American Orthotic and Prosthetic Association (AOPA)
Request for Proposals (RFP 04012015)

1. TITLE PAGE

Title of Project: Prosthetic management candidacy in lower limb amputees based on quantitative and qualitative assessment tools: a systematic review

Investigators:

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Funds Requested: $54,000 (US)

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2. ABSTRACT

As part of evidence-based practice involving lower-limb amputees, assessment tools that assist clinicians in selecting the most appropriate course of treatment and prosthetic technology lead to better patient care and may also reduce overall costs. The aim of this study is to conduct a comprehensive literature review of assessment tools from prosthetics and general rehabilitation (functional, mobility, participation and quality of life) that could be collectively used to determine candidacy for prosthetic management in lower limb amputees. To this end, all available literature in these areas that was published in the last 15 years will be systematically searched, reviewed and ranked according to a recognized system of critical appraisal. The evaluation of outcome measures will be performed according to the AOPA State-of-the-Science Evidence Report Guidelines and PRISMA. This study will be conducted by a strong team of researchers who have the necessary expertise in amputee rehabilitation, prosthetics, outcome measures and knowledge translation. The direct output of this systematic review will be an algorithm of care for prosthetic management of lower limb amputees. The algorithm will be formulated through the consensus of an expert group, and will take into consideration important criteria including content, structure, and format of the algorithm, as well as the clinical contexts of its potential application.

3. PROPOSAL

3.1 BACKGROUND & SIGNIFICANCE

Lower-limb amputation is a permanent disability with serious psychological, functional, and social consequences that have a pronounced effect on an individual's quality of life.[1-2] Proper prosthetic management, including the selection of appropriate prosthetic technologies, is essential to restoring mobility function and promoting successful rehabilitation.

Determining and providing the optimal prosthetic management is challenging even for highly experienced teams, and requires the careful consideration of a diversity of factors related to the patient. These not only include physiological and psychological factors such as the level of amputation, residual limb length, skin condition, muscle strength, motivation, and prosthetic satisfaction, but also demographics such as age, occupation, gender, culture, physical ability and living area.[3-6] Important factors known to influence rehabilitation outcomes after lower limb amputation include physical fitness,[7] overall health and comorbidities,[8] ability to execute certain physical tasks,[3] and pre-operative mobility.[9] Furthermore, setting out the course of rehabilitation, including the selection of prosthetic components, should consider the patients' personal needs and goals.[1,10-11] Personal goals for community reintegration may include but are not limited to the vocational rehabilitation, recreation or sports activities, ability to drive a car as well as social roles.[12]

There is a general understanding of the important considerations for determining candidacy for prosthetic management in lower limb amputees.[6] However, currently little consensus exists on the exact approaches that should be adopted to assess the factors and predictors of rehabilitation outcomes more formally for individuals with lower limb amputations. This includes a lack of agreement on the outcome measures to assess a patient's capacity and potential for rehabilitation, as well as validity of the tools that could be used to determine the prosthetic treatments or technologies that would be most suitable and effective for a particular amputee.[10,13-16]

In an effort to inform care and improve amputee outcomes, various assessment tools have been developed or adapted to measure the outcomes of prosthetic rehabilitation. These tools are not only essential in tracking the rehabilitation progress, but also when applied during the early stages of rehabilitation can aid in more effective planning of the rehabilitation procedure and selection of appropriate prosthetic components. Assessment tools can fall into a number of categories, including walking mobility tests (e.g., Timed Up and Go Test and 6 minute Walk Test), functional tests (e.g., Amputee Mobility Predictor and Functional Independent Measure), and quality of life (e.g., Orthotics Prosthetics Users' Survey, Satisfaction with Prosthesis and Nottingham Health Profile) providing both quantitative and quantitative information about an amputee's condition, abilities, and overall well-being. While many measures exist for use with lower limb amputees, utility limitations include lack of information about psychometric properties,[16] as well as resource and time requirements associated with their administration within clinical practice. As a result, there is currently little agreement on the application and use of these measures within prosthetic care. In fact, a very recent paper has recommended that clinical and research societies should endorse a set of best validated tools to support consistent measurement practice in this field.[17] Previous research has come up with a list of important predictors, outcomes and facilitators and emphasized that it can aid in identifying the most

valid predictors and outcome measures to be used in clinical practice.[6] A screening tool is still to be developed based on the valid predictors and assessment tools.

The development of best practice recommendations and/or evidence-based clinical guidelines is said to assist in clinical decision making aimed at improving patient outcomes.[18-19] In the prosthetics field, it is of particular importance for clinicians to be able to effectively and efficiently collect and use patient information to better predict the prosthesis type that will be most appropriate for the patient. One way that this may be achieved is by the development of algorithms. Defined as the "instructions for completing a task", the algorithms can be effective in operationalizing and systemizing best practice recommendations. An algorithm is typically formulated by a group of well-known experts who evaluate and contextualize evidence, and facilitate the interpretation of best practice recommendations for easier adoption by clinical professionals.[20] The goal of this research will be to use the findings of the literature review to determine the outcome measures that are the most appropriate for use in the development of a candidacy algorithm. Owing to their potential benefits, as seen in other areas of health care, algorithms in the prosthetic field can improve adherence to evidence-based guidelines, provide timely support for clinical decision-making, and be a resource for research and education. These approaches can reduce unnecessary testing, regulate costs, and ensure a constant quality of care in the patient's rehabilitation.[20]

3.2 OVERALL AIM

The primary aim is to investigate and conduct a comprehensive systematic review of validated assessment tools (functional, mobility, participation, general rehabilitation, quality of life) that will be used to determine candidacy for prosthetic management in lower limb amputees, and for the development of a candidacy algorithm.

3.3 DELIVERABLES

- We will conduct and deliver a systematic review of the literature to the working group by December 1, 2015.
- We will submit a manuscript (Alternate Assessment Tools or Category Systems-for Prosthetic Technology) to a peer-reviewed medical journal for publication by January 31, 2016
- In collaboration with the working group we will deliver a draft evidence-based statement and treatment algorithm to the expert reference group by April 30, 2016.
- We will present this work at the AOPA National Assembly in September 2016.

3.4. RESEARCH PLAN

The authors acknowledge that the following research plan is contingent on the approval by the AOPA working group, and thus is subject to change at AOPA's discretion.

To ensure a rigorous and comprehensive approach, the state-of-the-science evidence report guidelines of the American Academy of Orthotists and Prosthetists (AAOP) will be followed to ensure transparent and complete reporting from the inception of the systematic review to its termination. We believe these guidelines, prepared mainly by the experts in the field of

prosthetics & orthotics, would best address the objectives of this project. Furthermore, to guide the systematic review process, we will use the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) check list (www.prisma-statement.org). The PRISMA Statement consists of a 27-item checklist and a four-phase flow diagram intended to provide a template for the effective reporting of systematic reviews. Given that the PRISMA guidelines are regularly updated, these updates will ensure quality of the review process.[21]

3.4.1 Search Strategy & Screening

The search strategy, including the keywords and selection of databases will be implemented through consultation with, and facilitated by, a knowledgeable health research librarian and an Advisory Group (consisting at minimum of the Principal and Co-investigators, as well as a prosthesist) having combined expertise in the fields of amputee rehabilitation, prosthetics, outcome measures, knowledge translation, (please see Section 4 below). A literature search will be performed of databases including MEDLINE, RECAL, CINAHL, EMBASE, and Web of Science using a combination of a text word search strategy and subject headings. The search time span will be from the year 2000 to 2015, and the cited references in the reviewed articles will also be considered. A reference manager software (Mendeley) will be used to manage the lists of references and removal of any duplicates. Two researchers (JA and AE) will independently screen the title and abstract of identified studies against the following inclusion and exclusion criteria. If it is not possible to determine inclusion based on the abstract, the full paper will be acquired and inclusion will be re-assessed based on the full paper text.

Included in the selection will be papers that 1) pertain to the development and assessment of outcome measures, 2) describe clinical trials in which outcome measures or assessment tools are used, and 3) focus on the prediction of outcomes using a variety of different measures or tools. The preliminary inclusion criteria are listed below.

Inclusion Criteria

Publications will be included if they satisfy all of the following:

1. The paper describes one or more outcome measures/or assessment tools that:
   - were developed for use with amputee patients/subjects or individuals with related lower limb musculoskeletal conditions; or
   - were intended to measure functional ability of the lower limb, mobility, participation, or quality of life, or
   - were used as part of a clinical trial, study or intervention
   - were used to assess or predict patient or subject outcomes
2. The study population is comprised of, or intended use included individuals with lower limb amputation including:
   - unilateral or bilateral lower-limb amputation, or
   - those at any limb loss level (i.e., from loss of a digit to hip disarticulation), or
   - with any amputation cause (acquired or congenital)
3. The paper is written in (or translated into) English, and
4. The paper was published between 2000 and 2015 inclusive.

Exclusion Criteria

Publications will be excluded if any of the following exist:

1. The study describes an outcome measure or assessment tool, specifically for use with lower limb conditions that are not relevant to prosthetics),
2. The work is published as a dissertation, thesis, book chapter, or conference proceeding, or

3. The full publication is unavailable
4. The full tool and psychometric properties are not available within peer reviewed literature or from the author.

Disagreement on the papers to be included will be resolved by consensus between the two reviewers or third party settlement (i.e., one of the other research team members).

3.4.2 Quality Rating

Those articles meeting the inclusion criteria will be acquired in either paper or digital copy. If necessary, we will contact the corresponding authors for additional information. The study designs described in the articles included in the final review will be classified into the below-specified categories by the team members (reviewers) who will examine the Methods or Methodology section and define study type through a consistent format adopted from the AOPA guideline.[22] Any discrepancies will be resolved by discussion among the two reviewers (JA and AE), or the inclusion of a third reviewer (either VW or SK). The categories include structured reviews (meta-analysis and systematic review), experimental trials (randomised control trial, controlled trial, interrupted time series trial, single subject experimental trial, and controlled before-and-after trial), observational studies (cohort study, case-control study, cross-sectional study, qualitative study, case series, and case study) and expert opinion (group consensus and individual opinion).[22]

The internal and external validity of observational, quasi-experimental and experimental research will be reviewed according to the AAOP Evidence Report Guidelines and AAOP Assessment Form.[22] The form comprises of quality criteria that should be assessed by the reviewer. Each criterion specifies a threat to external and/or internal validity. Reviewers will check "No" if it is not sufficiently addressed, "Yes" if the threat is adequately addressed, and "N/A" if it is not pertinent to the study. Overall validity will be evaluated based upon the type and number of threats as "Low" (little-to-no confidence in the design/applicability), "Moderate," (confidence in the design/applicability) or "High" (strong confidence in the design/applicability). Although, "Expert opinion" and "structured reviews" papers are not subject to this standardized format, they may be evaluated by the PRISMA checklist.

The obtained studies from the previous phase will be a starting point to check the validity, reliability and construct of the measures used.[23] The following criteria will be considered in the form of a table:

- Test-retest reliability
- Inter-rater reliability
- Internal consistency
- Intrarater reliability
- Face validity
- Content validity
- Criterion validity
- Rasch scaling
- Minimal detectable change
- Responsiveness evaluation
- Floor/ceiling effects
- Construct validity
- Overall quality assessment.

In this phase, the instruments will be classified as “well-established” (e.g., sufficient information available to evaluate the measure, at least two research groups have used it and published journal articles, good psychometric properties), “approaching well-established” (e.g., sufficient detail available, presented in at least two journal papers, moderate or vague psychometrics presented), or “promising” (e.g., at least one peer-reviewed article, sufficient detail available, moderate or vague psychometrics).[24] The final list of articles will be included in the review. The review results will be further categorized based on whether the measures are (i) quantitative or qualitative assessment tools, (ii) applicable to specific sub-groups (i.e. pediatrics, geriatrics etc.) (iii) applicable to specific levels of amputation and (iv) general or amputee-specific assessment tools.

3.4.3 Development of the Algorithm

The findings of the systematic review will be synthesized to facilitate the development of an algorithm framework for an assessment and treatment pathway that would encompass all key decision points and episodes of care. The following method represents a tentative approach for the development of the algorithm, which may be revised based on the recommendations of the AOPA working group. This process will be facilitated through electronic survey, face-to-face meetings, and teleconference.

The Delphi method is a structured communication technique which relies on a panel of experts; it will be adopted to assess recommendations for the measures and assessment tools that will be included in the prosthesis candidacy algorithm. The significance of the Delphi method lies in the ideas it produces, both those that induce consensus and those that do not.[25] The real clinical practice should be reflected in the research to identify the most influential factors in prescription and usage of lower limb prosthesis.[6,26] Thus, in this study, the international experts and service providers will be presented with summarized information from the systematic literature review, and asked to provide their input about the measures that should be considered in the development of the algorithm. Input will be provided over a number of rounds, and after each round, a facilitator provides an anonymous summary of the experts' forecasts from the previous round as well as the reasons for their comments.[27] Thus, experts will be encouraged to further revise or clarify their earlier answers in light of the replies of other members of their panel. The strength of the Delphi method is that it allows the group to converge towards one "correct" answer, in this case an algorithm based on the most appropriate measures and assessment tools. A similar approach was successfully applied by our group to develop a “chronic pain assessment Toolbox for children with disabilities” Orava et al. (2014).[28]

The Delphi method will be developed by the project team in close collaboration with the AOPA working group as collective information from the systematic literature review, interviews with experts and survey. We will include the technical and functional aspects of prosthesis prescription in the statements. Wherever possible, we will input a range of prosthetic components to the algorithm, because it is intended to be a clinical candidacy tool that would help service providers in selection of components.[6,26]

In the next phase, the development and implementation of the algorithm will be based on input from the AOPA working group, and may range from simple paper based instructions and flow charts, such as a tool box, to sophisticated software-based programs, which can be developed with the assistance of our computer and systems engineers.

The main knowledge translation activities will include the following:

- The findings will be disseminated at AOPA National Assembly 2016 and through a submission in a peer-reviewed journal. An open access journal may be used to allow for greater reach within the prosthetics community.

- The need for evidence-informed decision tools is addressed through the creation of the algorithm.

- The expert panel will act as key champions to further disseminate the work and may also generate a knowledge-sharing plan based on the final product.

- With guidance of the AOPA working group, we will explore tools such as flintbox (www.flintbox.com) to make the results of this work, including the developed algorithm, accessible to the public. Our research team currently uses the flintbox to provide access to outcome measures etc. (e.g. http://www.flintbox.com/public/project/24539/)

*3.4.4 Proposed Research Timeline**

Activity	**2015**								**2016**								
	May	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Finalizing the methodology with the AOPA working group																	
Database Search																	
Screening																	
Quality Rating																	
Delivering the systematic review to the working group																	
Preparation and submission of the manuscript																	
Preparation of evidence-based statement and treatment algorithm with the working group																	
Preparation of the final report for presentation																	
Presentation at the AOPA National Assembly																	

* The dates are approximate and subject to change according to recommendations made by the AOPA working group.

4. THE TEAM

The following will be the main team members and advisory group for this project. Additionally, the project will involve the expertise of a senior librarian and clinical experts (prosthetists, physiatrists and therapists), as described in the proposal and below under the facilities.

Chief Scientist & Principle Investigator:

Dr. Jan Andrysek is a scientist in the Bloorview Research Institute at Holland Bloorview, and Assistant Professor at the University of Toronto (U of T), Institute of Biomaterials and Biomedical Engineering, where he is also the Associate Director of the Clinical Engineering graduate program. With career funding as principal investigator in excess of $1,000,000 CDN, he leads a program of research at Holland Bloorview focused on prosthetics and orthotics, which involves a multidisciplinary team of engineers, clinicians and trainees. Dr. Andrysek has a strong publication record in the area of prosthetics as primary or senior author, covering a broad range of topics relating to prosthetics and orthotics including evidence-based practices, technology development and assessment, mobility, and global health issues. Other outputs include the granted patents, and the commercialization of 3 prosthetic technologies including the MiniMac, GeriMac and AT-knee/LCKnee. As it pertains to this project, he will dedicate 15% of his time to provide the research and administrative leadership to ensure that the project is successfully completed and that the stated deliverables are completely and adequately addressed. He will directly work with Arezoo Eshraghi to conduct and present the review, which includes acting as one the two primary reviewers for the systematic review. He will work in collaboration with the AOPA working group from the inception of the project to its termination.

Co-Investigators:

Dr. Shauna Kingsnorth is the Lead of Evidence to Care within the Teaching & Learning Institute and a Clinical Study Investigator in the Bloorview Research Institute at Holland Bloorview Kids Rehabilitation Hospital, and Assistant Professor (status) at the Department of Occupational Science and Occupational Therapy, University of Toronto. For the past four years, Dr. Kingsnorth has led the Evidence to Care initiative to drive the use of high quality research evidence to inform care and treatment and has built a team of knowledge translation specialists and brokers with expertise in systematic and scoping reviews, clinical practice guidelines and strategies to optimize evidence-informed care. Outputs have included a chronic pain assessment toolbox and an invited keynote presentation at the 2014 Knowledge Mobilization Conference. Dr. Kingsnorth will provide methodological expertise related to systematic reviews and integrated knowledge translation. She will also assist in tailoring key messages and supporting dissemination opportunities and appropriate to maximize the reach of the findings commensurate with the outputs of this work. She will provide 30 hours of her time as required by the project.

Dr. Virginia Wright is a full-time clinician scientist in the Bloorview Research Institute at Holland Bloorview, where she holds a research chair in Chair in Paediatric Rehabilitation. Her program of research that has been funded by provincial and national peer-reviewed grants focuses on development and validation of pediatric outcome measures, particularly those pertaining to

gross motor mobility, functional status and QOL. Her total career funding as principal/co-principal investigator has been $1,500,000 CDN. One area of intensive outcomes interest has been in upper limb prosthetic outcomes. Outputs have included the development and validation of the Prosthetic Upper Extremity Functional Index (PUFI) and two invited papers on the outcome measure use (systematic review and core set development) in upper limb pediatric prosthetics, one of which was the keynote paper for the State-of-the-Science 2009 in Chicago.

Dr. Arezoo Eshraghi is a post-doctoral research associate in the Bloorview Research Institute at Holland Bloorview. She is a registered Prosthetist & Orthorist with both clinical and research background, mainly focusing on lower limb prosthetics. Arezoo has published a number of articles as main and co-author in the ISI-cited journals in topics ranging from lower limb prosthetics, amputee rehabilitation, and assessment to conservative treatments of musculoskeletal disorders. Also, she has a granted patent as suspension system for lower limb prosthesis, which is in the process of commercialization. She will work under the direct supervision of Dr. Andrysek, to conduct and coordinate the day to day activities relating to the literature review and development of the algorithm. Along with Dr. Andrysek, she will engage with the AOPA working group from start to finish. She will also act as one of the two primary reviewers for the systematic review.

Below are highlighted the areas of expertise offered by the team, including examples of past publications;

Lower Limb Amputee Care

- Dr. Jan Andrysek

  Chen CW, **Andrysek J**, Heim W, Fairley K, Clement RJ, Biddiss E, Torres-Moreno R. Evaluation of an instrument-assisted dynamic prosthetic alignment technique for individuals with transtibial amputation. Prosthet Orthot Int. 2015 Mar 11. pii: 0309364615574161.

  Sharma A, Torres-Moreno R, Zabjek K, **Andrysek J**. Toward an artificial sensory feedback system for prosthetic mobility rehabilitation: examination of sensorimotor responses. J Rehabil Res Dev. 2014;51(6):907-17.

  Wyss D, Lindsay S, Cleghorn WL, **Andrysek J**. Priorities in lower limb prosthetic service delivery based on an international survey of prosthetists in low- and high-income countries. Prosthet Orthot Int. 2015;39(2):102-11.

- Dr. Arezoo Eshraghi

  Eshraghi A, Abu Osman NA, Gholizadeh H, Ali S, Sævarsson SK, Wan Abas WA. An experimental study of the interface pressure profile during level walking of a new suspension system for lower limb amputees. Clin Biomech (Bristol, Avon). 2013;28(1):55-60.

Eshraghi A, Abu Osman NA, Gholizadeh H, Ali S, Abas WA. Interface stress in socket/residual limb with transtibial prosthetic suspension systems during locomotion on slopes and stairs. Am J Phys Med Rehabil. 2015;94(1):1-10.

Eshraghi A, Abu Osman NA, Karimi M, Gholizadeh H, Soodmand E, Wan Abas WA. Gait biomechanics of individuals with transtibial amputation: effect of suspension system. PLoS One. 2014;27;9(5):e96988.

- Prosthetists at the Holland Bloorview Rehabilitation Hospital, Sunnybrook Hospital and West Park Healthcare Centre

Outcome Measures & Tools

- Dr. Virginia Wright

Wong RKY, McEwan J, Finlayson D, Chung S, Wan L, Salbach NM, Kirkwood G, Meschino C, **Wright V**. Reliability and Validity of the Acquired Brain Injury Challenge Assessment (ABI-CA) in Children. Brain Inj. 2014;28(13-14):1734-1743.

Wright V, Rosenbaum P, Fehlings D, Mesterman R, Breuer U, Kim M. The Quality FM: Reliability and discriminant validity of a new measure of quality of gross motor movement in ambulatory children with cerebral palsy. Dev Med Child Neurol. 2014;56:770-778.

Wilson A, Kavanaugh A, Moher R, McInroy M, Gupta N, Salbach NE, **Wright V**. Development and pilot testing of the Challenge Module: a proposed adjunct to the Gross Motor Function Measure for high functioning children with cerebral palsy. Phys Occup Ther Pediatr. 2011; 31:135-149.

Wright V, Hubbard S, Jutai J, Naumann S. Evaluation of the validity of the Prosthetic Upper extremity Functional Index (PUFI) for children. Arch Phys Med Rehabil. 2003;84:518-527

Wright V, Hubbard S, Jutai J, Naumann S. The Prosthetic Upper Extremity Functional Index: development and reliability testing of a new functional status questionnaire for children who use upper extremity prostheses. J Hand Ther. 2001;14:91-104.

Jutai J, Ladak N, Schuller R, Naumann S, **Wright V**. Outcomes measurement of assistive technologies: an institutional case study. Assist Technol. 1996;8(2):110-20.

- Dr. Jan Andrysek

Klejman S, **Andrysek J**, Dupuis A, Wright V. Test-retest reliability of discrete gait parameters in children with cerebral palsy. Arch Phys Med Rehabil. 2010;91(5):781-7.

Andrysek J, Christensen J, Dupuis A. Factors influencing evidence-based practice in prosthetics and orthotics. Prosthet Orthot Int. 2011;35(1):30-8.

- Dr. Shauna Kingsnorth

  Orava, T., Townley, A., Provvidenza, C., Adler, E., Ami, N., Gresley-Jones, T., Mankad, D., Fay, L., Slonim, N., Hoffman, A., Joachimides, N., Hung, R., Fehlings, D. & **Kingsnorth, S**. (2014). Chronic pain assessment Toolbox for children with disabilities. Holland Bloorview Kids Rehabilitation Hospital, Toronto, Ontario. Available from: http://hollandbloorview.ca/toolbox

Literature and Systematic Review

- Dr. Shauna Kingsnorth

  Lindsay, S., **Kingsnorth, S**., Mcdougall, C., & Keating, H. A systematic review of self-management interventions for children and youth with physical disabilities. Disabil Rehabil. 2014;36(4):276-88

  Lindsay, S., **Kingsnorth, S**., & Hamdani, Y. Barriers and facilitators of chronic illness self-management among adolescents: A review and future directions. J Nurs Healthcare Chronic Illness, 2011:3(3), 186-208.

  Treurnicht Naylor, K., **Kingsnorth, S**., Lamont, A., McKeever, P., & Macarthur, C. The effectiveness of music in pediatric healthcare: A systematic review of randomized controlled trials. Evidence Based Complementary and Alternative Medicine, 2011 Article ID 464759, 18 pages.

  Kingsnorth, S., Healy, H., & Macarthur, C. Preparing for adulthood: A systematic review of life skill programs for youth with physical disabilities. J Adolesc Health. 2007;41(4): 323-332.

- Dr. Jan Andrysek

  Andrysek J. Lower-limb prosthetic technologies in the developing world: a review of literature from 1994 to 2010. Prosth Orth Int. 2010;34(4): 378-398.

- Dr. Virginia Wright

  Wright V, Majnemer A, Maltais DB, Burtner PA, Sanders H. Motor measures: a moving target? Semin Pediatr Neurol. 2013;20(2):84-99.

  King G, **Wright V**, Russell DJ. Understanding paediatric rehabilitation therapists' lack of use of outcome measures. Disabil Rehabil. 2011;33(25-26):2662-71.

  Wright V. Evidence note on upper limb prosthetic outcome measures. The Academy Today. 2013;9(1):A11-A13.

Wright V. Prosthetic Outcome Measures for use with Upper Limb Amputees: A Systematic Review of the Peer-reviewed Literature, 1970 to 2009. J Prosth Orthot. 2009;24(4S):3-63.

- Dr. Arezoo Eshraghi

  Eshraghi A, Osman NA, Gholizadeh H, Karimi M, Ali S. Pistoning assessment in lower limb prosthetic sockets. Prosthet Orthot Int. 2012;36(1):15-24.

  Gholizadeh H, Abu Osman NA, **Eshraghi A**, Ali S. Transfemoral prosthesis suspension systems: a systematic review of the literature. Am J Phys Med Rehabil. 2014;93(9):809-823.

Knowledge Translation

- Dr. Shauna Kingsnorth

  Ryan, S.E., Shepherd, T., Renzoni, A.M., Anderson, C., Barber, M., **Kingsnorth, S**., & Ward, K. (Accepted March 5 2015). Towards advancing knowledge translation of AAC outcomes research for children and youth with complex communication needs. [TAAC-2014-0038] Augmentative and Alternative Communication.

- Dr. Jan Andrysek

  Andrysek J, Christensen J, Dupuis A. Factors influencing evidence-based practice in prosthetics and orthotics. Prosthet Orthot Int. 2011;35(1):30-8.

  Christensen J, **Andrysek J**. Examining the associations among clinician demographics, the factors involved in the implementation of evidence-based practice, and the access of clinicians to sources of information. Prosthet Orthot Int. 2012;36(1):87-94.

- Dr. Virginia Wright

  Brewer K, Pollock N, **Wright V.** Addressing the challenges of collaborative goal setting with children and their families. Phys Occup Ther Pediatr. 2014;34(2):138-152.

  King G, **Wright V**, Russell DJ. Understanding paediatric rehabilitation therapists' lack of use of outcome measures. Disabil Rehabil. 2011;33(25-26):2662-71.

  Wright V, Maltais D, Sanders H, Burtner P. Section II: ICF body structure and functions-motor functions. In: Majnemer A, editor(s). Measures of outcomes and their determinants for children and youth with developmental disabilities. London: MacKeith Press; 2013.

  Sanders H, **Wright V**, Burtner P. Section III: ICF Activities and Participation: Motor functions. In: Majnemer A, editor(s). Measures of outcomes and their determinants for children and youth with developmental disabilities. London: MacKeith Press; 2013.

5. FACILITIES AND RESOURCES

Holland Bloorview Kids Rehabilitation Hospital is Canada's largest pediatric rehabilitation and continuing care teaching hospital, and is fully affiliated with the University of Toronto. It houses both the internationally recognized Bloorview Research Institute which is dedicated to improving the lives of children with disabilities through client and family-centred rehabilitation research, and the Teaching & Learning Institute, focused on training and knowledge translation activities.

The Research Institute brings together a multi-disciplinary team of scientists who work collaboratively with clinical staff, clients, and families to generate clinically-driven and applied pediatric rehabilitation research. Scientists in the Bloorview Research Institute develop outcome measures to evaluate interventions. Some successful examples are Prosthetic Upper Extremity Functional Status Index, FOCUS© Outcome Measure, Juvenile Arthritis Functional Status Index, Hypertonia Assessment Tool, Quality Function Measure, Challenge Module for the Gross Motor Function Measure.

The Teaching & Learning Institute plays a vital role in ensuring excellence in training of the next generation of health professionals. A core component of the Institute is Evidence to Care. This hospital wide initiative holds expertise in knowledge translation to transform the best research evidence into high quality and optimal care by advancing systematic reviews, clinical practice guidelines and evidence-informed best practices in childhood disability. A key focus is bringing together knowledge translation experts, health sciences librarians, health care professionals, decision-makers, families and clients to enhance the hospital's role as a producer, generator and user of research evidence.

Being fully affiliated with the University of Toronto enables us to access a broad range of healthcare databases, including but not limited to the MEDLINE, EMBASE, CINAHL, Web-of-Science and RECAL. A full-time Health Sciences Librarian is available to provide guidance and expertise through the Teaching & Learning Institute. The librarian will be fully engaged in this project, to help search for and retrieve articles.

In addition, our research institute has close collaborations with the Sunnybrook Hospital and West Park Healthcare Centre, providing access to experts (prosthetists, physiatrists and therapists) involved in the care of adult and elderly patients, this is in addition to our access to clinicians dealing with pediatric populations at Holland Bloorview.

Finally, the Bloorview Research Institute fully supports this project, granting access to a broad range of resources that will be needed for this project. In addition to the library resources, we have access to computers, software (i.e. Mendeley etc) and space to conduct the work. The support of Holland Bloorview extends to providing in-kind in terms of the salaries of the co-investigators, clinical staff, and library services.

6. BUDGET (The budget below is in US funds, converted from Canadian funds at a rate of $0.80 based March 25th 2015 conversion rates)

	Details	Amount	Total
Salary	Chief Scientist/Principal Investigator, Co-Investigator S.K. and V.W. and other personnel Co-Investigator A.E.	In-kind In-kind $43,792	$43,792
Materials	Printing Articles retrievals* Stationary and Office Supplies Open access journal fees Teleconference	$50 $50 $50 $700 $150	$1000
Travel	Air Travel Ground Travel (taxi, train, …) Hotel Meals Conference registration fees	$3000 $400 $1000 $400 $600	$5400
Indirect Costs	Institutional overhead at 7.1% of total budget	$3808	$3808
Total			**$54,000**

* For the articles outside of our library system.

BUDGET JUSTIFICATION

Salaries

The largest portion of the budget relates to the work involved in the facilitation of the systematic review. Dr. Arezoo Eshraghi will dedicate 3 days per week (60% of her time) for this project over its duration of 16 months. At an hourly rate of $23 and including 19% in lieu of benefits, a total of $43,792 is budgeted for her salary. She will be responsible for the day-to-day activities in the coordination and execution of this project.

Salaries of the other team members are covered by the Holland Bloorview Kids Rehabilitation Hospital. Dr. Andrysek will dedicate 15% of his time to the project, and Dr. Kingsnorth and Wright will dedicate 10-20 hours each, as needed. Salary for the librarian is also covered via the Holland Bloorview. The involvement of the prosthetists and physiatrists (other than Arezoo Eshraghi) in terms of total time will be small (2-3 hours each) and absorbed by the respective clinical programs.

Materials

Some of the articles may not be available through our regular library system and catalogs, and a fee may be required for retrieval. Related fees have been budgeted in the amount of $50. Printing of articles and rating forms to facilitate the review process has been budgeted at $50. Office supplies including printing of articles are budgeted at $50. Teleconferencing costs are estimated at $150, based on a $0.08 per minute rate. Finally, in an effort to make the findings of this work easily accessible, we aim to target an open access peer-reviewed journal for publication. While open access fees can greatly vary depending on the journal, we have budgeted $700.

Travel

It is anticipated that for the consensus and algorithm development, meeting with AOPA working group (at least 2 times) is necessary. Additionally, costs of travel and accommodation for attending the AOPA National Assembly are included in the proposed budget. The costs are based on the travel of two of the team members.

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