the Planned Parenthood of Michigan, donating about \$9,000 worth of medical supplies. Since the organization headquarters are in Ann Arbor, there are many local disparities that B4P aims to address. In addition to medical shipments, Blueprints for Pangaea also hosts an annual *Day of Service* to engage with the local community, performing various service projects. These include creating care packages that are donated to the Shelter Association of Washtenaw County located a few minutes from the University of Michigan campus. Also, various blankets are made, which are then donated to children's hospitals in the Metro Detroit Area.

Global partners also exist as Blueprints for Pangaea has conducted multiple international shipments to Mexico, Syria, Ukraine, India, and many other countries. After receiving medical supplies in the B4P warehouse, a team of members then inventories the received medical supplies, filtering by type, expiration date, and quality. Simultaneously, another group of members consolidates a list of various potential recipients, and begins comparing each recipient's supply needs with the warehouse inventory. After taking financial and logistical matters into consideration, the organization holistically chooses a recipient whose need most closely matches B4P inventory to ensure the best use of resources. Critics may argue that the medical supply reallocation process is futile,

as on occasion, organizations donate supplies that the recipient already possesses, or supplies are damaged or expired (Compton et al., 2018). For example, Haiti was in desperate need of medical supplies after a major earthquake in 2010, and while they received many donations, much of it was damaged or unusable given the hospital's circumstances and environment (Compton et al., 2018). However, Blueprints for Pangaea eradicates these barriers by implementing a meticulous inventorying process, ensuring each pallet of supplies sent to a recipient is unexpired, up to the standard for quality, and compatible with the hospital's abilities and needs.

Blueprints for Pangaea does face some of its own challenges as an organization. The inventorying process described above is tedious and time consuming. B4P organizes volunteering events to engage with the community and spread awareness regarding the issue of medical supply wastage. Thus, other organizations around the Ann Arbor campus as well as local high schools help by attending the inventorying events and sorting through donated medical supplies. The entire inventorying process is continuously being revised as the team evaluates and finds room for improvement. Additionally, the organization requires funding to conduct the various shipments of medical supplies and pay for warehouse rental fees. Part of B4P's finance department is solely dedicated to continuously sourcing and writing various grants. The majority of B4P's funding comes from grants that are applied for, some of which are through the University of Michigan itself. A portion of the organization's funding also comes from donors, which consists of other healthcare organizations, high net-worth individuals, or companies such as Colgate and Zipcar. To mitigate some of the challenges that B4P faces, the organization is currently in the process of developing an inventorying app which can scan various medical supplies' barcodes and input the necessary data into a database that members can analyze. B4P's unique model and commitment to its mission keeps the organization motivated and successful despite the difficulties encountered as a medical surplus recovery organization. This has permitted the organization to execute many local and international shipments since its founding in 2013.

To highlight B4P's tangible impact, in August 2021, the organization executed a shipment to India in response to the COVID-19 pandemic. The shipment entailed sourcing various PPE items, specifically N95 respirators, face shields, and surgical masks. To ensure the proper medical supplies requested by the recipient organization in India, Manav Sadhna, were received, B4P consulted its major supplier, Michigan Medicine, as well as additional clinics. Local clinics identified in the metro-Detroit area, Community First Health Centers and Lake Huron Medical Center, were able to contribute their excess PPE supplies and monetary donations to support B4P with shipment expenses. After the supplies were received in India, they were distributed at various COVID-19 vaccine distribution centers in "68 low-income communities in Ahmedabad and 946 villages across Gujarat" (Manavsadhna, 2021). With the help of B4P, Manav Sadhna was able to deliver over 4,500 medical kits to rural communities (Manavsadhna, 2021). Healthcare providers were able to utilize the face shields and N95 respirators to protect themselves from contracting the virus (Health and Awareness – Manavsadhna, n.d.). In addition, the surgical masks were given to patients as they arrived at the various centers. Overall, twelve pallets of medical supplies worth over \$200,000 were donated to Manav Sadhna, B4P's recipient organization in India (Blueprints for Pangaea, n.d.). B4P's model allows the organization to reduce existing inequities in areas that lack medical supplies, and thus help patients receive the best care possible.

As mentioned previously, Michigan Medicine is the major supplier for B4P's headquarters. The hospital system sends a few pallets of medical supplies to the B4P warehouse on a biweekly basis. These pallets go through the inventorying process as volunteers come to the warehouse and are led

by B4P members. This helps the organization estimate what types of medical supplies are donated and the quantity of these supplies. Inventorying allows B4P to accurately match what exists in the warehouse to recipient needs and requests. Michigan Medicine is one of the largest hospital systems in the state of Michigan and has just over one thousand hospital beds (Kar, 2021). As a result, large amounts of unused medical supplies are generated that would otherwise be discarded to landfills. B4P's operation model helps reduce this wastage and gives supplies a new purpose towards alleviating health inequities globally.

Medical supply wastage is a prevalent issue that affects areas worldwide in a disproportionate manner. As some countries deal with large amounts of medical supply surplus, others are left without the basic medical necessities needed to provide proper care to patients. Moreover, the majority of excess supplies generated ends up in landfills exacerbating growing environmental concerns. Blueprints for Pangea aims to address and reduce the disparities that arise from this problem by reallocation of excess medical supplies to those with greatest need. The B4P model exemplifies that tangible change can be created by reallocating medical supplies both locally and globally. In the future, B4P aims to expand to have global chapters, which can help inform new audiences of medical waste, propose new ideas to tackle the problem, and take global action in order to address medical supply inequities.

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