INTRODUCTION

Additive Manufacturing (AM), colloquially known as 3D-printing, has been deemed capable to revolutionize a great number of industries, including the Health Care industry. In the field of upper limb prosthetics, it has been attempted to leverage the potential advantages of AM, such as crowd based design optimization, infrastructure independent fabrication, and economical material use, in the interest of providing low-cost, readily available devices to recipients whose needs were only insufficiently met by traditional approaches of device prescription and fitting. While the popular media has been quick to emphasize the potential—perceived or real—of 3D printed prostheses, clinicians have generally been less euphoric and the base of scientific evidence on appropriateness of evaluation and reporting approaches. The group, members of which are located throughout the continental US, conducted bi-weekly online meetings over the course of several months to accomplish these objectives. The eventual survey was realized in Qualtrics Research Core (Seattle, WA) and is now available online. Data collection is currently ongoing.

METHODS

A focus group consisting of experts from different disciplines related to upper extremity prosthesis device production was assembled to develop a comprehensive outcome survey tool, following four stages:

1. Definition of goals and target populations that will be addressed with the survey.

2. Identification of existing survey tools that can be adapted for the purposes of the eventual instrument.

3. Combination of core areas identified under 1.) and 2.) into a comprehensive questionnaire, utilizing skip logic and other methods to minimize survey length and user burden.

4. Iterative testing and refining of the draft survey to assure technical function as well as appropriateness of evaluation and reporting approaches. The group, members of which are located throughout the continental US, conducted bi-weekly online meetings over the course of several months to accomplish these objectives. The eventual survey was realized in Qualtrics Research Core (Seattle, WA) and is now available online. Data collection is currently ongoing.

RESULTS

The current survey has 107 and 108 questions respectively in the version for caregivers (capturing experiences of underage users) and for end users. Those questions are organized in 10 blocks (Table 1), some of which are only presented if previous answers suggest that they are applicable in the individual case. Completion time for the complete survey is estimated at 15-20 minutes.
ABSTRACT (POSTER PRESENTATION)

A recently developed comprehensive outcome data survey for users of upper limb prosthetic devices addresses limitations of existing tools.

CLINICAL APPLICATIONS

The survey may be used for individual outcome assessment purposes over time. Aggregated data may inform prescription of conventional and novel prosthetic devices in the future.

REFERENCES

1. Giannatsis and Dedoussis. Additive fabrication technologies applied to medicine and health care: a review. Int J Adv Manuf Tech 40.1-2 (2009): 116-127. DOI: 10.1007/s00170-007-1308-1

2. Jelle ten Kate, Smit, 3D-printed upper limb prostheses: a review. Breedveld, Disabil Rehabil Assist Technol. 12.3 (2017): 300-314. DOI:10.1080/17483107.2016.1253117

3. Zuniga, Jorge, et al. Cyborg beast: a low-cost 3d-printed prosthetic hand for children with upper-limb differences. BMC Res notes (2015): 8:10. DOI: 10.1186/s13104-015-0971-9

DISCUSSION

Dependable outcome data is important to evaluate and compare novel approaches to prosthetic device provision. Survey tools can reach a large target population and have a comparably low burden of participation, which mitigates the common issue of recruiting a desirably large sample population. However, establishing the internal and external validity of such tools can be challenging. Other challenges include assuring the sensitivity and specificity of an instrument that is intended to address the same construct in a wide and diverse population or range of device classes, respectively. We have attempted to solve those challenges by developing the survey based on existing tools and leveraging the combined insights from a diverse expert panel. It is our hope that it will succeed to gather a substantial quantity of outcome data with the here presented comprehensive survey tool. This will help objectively assess the comparative effectiveness of different prosthesis concepts, including 3D-printed devices, in specific user scenarios.

CONCLUSION

Table 1: Overview of survey contents

| Block  | Description               | Num. of Questions |
|--------|---------------------------|-------------------|
| 1      | Eligibility               | 6                 |
| 2      | Demographics              | 12                |
| 3      | Type of device            | 20                |
| 4-7    | Usefulness of specific device(s) | 14 each |
| 8      | Problems with device      | 9                 |
| 9      | e-Nable community         | 3                 |
| 10     | Conclusion                | 2                 |

Figure 1: Volunteer assembling a 3D-printed prosthetics device.