Evaluating Obstacles and Applicability of 3D Printed Prostheses in Developing Countries
Yonadav Diamond, Frank J. Fedel
Eastern Michigan University

INTRODUCTION
Approximately 30 million people are in need of orthotic and/or prosthetic care in Africa, Asia, and Latin America (WHO 2011). Several obstacles to establishing reliable and effective O and P care in developing countries exist, including inadequate training programs for health professionals, lack of access to materials, cultural barriers/differences, and costs of facilities and machinery (Tarp and Hjertholm, 2000). Additionally, a lack of understanding of cultural considerations and poor preparation are major impediments on various foreign aid projects (Williamson 2009). Often, there is not adequate time spent considering all of the potential obstacles that may present themselves between project conception and project implementation. Furthermore, it is essential to patient well being that there is adequate and appropriate follow-up by health professionals. Traditional methods of casting, modification, and fabrication are often too costly and time consuming for countries with limited budgets. However, with 3D printers, a new opportunity for affordable manufacture of prostheses has opened up (Kurman and Lipson 2013).

METHOD
While there are several models of open-source 3D printed prosthetic hands available online, and many articles which speculate on the use of this technology in poorer nations, there is no explicit overview of what it would take to actually implement this technology and what issues would have to be overcome. The first objective of this project is to estimate the time, cost, and process involved in the printing and assembly of the Cyborg Beast (e-NABLE) prosthetic hand using a Printrbot Simple (Printrbot, Lincoln, CA), a low-cost 3D printer. The second objective is to map and frame this procedure while considering constraints associated with its use in developing countries.

RESULTS
In addition to the actual assembled Cyborg Beast prosthesis, a framework will be created from which development workers and O&P professionals can consider potential 3D printed prosthetic-related projects in developing countries.

DISCUSSION
With the increasing effectiveness of 3D printing and its decreasing cost, this technology may potentially emerge in developing countries and become more pertinent to prosthetic care. While 3D printing provides this opportunity, it is essential that prosthetists are guiding forces in its applications. If we are to expect this technology to be used for the patient’s best interests it is necessary that prosthetists be involved in project organization, implementation, and follow-up. This work would be done in conjunction with NGOs, local government, prostheses manufacturers, fitters, and clinicians.

CONCLUSION
A guideline for applications of 3D printed prostheses will help lead future endeavors in developing countries.

CLINICAL APPLICATIONS
Armed with data relating to cost and time, as well as a framework to begin asking relevant psychosocial and logistical questions, clinicians and development workers interested in using 3D printing abroad will be able to work more thoughtfully and efficiently.

REFERENCES

