Burma Children
Medical Fund
Health for All

3D Prosthetics Project 2024 Report

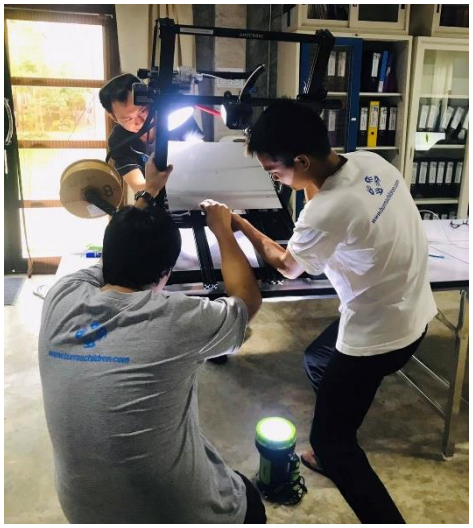
Burma Children Medical Fund

Introduction

Since its establishment in June 2019, the 3D Prosthetics project by the Burma Children Medical Fund (BCMF) has focused on providing free and effective upper limb prosthetic solutions to underserved communities, particularly refugees and migrants along the Thai-Burma border. By leveraging 3D printing technology, the project has since expanded and significantly enhanced access to personalized prosthetic, orthotics and assistive devices, improving mobility, independence, and overall quality of life for beneficiaries.

Printing AFOs for a recipient

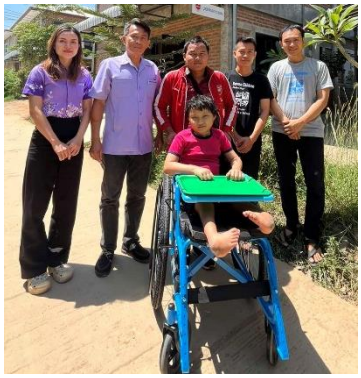
In 2024, BCMF remained the only organisation providing free functional upper limb prosthetics in Thailand for both adult and child migrant and refugee recipients, while also enhancing the project's technological capabilities and expanding its services into the area of neck and hand braces, 3D printed accessories for wheelchairs, as well as accelerating the production of ankle foot orthotics (AFOs). This report provides an overview of key accomplishments, patient data, challenges encountered, and strategic plans for 2025. Additionally, it outlines the importance of partnerships, sustainability efforts, and ongoing innovations that will define the project's trajectory in the coming years.



Repairing one of the printers

Patient enrolment and treatment statistics

In 2024, BCMF registered **54** recipients. Of these, **15** are children and **16** are female. **23** of the total recipients resided in **4** States and **2** Divisions of Burma, while the remainder resided in Tak Province, Thailand. Recipients were referred from several partners for primarily non-congenital conditions. **42%** were referred by Mae Tao Clinic, **23%** were referred by partner non-governmental organisations and community-based organisations, **26%** were referred by BCMF staff or identified during BCMF's outreach projects, and **5** were referred by private individuals or partner hospital in Burma. From the recipients registered in 2024, **38** received a 3D printed product, **2** recipients are waiting for their 3D printed product while a further **8** are waiting for the creation of a 3D printed prosthetic that will fit their stump and be functional.



A wheelchair recipient with a modified wheelchair

E chart symbols printed by the 3D team

BCMF also provided **6** previous recipients with 3D printed prosthetic arms, assistive devices, orthotics or modified wheelchairs with 3D printed parts. A total of **13** AFOs were printed and provided to recipients in 2024. Besides this, **12** 3D printed prosthetic arms and hands were provided, as well as **10** orthoses and **1** assistive device.

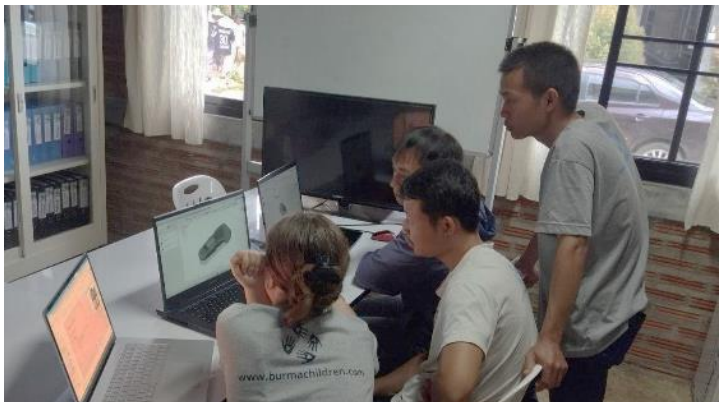
In addition to helping 3D recipients with printed 3D products, the 3D team also printed various products to help with other outreach projects. In 2024, **12** wheelchairs were modified with detachable trays using 3D printed parts, **1** ultrasound probe cover was printed for BCMF's cross-border echocardiogram screenings, and **8** E chart symbols were printed to use during BCMF's vision screening missions. Lastly, **117** PVC pipe caps were printed for emergency cross-border support.

As the fitting of the 3D printed product with the recipient is a crucial part of the process, patients need to make more than one trip to BCMF's office to have the 3D printed product properly fitted. This is crucial to not only ensure comfort and use, but to prevent injuries. When recipients cannot travel easily to BCMF's office, staff must send the products to the recipients. The recipients will provide feedback to BCMF staff, and if any changes need to be made, BCMF staff will work on implementing these, often reprinting the 3D product. Additionally, as half of the recipients in 2024 resided in Burma, the ongoing civil war delayed this process further for most of them.

Visiting a recipient at their home to fit him with his new prosthetic arm.

Contributions and notable achievements

The ongoing collaboration with Queen's University in Canada includes an intern being welcomed by the BCMF 3D printing team every year for three to four months. This intern builds the capacity of the 3D team and assists them in creating and fitting better prosthetics, orthotics and assistive devices. In exchange the intern will gain practical experience while being immersed in a different culture.

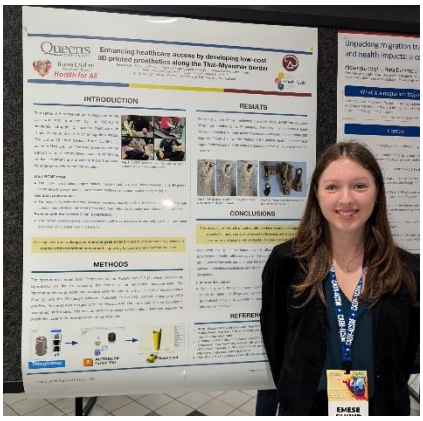


The 2024 intern from Queen's University, Emese Elkind, discussing the design of a prosthetic arm for an above elbow amputee, being modified using Fusion 360 software

BCMF 3D team scanning another staff's hand to create a prosthetic hand for carrying buckets of water

Thanks to this collaboration, our 3D team have been able to increase their skills and provide better 3D printed products. Skills learned so far include using a 3D scanner and editing scanned images, learning how to use Fusion 360 to redesign prosthetic upper limbs to fit recipients better, and redesign the socket of prosthetic arms made for lower limb amputees to ensure proper fit of their stump.

In turn, **2** former 3D interns from Queen's University, Emese Elkind and Olivia Radcliffe, in collaboration with the Queen's University and BCMF, published a research paper on a prosthetic arm with an interchangeable hand that they designed together. In October 2024, Emese presented about this at the Canadian Conference on Global Health in Vancouver, Canada.



Emese at the Canadian Conference on Global Health

Currently, Emese is working with a team from the Queen's Biomedical Innovation Team to design a body-powered, above-elbow, 3D-printed prosthetic arm. This will help many above-elbow amputees waiting to receive a functional prosthetic arm, as currently BCMF can only offer a non-functional one.

A collaboration with B and Brothers Company Limited played a crucial role in advancing technical expertise and refining 3D printed products in 2024 by training the team in new software and refining their 3D printing skills. The acquisition of two new 3D printers significantly increased production quality, improving the patients' comfort as well as the durability, usability and lifespan of the product printed. This brings the total up to **6** functioning printers, while **3** broken printers are being used for their spare parts.

BCMF 3D team training at B and Brothers Company Limited

Meeting with Sirindhorn School of Prosthetics and Orthotics on future potential collaboration

A recipient with his kinetic hand

Furthermore, partnership with **Free 3D Hands in Australia** led to the development of the kinetic hand, a prosthetic with fully functional, articulated fingers for above elbow amputees. BCMF staff tested this new 3D product and is planning to offer it to 8 recipients, who have been waiting for a functional prosthetic arm. One recipient waiting since 2019, finally received their functional prosthetic arm. Additionally, the project introduced a new series of orthopaedic braces that provide better alignment and comfort for users, further broadening its impact.

In 2024 the team also began a partnership with the Four Rivers ACTS-Foundation. The foundation gives out lower limb prosthetics and has been struggling with providing affordable prosthetic feet pieces for the lower limb prostheses, as they break easily and cost about 100 USD to replace. In response to this, the BCMF 3D team with the help of Queen's University intern Emese Elkind started experimenting with printing replacement feet pieces. BCMF plans to finalise a prototype in 2025 and provide it free of charge to recipients.

Prototypes of the foot that will be given to Four Rivers ACTs-Foundation lower limb prosthetic recipients with a broken foot piece

Patient Success Stories

Zarni

Zarni, a two-year-old girl from Karen State, Burma, faced numerous challenges after being born with a congenital heart disease and slight club feet. Despite her family's modest income, they found hope through BCMF. On November 10, 2023, Zarni underwent heart surgery with the help of BCMF. As she struggled to walk and her right foot continued to point slightly inwards despite receiving physiotherapy at Mae Tao Clinic (MTC), she was referred to BCMF to receive a free AFO. BCMF printed and provided her with a pair of custom fitted AFOs, and on May 12, 2024, Zarni received it. Combined with regular physical rehabilitation she managed to walk better with them. Her mother joyfully shared, "After receiving the AFOs, Zarni can walk well, and I no longer need to carry her. I am very happy and thankful to all donors and BCMF." Today, Zarni walks with confidence, embodying hope and resilience.

AFOs are printed according to recipient's measurements and needs

Aung and his mother

Aung, a four-year-old boy from Karen State, Burma, faced numerous health challenges from birth, including seizures and difficulty walking due to cerebral palsy. His family could not afford hospital treatment, but starting in April 2024, Aung attended daily physiotherapy at MTC, and Aung learned to walk with a walker. MTC then referred him to BCMF to receive an AFO, providing him with further support when walking. In March 2024, BCMF provided Aung with a custom fitted AFO. Today, Aung can walk well with the help of the AFOs, and a walker provided by MTC, bringing immense joy to his mother, who dreams of seeing him attend school. "I am very happy to see my son walk well with the AFOs and walker," she said. "I want to see him walk just like other children. I'm grateful to all the donors and BCMF for helping my son."

Soe practicing grabbing objects with his prosthetic arm

Soe with the 3D Project Manager

Soe, a 14-year-old boy from Tak Province, Thailand, faced a life-altering accident on July 28, 2024. While working as a construction day labourer, he suffered a severe electric shock and fell from the third floor of the building, resulting in multiple injuries and severe burns to his chest, neck and left hand. Despite initial treatment, Soe's burn injuries required the amputation of his left hand. With support from BCMF, Soe underwent surgery and later received a prosthetic arm, designed by the charity Free 3D Hands, and custom printed to fit his needs by BCMF's 3D team. In November 2024, Soe proudly accepted his new prosthetic arm, boosting his confidence and independence. "It is beautiful," he said. "With this new arm I feel confident. It will support me with the tasks that I could not do before, like lifting things or helping with the cooking."

Than with her hand brace

Daw Than, a 60-year-old former vegetable vendor from Mon State, Burma, suffered a stroke, leaving her unable to move or speak. After her husband brought her to MTC she slowly regained her ability to move and talk. With no income or family support, she and her husband have lived in a village patient house supported by MTC. The physiotherapist recommended a hand brace to avoid stiffness in her tendons and joints. She said, "Thanks to a custom hand brace from BCMF, my hand has improved, and I now help clean the patient house while dreaming of returning to my former work."

Challenges and Areas for Improvement

Despite notable progress, several challenges persist. Technical limitations, including design constraints and occasional printer failures, have affected service efficiency. Additionally, the ageing 3D printers in Burma stopped working, which brought printing in Burma to a full stop. Legal obstacles such as a lack of travel documents to travel within Thailand as well as logistical obstacles including waiting for safe travel conditions due to the ongoing civil war in Burma have further prevented some recipients from requesting, being properly fitted or receiving their 3D printed product.

3D team assembling a prosthetic arm for a recipient

BCMF staff sewing Velcro straps for a prosthetic hand

Sustainability concerns have also arisen due to material waste from unsuccessful prints, highlighting the need for improved strategies, especially as limited access to recyclable materials drives up production costs. Currently, the team is experimenting with recycling failed prints and small pieces used to stabilize the product during printing. These are then melted and moulded into new forms. Addressing these sustainability issues is essential for ensuring long-term success, particularly as the demand for BCMF's services continues to rise.

Strategic Plans for 2025

To address these issues, the 2025 strategic plan focuses on optimizing production efficiency through the enhancement of 3D printing technology to reduce recipient wait times and improve the quality of prosthetic devices. Advancements in prosthetic design will be prioritized, emphasizing refined 3D modelling techniques for above-elbow prostheses while fostering collaborations with academic institutions to enhance manufacturing precision. In addition to this, the team will continue to work on recycling 3D waste to work towards sustainability.

Conclusion

Despite these challenges, the BCMF 3D Prosthetics Project has made significant strides in improving the lives of individuals with disabilities. By integrating cutting-edge prosthetic technologies with recipient-centred rehabilitation approaches, the project continues to restore autonomy and enhance community reintegration. Moving forward to 2025, the primary focus will be on further technological advancements, improving logistical efficiency, and fostering long-term sustainability. Increased emphasis will also be placed on data collection and impact measurement, ensuring that the project's outcomes remain transparent, and evidence based. With an evolving landscape in both technology and global health, BCMF remains committed to adapting its methodologies and expanding its reach to maximize positive outcomes for its beneficiaries.