Development and acceptability testing of decision trees for self-management of prosthetic socket fit in adults with lower limb amputation

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\textbf{ABSTRACT}

\textbf{Purpose:} The most common complaint lower limb prosthesis users report is inadequacy of a proper socket fit. Adjustments to the residual limb–socket interface can be made by the prosthesis user without consultation of a clinician in many scenarios through skilled self-management. Decision trees guide prosthesis wearers through the self-management process, empowering them to rectify fit issues, or referring them to a clinician when necessary. This study examines the development and acceptability testing of patient-centered decision trees for lower limb prosthesis users.

\textbf{Methods:} Decision trees underwent a four-stage process: literature review and expert consultation, designing, two-rounds of expert panel review and revisions, and target audience testing.

\textbf{Results:} Fifteen lower limb prosthesis users (average age 61 years) reviewed the decision trees and completed an acceptability questionnaire. Participants reported agreement of 80% or above in five of the eight questions related to acceptability of the decision trees. Disagreement was related to the level of experience of the respondent.

\textbf{Conclusions:} Decision trees were found to be easy to use, illustrate correct solutions to common issues, and have terminology consistent with that of a new prosthesis user. Some users with greater than 1.5 years of experience would not use the decision trees based on their own self-management skills.

\textbf{IMPLICATIONS FOR REHABILITATION}

- Discomfort of the residual limb-prosthetic socket interface is the most common reason for clinician visits.
- Prosthesis users can use decision trees to guide them through the process of obtaining a proper socket fit independently.
- Newer users may benefit from using the decision trees more than experienced users.

\section*{Introduction}

The most frequent reason people with limb loss seek consultation of a prosthetist is lack of socket comfort [1]. A comfortable fit between the socket and residual limb is necessary to optimally utilize the prosthetic limb [2]. Prosthetic fit is a fundamental factor in successful ambulation [3]. While improvements in certain residual limb suspension systems have decreased discomfort associated with prosthesis wear [4,5], the issue of comfort remains paramount. Achieving a comfortable fit requires that the user manages his/her socket suspension conjointly with fluctuations in residual limb size, whether from volume and shape changes normally experienced throughout the day or secondary to long-term changes to the residuum. Failure to manage a proper fit could result in preventable secondary complications: wound formation, residual limb pain, and musculoskeletal impairments [6]. These complications, if not managed, can result in nonuse of the prosthetic limb or even re-amputation [7]. Therefore, in order to maximize function and to prevent secondary complications associated with prosthesis wear, interventions designed to facilitate self-management of fit could benefit both prosthesis users and their caregivers.

One strategy to empower prosthetic limb user’s self-management abilities is with the use of decision trees. A decision tree is a branching, binary algorithm that guides users to a solution based on the responses chosen. Decision trees have been utilized to facilitate clinical decision-making for the management of torticollis, wound care, and phantom limb pain [8–10]. However, decision trees have not been created to address prosthetic socket fit. Since fit and comfort are related, and comfort is the most common reason for clinical visits, it is befitting that decision trees be designed for the prosthesis user themselves. Accordingly, the purpose of this study was to develop prosthetic socket fit decision trees, and test the trees for acceptability amongst prosthesis users. Considering that the majority of lower limb amputations occur in persons over age 60 [11], the decision trees were designed with consideration of an older adult population.

\section*{Methods}

The development and acceptability testing process of the decision trees were performed in four stages. Stage 1 involved a comprehensive literature review of socket fit issues for the most common