

# Clinic In A Can: meeting the needs and challenges of healthcare delivery in rural Africa

Michael Joseph Wawrzewski III is a US physician with an interest in engineering. Working in remote areas led him to realise the need for innovations and the ubiquitous shipping container was reinvented

## Our story

Years ago, a Kenyan man told the story of his sister, who had come home to have her first baby. While home, she began running a fever, and the family decided to take her to the nearest hospital, 10 miles away through rough terrain. Utilising their only method of transportation, the family took turns pushing and pulling their ailing relative in a wheelbarrow. Somewhere between the village and the hospital, she and the baby died.

Over the past 24 years, we have heard many such stories and witnessed their effects first-hand. Too often people suffer and die needlessly without receiving simple medical treatment.

Many seek to build traditional brick and mortar hospitals for communities. Often, however, the cost, time, and government limitations make this impractical and unobtainable. In spite of these obstacles, something must be done to bring help and hope to communities within which no healthcare facilities exist within hours or even days' distance.

Clinic In A Can was conceived in 2002 as a solution to this problem. We desire to transform communities by manufacturing affordable, re-locatable medical facilities, equipping local doctors and nurses to do what they do best: care for those in need. We have taken great pains to develop our platform from the highest quality components, with sustainability and longevity in mind. Geography should not be the deciding factor if someone lives or dies.

## Why a shipping container?

Shipping containers are the accepted method of transporting goods internationally with over seventeen million containers in the world today. The logistical infrastructure for the modern day container has been developed in every country. Containers are transported either by ocean going ships, trains, trucks and as urgency necessitates, worldwide by planes or to remote locations by helicopter.

Michael Joseph Wawrzewski III, BS, PA-C is a Physician Assistant specialising in Emergency and Critical Care Medicine. He founded Hospitals of Hope in 1998 and soon after constructed a level II hospital in Cochabamba, Bolivia. Michael was the recipient of the 2005 National American Academy of Physician Assistants Humanitarian of the Year award and the 2008 National Frist Humanitarian Award from HCA (Hospital Corporation of America). He is currently spearheading the Clinic In A Can global healthcare initiative.



Ever since the first shipping container was constructed, individuals have transformed these steel boxes into economical living quarters or businesses. Made from 12 gauge steel, the shipping container is very durable and structurally sound. Engineered to carry over 45 000 lbs of internal cargo with an additional six containers stacked on top, the shipping container is a virtual engineering marvel.

Though as the container was transformed from its original intended purpose to one in which humans desired to inhabit the structure, inherent issues were discovered. Uninsulated and typically painted a non-reflective color, the shipping container virtually turns into an oven when exposed to the ultraviolet rays of the sun.

## Creating a modern medical space envied by all

Our early attempts to convert a shipping container into a clinic was disastrous. We were plagued with the same issues all owners of converted containerised buildings endured. Attempts to mitigate these issues were met with inconclusive results. What seemed to be affordable construction materials for interior wall studding and finish were prone to termite infestation and mold.

To meet the strict medical codes for a clinical space required total re-engineering. Wood studs were replaced with galvanised steel eliminating the threat of termites. A new type of insulation was used that turned the shipping container into a thermos. Heat stayed out, cool air stayed in and any exterior ambient noises were reduced by 30 decibels when utilising this new insulation. The walls and ceilings were replaced with hospital grade materials that were washable and required no maintenance. Armstrong seamless vinyl flooring and Midmark steel-pressed and powdered coated medical cabinets completed the interior clinical space.



### Solar powered air conditioners?

As the interior space of the container clinic dramatically improved, another basic issue needed to be addressed, climate control. Inefficient but affordable window air conditioners were our first solution, powered by diesel generators. Soon we changed to split air conditioning units. Inverter technology (DC) was incorporated into these split air conditioning compressor motors which dramatically improved their efficiency. Inverter type air conditioning units continuously regulate the temperature by varying the speed of the compressor motor. Sensors detect a reduction in the room temperature signaling the compressor motor to decrease and then power off. The condenser fan continues to distribute conditioned air independent of the compressor. Although more expensive than a window unit, this innovation has been revolutionary in conserving electricity. Instead of a 5000 BTU window ac unit consuming 660 watt indiscriminately, a 9000 BTU with a SEER 25 rating will initially require 800 watts on start-up but within minutes will decrease wattage demand to an average of 360 watts or less. The 9000 BTU inverter unit will deliver 80% more cooling BTU's than the window air conditioning unit and only require 55% of the electrical power.

### Technological advances and the miniaturisation of medical equipment

The advances in technology has impacted the medical diagnostic industry the most reducing the sheer size and space equipment require down to tablet and handheld devices. For example the GE Logiq 700 ultrasound machines manufactured in 2001 required 1548 watts of electricity to operate, was the size of a washing machine and weighed 420 lbs. GE Healthcare now produces the Venue 50 ultrasound which is a touch-screen tablet weighing only 8.8lbs. The Abbott Point-of-Care device 'I-stat' has converged five different diagnostic laboratory machines into one hand-held device utilising whole blood to produce a barrage of laboratory results in five minutes or less. Poskom Co, Ltd manufactures a Food and Drug Administration and CE approved lightweight 2.4 Kw lithium powered, portable x-ray which when combined with a wireless DR plate and laptop computer is an extremely affordable radiology solution. A six metre containerised clinic can now be fully kitted to offer critically ill or injured patients advanced diagnostic tests which can lead to life saving interventions.

### Electricity and healthcare

In regards to healthcare, one of the most significant factors that differentiates developed nations from those that are developing, is electricity. Without electricity, simple diagnostic machine like a microscope, cbc machines or

x-ray are rendered useless. Instead of stocking disease preventing vaccinations inside a refrigerator, patients must rely on healthcare workers transporting vaccines over treacherous roads in a portable cooler. Surgical procedures cannot be performed safely without properly sterilised instruments or functioning surgical lights. By solving the problem of electricity, we will begin the first step in improving the healthcare standards of a infrastructure poor country.

### Solar: a renewable power source for containerised clinics

The most important element that has already been discussed which directly improves the ability of medical professionals to diagnosis and treat patients, is electricity. Until recently, generators have been the only electrical option in countries without grid power. The majority of generators that the masses can afford produce 'dirty' power which has the potential to irreparably damage costly medical devices or reduce the life expectancy of electromechanical equipment.

The alternative solution to the use of diesel or gasoline powered generators for electricity is solar power. As the demand for renewable energy alternatives has surged in the West, so economy of scales has positively affected the cost of solar power that until recently was unaffordable. For example, solar panels have gone from US\$77/watt in 1977 to US\$0.613/watt in 2013 which is a 99% decrease in the cost of solar panels. In addition, charge controllers and solar inverters have become more economical and reliable. One of the key differences between solar and generator power is a solar inverter produces pure sine wave electricity, or clean power which is essential for medical devices. Solar systems initially cost 21% more than a generator but this cost difference is negated after six months due to the fact that a generator requires fuel and maintenance. Once the up-front cost of solar has been paid for, electricity is free for the next five to seven years. The only required maintenance on the solar system is washing the solar panels as required. The next evolution that will create an even better solar system is the change from lead-acid batteries to lithium ion batteries. As of now, a lead acid battery can only discharge 50% of it's stored electricity. Which means our clinic can be powered for 18 hours without sunlight. Discharging the battery below 50% risks permanent damage. This is unlike the battery of a cellular phone which can be fully charged and discharged thousands of times without battery damage. Complete use of stored energy.

Clinic In A Can was conceived by medical professionals for medical professionals. Our extensive field experience working with disaster relief and health services in underserved areas of the world is key to our success. From our work, we realised the acute need for an economical, solar powered, ready-to-use medical clinic solution, that was durable yet versatile enough to function in almost all situations throughout the world.

It is true, anyone with a cutting torch and welder can convert a shipping container into to a make-shift building. Some may even claim that it is a clinic, but it is not a Clinic In A Can ([www.clinicinacan.org](http://www.clinicinacan.org)).

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