

Medicine from the Sky: Community Outcomes of Drone Deliveries in the Himalayan Region

BRIEFING PAPER

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Introduction

Providing equitable healthcare access using drones helps to ensure that no one is left behind.

One of the central principles of the United Nations' 2030 Agenda¹ and the Sustainable Development Goals (SDGs)² is "leave no one behind". In practice, this transformative proposition entails ensuring that every individual worldwide can access basic human rights, with healthcare being particularly significant. India, as one of the fastest-growing economies, with its large population and considerable diversity in geographical, social and economic conditions, serves as a compelling case study, highlighting the various challenges that may arise in seeking to meet this goal.

According to a 2024 report by public policy think tank NITI Aayog, India has consistently improved its score for delivering on Sustainable Development Goal 3 (Good health and well-being)

over the past five years.³ Additionally, government health expenditure as a proportion of total health spending has steadily increased in India, leading to a corresponding decline in out-of-pocket costs.⁴ While these trends are positive, the Economic Survey of India 2023–2024 highlights that, although welfare spending is essential, it is imperative to focus on transforming the implementation and effectiveness of government programmes to maximize the impact of each rupee spent.⁵

In this context, emerging technology can play an important role. In particular, the use of drones can have a transformative impact on ensuring access to healthcare for all communities while delivering greater efficiency in the use of resources.

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The need for swift healthcare deliveries

Healthcare provision in India requires innovative solutions to strike a balance between access to services and efficient use of resources.

India's primary healthcare infrastructure is highly complex, expansive and effective. The system works hard to ensure that all citizens have access to primary healthcare. However, despite consistent government efforts, the diverse geographical terrain and challenging climatic conditions often mean that populations who live in remote and/or hilly areas have limited access to healthcare services.

In the Himalayan belt, the state of Arunachal Pradesh, in the northeastern extremity of India, is characterized by steep mountainous terrain and dense forests, which pose significant challenges to surface transport and infrastructure development; the fact that the population is dispersed in small settlements scattered across extensive mountain ranges further complicates the provision of healthcare services to all communities. In the East Kameng district of the state, the distance between the district hospital in Seppa and the community health centre in Chayangtajo is just 84 km (52 miles), but due to the mountainous topography it takes approximately six hours for an ambulance to travel

between these two locations. During the monsoon season, severe landslides frequently disrupt the route, resulting in the two medical facilities being completely cut off from one another, sometimes for several days.

Delivering healthcare quickly is a particular challenge in such hard-to-reach regions. Early in the 2010s, for example, rural Telangana in south-central India faced an increase in snakebites – potentially lethal if not treated rapidly – and there was a pressing need to deliver anti-venom vaccines quickly in order to maintain their effectiveness and boost immunization. An even larger emergency hit with the COVID-19 pandemic. Self-testing kits, and afterwards vaccines, needed to be delivered without delay and in large quantities throughout the vast Indian territory.

Technology provided a possible solution: the use of drones to ensure speedy delivery of testing samples and vaccines. This was the rationale behind the start of the Medicine from the Sky (MFTS) initiative.⁶



Initiation

In September 2020, India launched its first coordinated drone-based medical delivery programme.

The Himalayan drone network completed two years of operations on 15 August 2024, India's Independence Day, making it the country's longest-running drone delivery network.

↓ Children waiting for the drone at its destination.

Source: Ground team at Arunachal Pradesh

In a trial programme in Vikarabad, Telangana, drones were used to transport medicines, vaccines and samples to local health centres from medical stores and district hospitals. A total of about 10,000 doses of vaccines were transported using drones over a period of six-week trials covering more than 850 km (530 miles). The Vikarabad trial, as the first, was designed using inputs from healthcare experts, policy-makers and state governments. This were followed by a full-scale pilot programme in Arunachal Pradesh, where lessons learned from the trial were implemented to document how health systems respond when drones are integrated. The Arunachal Pradesh pilot programme was funded by the United States Agency for International Development (USAID) under the Sustainable Access to Markets and Resources for Innovative Delivery of Healthcare (SAMRIDH) programme managed by IPE Global.

By 2024, the initiative had covered a catchment population of more than 100,000 people, bringing primary healthcare closer to their doorstep. Individuals, including children and elderly people, have benefitted immensely from drone-based solutions. Upwards of 700 flights have flown more than 15,000 aerial km (9,300 miles), resulting in over 12,000 medical products – including diagnostic samples, vaccines and medicines – being delivered in Arunachal Pradesh. In a special case, the World Health Organization also used the drone service to transport measles/rubella (MR) samples from a remote village. Approximately 15,000 hours of land-travel time were saved during the initiative. Over and above the flight statistics, the initiative has benefitted numerous key stakeholders over the last mile.

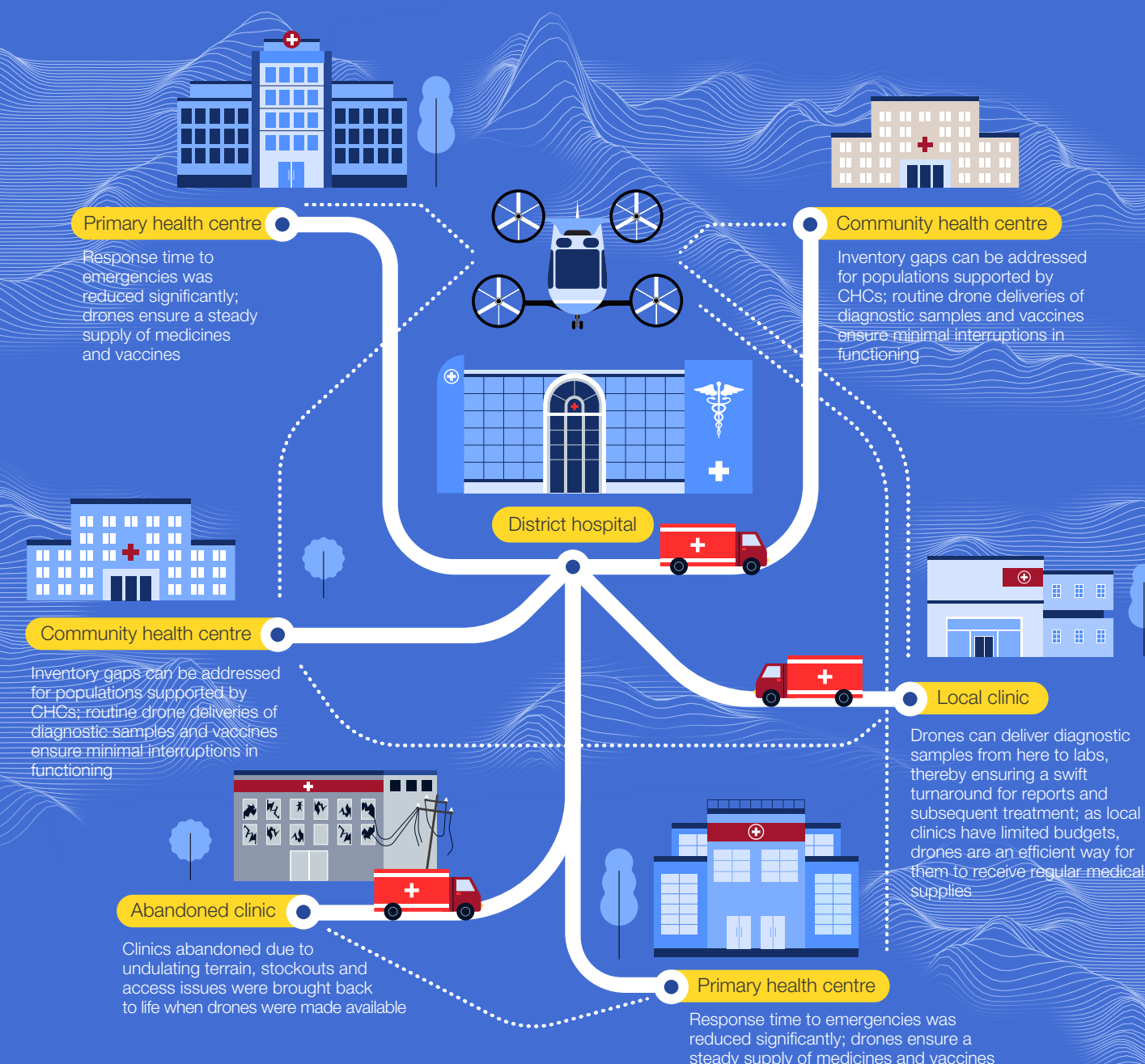


FIGURE 1 | High-level diagrammatic representation of the drone distribution system

The Arunachal network has become India's longest-running drone delivery network

15,000+ KM
covered through rain, wind and sunshine

10,000+
different products delivered



3

Principal areas of impact

Medicine from the Sky has transformed local medical services, created new jobs, provided opportunities for women and holds the potential to have a positive environmental impact.

3.1 Saving patients time and money

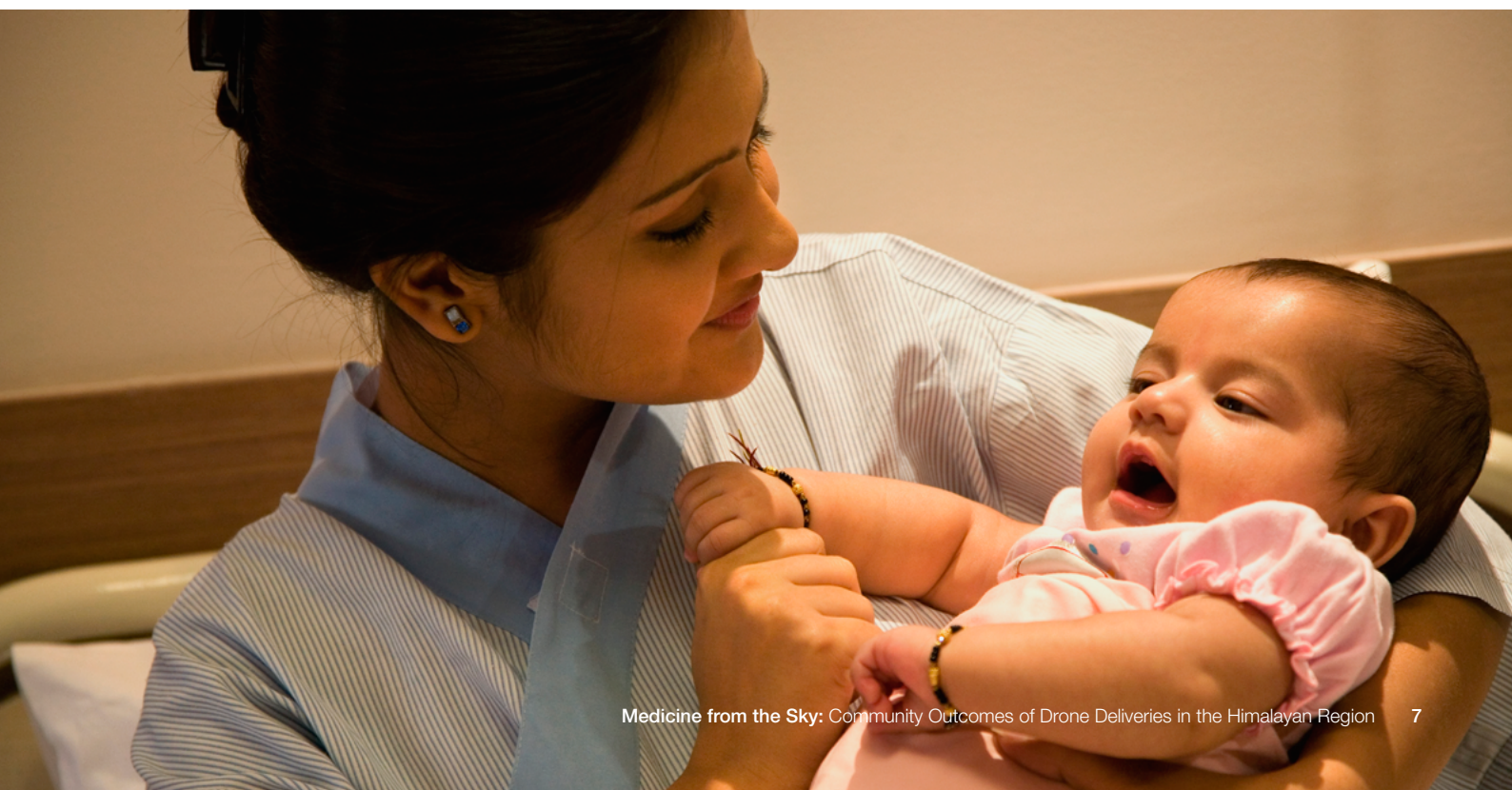
In rural areas with highly undulating terrain, travelling from a remote settlement to a primary health centre or district hospital can be an arduous effort, sometimes involving several individuals over a few days. A sick patient may need to arrange for transport and to be accompanied by family members for support. Travel to the health centre and incidental costs such as for places to stay

and medicines form a significant part of the total expense. Drone delivery saves rural patients time and money: the ability to deliver medicines and diagnostic samples to laboratories, sub-centres and community/primary health centres (CHCs/PHCs) by drone can save them as much as three days and several thousand rupees in costs.



We came to know about it a month ago in the church. Due to the poor road conditions, inadequate supply of medicines and such, the community greatly benefits from this initiative. This also removes the need to travel long distances to the district capital to get tested, as now blood samples can be flown out using the drone. I hope the project continues in our state.

Father Johnny, Holy Cross Church



3.2 Providing local training and jobs

Training local people to operate the drones is an important part of the programme. In Arunachal Pradesh, locals proved to be skilled and adaptable. Training was also offered in the proper handling

and cold storage of medical supplies, equipping the community to operate and maintain the drone delivery system, creating new jobs for local people.

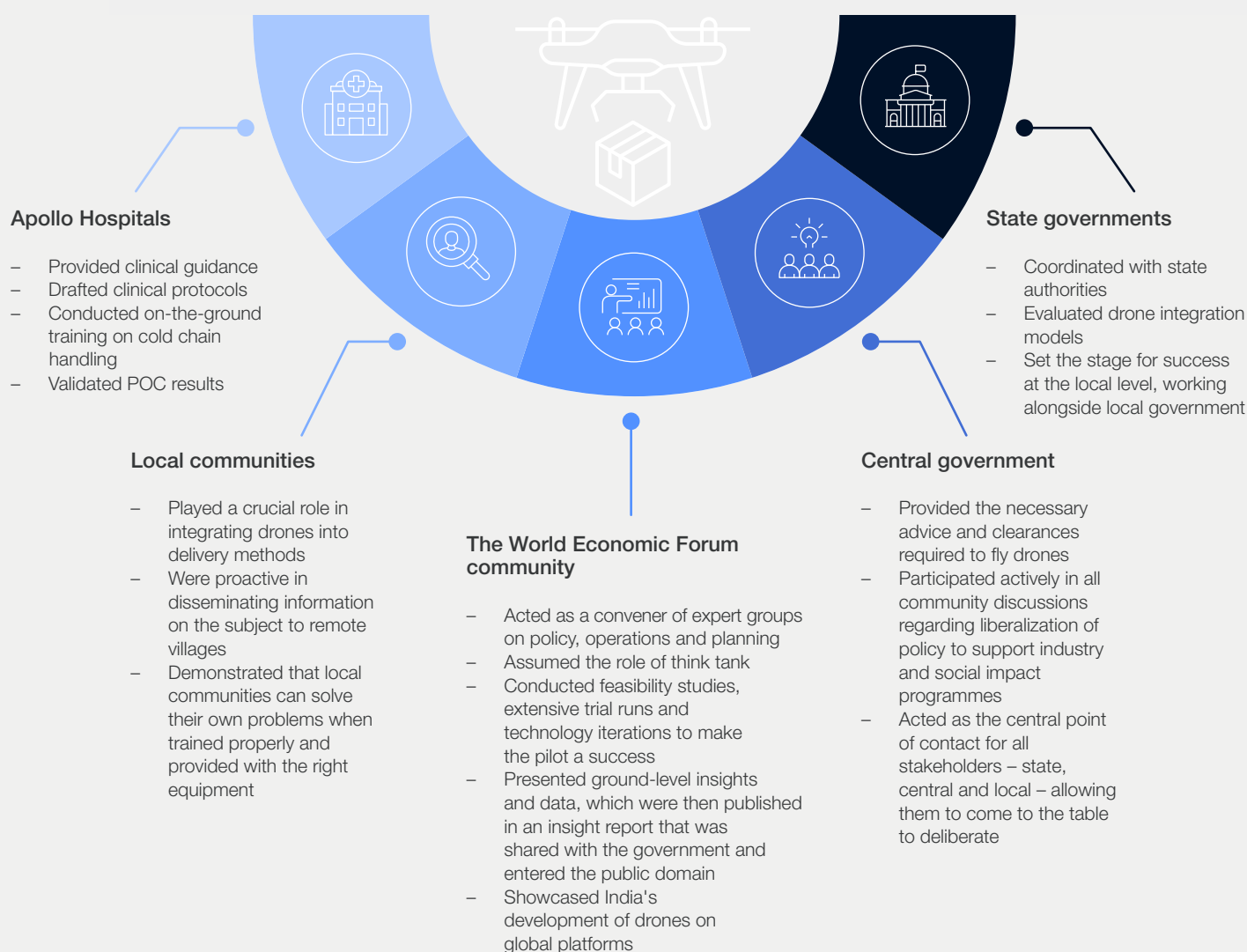


↑ An Apollo healthcare expert training session on handling cold chain management for medical supplies during drone operations.
Source: Apollo Hospitals



↑ A local healthcare worker prepares a drone for take-off post-training.
Source: Redwing

FIGURE 2 | Stakeholders who contributed significantly to the initiative



Source: World Economic Forum

3.3 Opening up women's participation

In 2023, Jasmine Nikh became Arunachal Pradesh's first woman pilot. As a trained paragliding expert, Nikh was intrigued by the MFTS initiative after reading an article in a local newspaper. Her debut operating a drone was witnessed by scores

of spectators, including members of her family and people from her village. As the first woman drone operator from North East India, she has set an example for other young women who may be interested in taking up the role.⁷

3.4 Empowering local workers

Local workers quickly became adept at mounting and dismounting, loading and unloading the drones. Fifteen local youths were employed as operators and healthcare workers, two of whom were also recognized by USAID (the principal funding agency for the pilot programme) for their contributions.

Doctors gained access to faster screening services and as a result of the initiative were able to make swift, effective diagnostic decisions. Healthcare services could be provided in periodically functional health facilities.



This is a very good initiative from our government and shows they care about us even though we are far from Itanagar. I have heard people can send their blood samples using this drone to Seppa and get the reports back on WhatsApp. This is helping people save a lot of time and money as you know the road conditions are not that good.

Tame Yangfo, community member, Chayangtajo



3.5 Having positive environmental impacts

Because drones are electric, they have the potential to reduce CO₂ emissions vs. traditional means of distributing vaccines and medical supplies by land. In the long term, using drones and other larger

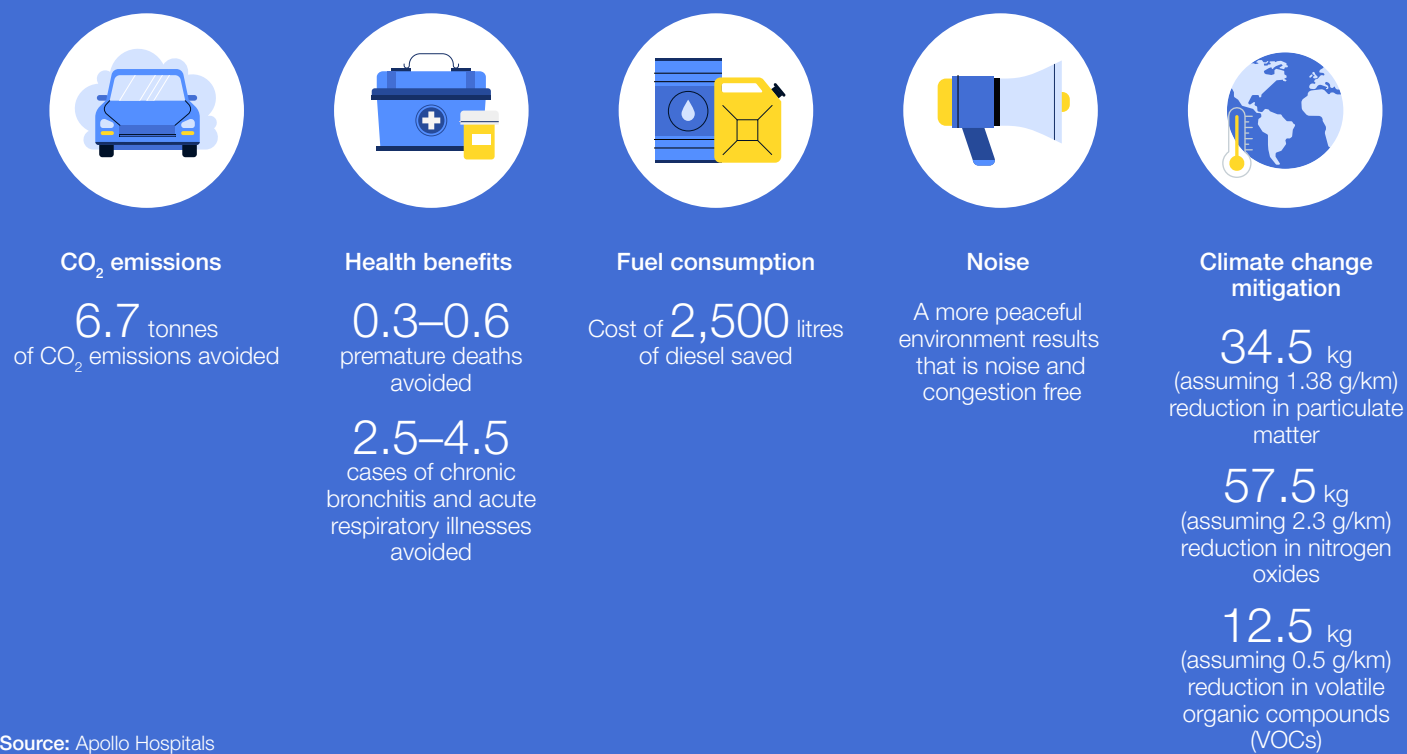
advanced air mobility vehicles can enable the more efficient delivery of goods and people to remote areas, avoiding the need to construct intrusive road infrastructure in protected natural areas.

FIGURE 3 | The environmental impact of using drones instead of traditional vehicles



Being electric, drones have the potential to reduce **CO₂** emissions compared to traditional means. In the long term, drones and other larger advanced air mobility vehicles can be used to connect goods and people to remote areas, avoiding the need to construct more intrusive road infrastructure in protected natural areas.

Assuming a diesel vehicle covers **25,000 km** (15,500 miles) in hilly terrain annually at a mileage of **10 km/l**, the environmental impact of taking it off the road for one year is as follows:



Source: Apollo Hospitals

3.6 | Influencing capital expenditure decisions

In Arunachal, community health centres that had become defunct because of accessibility issues and stock outs of medicines were brought back into the grid solely because the use of drones helped solve such problems. Doctors returned to these centres and medicines could be supplied on demand. In

the future, decisions on new infrastructure and construction could well be based on the robustness and expansion of the drone network. One further consideration is that a rise in demand for drone operations will result in a crowded sky at lower altitudes.



↑ The Redwing drone fleet used in the Arunachal Pradesh pilot programme seen against the backdrop of the Himalayas.

Source: Redwing

BOX 1 | Drones provide a new supply line

Using drones has given rise to a new indent process – which mirrors the existing system used for drugs and vaccines but is kept independent, making it easier for healthcare facilities to administer. The new system helps doctors to

maintain the supply of medicines and ensure no patient returns home empty-handed. More frequent deliveries mean emergency medicines are no longer stocked out, resulting in a better service than the previous bimonthly medicine delivery system.

3.7 | Ensuring local awareness of benefits

The MFTS initiative ensured that local populations and governments were involved. Local governments were instrumental in conveying the importance of drones to the people of their region and the need for them. The Arunachal initiative included a drone ambassadors' programme in which the heads of all

villages were called upon to nominate local youth as ambassadors. Children from local schools were also invited, to boost interest in the technology. Collaborations included essay-writing and drawing competitions for local children.



Post-delivery, my wife could not pass urine. I informed the local ASHA [accredited social health activist] about this. The ASHA contacted the MO [medical officer] (she was present at the PHC that day), who got a catheter delivered using the drone to the PHC and treated the patient. I will be forever grateful to these two for saving my wife's life. The drone saved my wife's life. Thanks to the MO and the ASHA.

Ato Tayem, community member and husband of beneficiary, Bula camp



↑ Local children in Seppa, Arunachal Pradesh, look on as a drone bearing medicines takes flight.

Source: Redwing



↑ A local school in the town of Chayangtajo, Arunachal Pradesh, held a poster-making competition to welcome drone flights.

Source: Redwing

BOX 2 | Drones aiding with childbirth-related complications

The MFTS initiative has touched many lives. A notable story is that of an Indigenous woman near Bula Camp village in East Kameng district. When this young mother experienced complications during childbirth, there was a high risk of infection and her life was endangered, necessitating travel to a district hospital for an immediate procedure. As the mother could not and did not want to travel,

visiting the district hospital was not an option, but fortunately the drone service was operating in her village. Local medical staff sent a request for the products they needed to enable them to conduct a quick procedure and the drone was able to transport these quickly and efficiently. The treatment took place without incident in the mother's home.

Comparing drone operations to their alternatives

Drones are better suited than road vehicles to offering on-demand diagnostics and deliveries. They can bring urban-level care to rural areas.

4.1 Advantages of drones

Faster

In the pilot programme, drones were found to be up to eight to 10 times faster than alternative means of delivery; it is very challenging to deliver an on-demand drug and medical diagnostics network using road vehicles. In the drone network, while all health facilities in East Kameng can be reached within 40 minutes, the same cannot be said for a

road network. If a patient needs medication urgently or a health facility is running out of drugs, drones are better able to fulfil these requirements, and the waiting time for patients is subsequently reduced. Generally, drones offer near-equivalent care compared to a patient visiting a laboratory directly.



In Bameng, normally four times a year we order bulk supplies, and every time it costs us around 3,000 rupees. It also takes a whole day to receive the delivery due to the poor road conditions. Drones, on the other hand, are very fast and can bring in medicines from Seppa in just about 20 minutes.

Medical officer in charge, Bameng Primary Health Centre

Better in adverse weather conditions

Districts in the Himalayan belt can face rains and landslides for up to four months a year. Therefore, road networks are severely damaged and disrupted for a significant amount of time. This makes it challenging and impractical to offer uninterrupted healthcare using a road-based network. Drones are far superior in this respect. Even though drones also have

difficulty flying in medium and heavy rains, they proved their light-rain capability during the pilot programme.

In addition, drones' capacity to operate in the aftermath of heavy rain or a landslide makes them much more reliable than land-based networks during the rainy season.

BOX 3 Need for stress testing

Drones must be operated in extreme conditions so extended stress testing of drone systems is a necessity. While hybrid vertical take-off and landing

drones (VTOLs) may handle mild to moderate rain and wind speeds, emergency situations during rough weather must be tested.



↑ A Redwing drone with a medical payload takes off.
Source: Redwing

More agile than ground transport

The speed and agility of a drone-based network is comparable to that of a 15-vehicle, 30-person road network team. Turnaround times matter greatly for

high-quality diagnostics services. A road-based network would also be inoperable for many months due to landslides.

4.2 A drone-enabled future

1. MFTS in the Himalayan region highlighted the potential for scaling drone-based healthcare delivery across states in regions with similar geography. The programme illustrated that sustainable growth can be achieved through public-private partnerships, investment in research and development (R&D), supportive policies and empowering local communities.
2. The programme demonstrated that other payloads could be carried and diseases addressed if drones were used to access those

areas; for example, to aid with chronic disease treatments such as for TB and HIV, and delivery of dialysis and surgical instruments

3. In combination with drone deliveries, telemedicine services can ensure comprehensive healthcare solutions over the last mile, enabling remote consultations with specialists coupled with timely delivery of prescribed medications.

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Endnotes

1. United Nations. (n.d.) *Transforming our world: The 2030 Agenda for Sustainable Development*. Retrieved August 6, 2024, from <https://sdgs.un.org/2030agenda>
2. United Nations. (n.d.). The 17 goals. Retrieved August 6, 2024, from <https://sdgs.un.org/goals>
3. NITI Aayog. (2024). *SDG India Index 2023–24: Towards Viksit Bharat: Sustainable progress, inclusive growth*. https://www.niti.gov.in/sites/default/files/2024-07/SDG_India_Index_2023-24.pdf
4. Information taken from National Health Accounts Technical Secretariat (NHATS) estimates for India (2019–2020). See, for example: Ministry of Health and Family Welfare (2023, April 25). <https://pib.gov.in/PressReleaseframePage.aspx?PRID=1919582#:~:text=The%20government%20spending%20on%20health,%2D15%20and%202019%2D20>
5. Government of India. (2024). *Economic Survey 2023–24*. <https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf>
6. World Economic Forum. (2022, August 15). *World Economic Forum's 'Medicine from the Sky' drone delivery programme set for take-off in Indian state of Arunachal Pradesh* [News release]. <https://www.weforum.org/press/2022/08/world-economic-forum-s-medicine-from-the-sky-drone-delivery-programme-set-for-take-off-in-indian-state-of-arunachal-pradesh-a5d18ddc40/>
7. North East Live TV. (2023, March 18). *Meet Jasmine Nikh, the first female drone operator in India's health sector*. <https://northeastlivetv.com/around-ne/meet-jasmine-nikh-the-first-female-drone-operator-in-indias-health-sector/>



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