



Photo courtesy of Aevice Health Pte Ltd

DuPont™ Liveo™ Soft Skin Adhesives enable development of smart stethoscope

Case study: Repositionable, safe & comfortable AeviceMD device aids in improved outcomes for patients with asthma

Asthma: A major health concern

According to the World Health Organization⁽¹⁾, asthma is a major noncommunicable disease (NCD) affecting both children and adults; it is the most common chronic disease among children. Inflammation and narrowing of the small airways in the lungs causes asthma symptoms, including coughing and wheezing. Over a lifetime, it can cause permanent lung damage and even death.

Asthma is a serious condition that affects large numbers of people, especially children:

- Asthma affected an estimated 262 million people in 2019⁽²⁾ and caused 455,000 deaths⁽²⁾.
- The Global Initiative for Asthma (GINA) 2021 report found that while 50% to 75% of children and adolescents are classified as having only mild asthma, 30% to 40% of all severe exacerbations occur in this age group.

⁽¹⁾ Source: <https://www.who.int/news-room/fact-sheets/detail/asthma>

⁽²⁾ Source: Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396(10258):1204-22



Improving the diagnosis, treatment & monitoring of chronic respiratory diseases

Most asthma-related deaths occur in low-income and lower-middle-income countries, where underdiagnosis and undertreatment are frequent issues.

The core mission of Singapore-based Aevice Health Pte Ltd is to develop simple and powerful solutions to empower patients to take charge of their chronic respiratory diseases.

Aevice Health and DuPont™ Liveo™ partnered in the development of AeviceMD, a smart AI wearable stethoscope that provides continuous, connected care for at-home monitoring and early detection of asthma exacerbation (commonly referred to as an “asthma attack”) in patients.

About Aevice Health Pte Ltd

With a mission “to drive medical innovations that transform healthcare, improve outcomes and empower lives,” Aevice Health Pte Ltd is a MedTech spinoff of Nanyang Technological University. The company is at the forefront of addressing chronic respiratory disease – one of the generation’s biggest healthcare challenges. Aevice Health’s non-invasive wearable devices enable the early detection of cardiopulmonary abnormalities remotely and in real time so patients can receive fast, targeted care from the ease and comfort of home. Learn more at aevice.com.



AeviceMD smart stethoscope for asthma patients

The AeviceMD smart stethoscope device helps monitor asthma symptoms continuously in real time. The app notifies the patient when it detects early signs of exacerbation to prompt timely intervention and reduce adverse events. By tracking the historical trends in a patient's symptoms, doctors can determine that patient's response to treatment and customize a treatment plan to improve that patient's outcome.

The device tracks respiratory rate at rest (breath rate per minute) and heart rate (beats per minute). It also provides wheeze detection by detecting the narrowing or inflammation of airways.

The AeviceMD is intended for use at rest for up to 10 hours per day. The wearer can be sleeping or can be awake and simply relaxing. The number of days of use depends on the use case prescribed by the doctor. The main use case involves 30-day use for patients to monitor their condition after being discharged from the hospital.

The device is classified as a Class II medical device and currently is pending U.S. Food and Drug Administration (FDA) clearance. The main target market is the U.S., followed by Japan and Singapore.

Aevice Health actively is working with hospitals and pharmaceutical companies to bundle its device offering with drugs used to treat asthma, as well as to enable clinical trials and the monitoring of the impact of treatment on patients' conditions.

Addressing design & manufacturing challenges

The AeviceMD smart stethoscope was created to treat children ages 2 and up, so consideration had to be given to very sensitive and fragile skin – including skin allergies, which are common in children – during design.

Safe, biocompatible & gentle adhesives for pediatric comfort

In developing its smart stethoscope for children, Aevice Health was seeking an attachment solution other than strips and acrylics – a solution that would be safe, comfortable and long-lasting and could improve children's experience, comfort and compliance significantly. Standard acrylic double-sided tape attachment solutions, which proved to be harsh on the skin, were not adequate.

In a collaborative effort that began in 2020, the DuPont™ Liveo™ technical and commercial teams helped Aevice

Health select the right adhesives from the broad range of Liveo™ Silicone Skin Adhesives, which includes numerous soft skin adhesives (SSAs) and pressure sensitive adhesives (PSAs) intended for medical use.

The team concluded that the Liveo™ SSA products, which typically are used in advanced wound care, were best suited to the sensitive skin of children.





Enabling repositionability, reducing waste & ensuring device tightness

One of the key challenges was to develop a disposable system on which the hardware could be attached, detached and reattached. DuPont™ Liveo™ Technical Service & Development Professional Jason Siang helped the Aevice Health team develop a multilayer tape concept that included a state-of-the-art medical soft skin adhesive layer for attachment to the skin.

“With small children, repositionability and gentleness both are critical considerations,” Siang said. “Our silicone Liveo™ Soft Skin Adhesives offer reliable, repositionable adhesion while still being suitable for use on sensitive skin.”

As a result, this design enables the device to be repositioned up to seven times or more, according to Aevice Health’s *in-vivo* patient tests. The device also remains tight for 10 hours or more.

Instead of being a disposable device and generating significant plastic and electronic waste, the device can be worn multiple times for several hours on the child’s body. Testing found that only the tape needed to be replaced – not the hardware itself – and the removal of the tape was neither damaging to the skin nor painful to the young patient.

“The sensor is *not* single-use. For our solution, the adhesive is the only consumable,” said Aevice Health Chief Technology Officer Rex Tan.

“To improve comfort and ease of use, we decided to use a Liveo™ silicone-based patch. It was important that this silicone-based component can be used for as many times as possible so as not to result in a large amount of waste rubber.”

Expert Liveo™ team addresses coating challenges

The next step was to implement the production of the double-sided tape. For decades, key coating partners have built expertise in processing Liveo™ silicone SSAs and PSAs. The Liveo™ team was able to connect Aevice Health with a trusted partner to enable processing of the double-sided tape needed for the AeviceMD smart stethoscope. The double-sided adhesive was coated with a customized Liveo™ adhesive blend and then die-cut to fit the silicone rubber patch.

Within a six-month timeframe, the team succeeded in finalizing development and production of the device. By the end of Q3 2022, the team had produced 500 units and 5,000 patches, with a pipeline of deployment and larger volume production anticipated for 2023.

“The DuPont™ Liveo™ Healthcare Solutions team was instrumental in helping us select the proper adhesive for our application,” Tan said. “Their technical knowledge and ability to bring together the necessary players to create the adhesive patch allowed us to finalize and produce the new generation of AeviceMD.”

Given the success of the AeviceMD smart stethoscope project, DuPont™ Liveo™ and Aevice Health plan to continue collaborating and are discussing how to develop future generations of devices with improved functionalities – including a version of the AeviceMD targeted to serve adults – particularly geriatric patients, who tend to be more susceptible to respiratory conditions.

Learn more about the AeviceMD smart AI wearable stethoscope at aevice.com/aevicemd.

For further information about Liveo™ Silicone Skin Adhesives

Visit liveo.dupont.com – or scan the QR code below to be taken directly to the Liveo™ Silicone Skin Adhesives web page.



About DuPont™ Liveo™ Healthcare Solutions

DuPont™ Liveo™ is a globally recognized leader in technology for a broad range of innovations in medical devices, biopharmaceutical processing and pharmaceutical solutions. DuPont high-performance materials help create safer healthcare environments and protect the health of patients and healthcare providers worldwide. We help enable smarter healthcare and positive patient outcomes.



To learn more about DuPont™ Liveo™ Healthcare Solutions, visit liveo.dupont.com.



Smarter Healthcare.
Positive Patient Outcomes.

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