

A Trip to Remember

Citation for published version (APA):

McCrum, C. (2019). *A Trip to Remember: Assessing and Improving Walking Stability in Older Adults*. [Doctoral Thesis, Maastricht University]. Gildeprint Drukkerijen. <https://doi.org/10.26481/dis.20191219cm>

Document status and date:

Published: 01/01/2019

DOI:

[10.26481/dis.20191219cm](https://doi.org/10.26481/dis.20191219cm)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

7.4: Valorisation

The research described in this dissertation had the general aim to further our understanding of how gait stability and adaptability are affected in older adults, in order to generate new knowledge that could improve the effectiveness and specificity of exercise-based falls reduction interventions for both healthy and clinical populations at an increased risk of falls. Valorisation refers to generating societal or economic value from knowledge and, in this section, the valorisation of the knowledge gained in this dissertation will be outlined in the contexts of societal and economic relevance, target interest groups, translation of knowledge and innovation, and implementation.

Societal and Economic Relevance

The societal relevance of better understanding and improving older adults' gait stability has been discussed at length in this dissertation because falls represent a major societal burden and their prevalence and associated consequences will continue to increase in our ageing societies. To the individual, falls represent a threat to physical function and independence, and by extension to social engagement and overall quality of life. The benefits of physical activity and social participation for overall health are well established, but these can become even more important as we age, in order to minimise physical and mental decline. Falls and fall-related injuries can severely disrupt this, with recovery (or lack thereof) and bedrest following injury accelerating physical decline and potentially resulting in social isolation, which can be further exacerbated by an increased concern about falling again. To our societies and economies as a whole, reducing falls and fall-related injuries would help relieve some logistical and financial pressure on our healthcare systems.

However, the above address falls and fall-related injuries, and not specifically our understanding of gait stability and adaptability, which was the focus of this dissertation. The direct relevance of this understanding lies in the potential for optimising falls reduction interventions. There are a number of challenges with implementing exercise-based falls reduction interventions in society. The first is that they are costly, due to the time required (in order to achieve a minimum effective dose) and the other logistical requirements such as locations, staff and equipment. As discussed in **Part Six** of this dissertation, improving the specificity of these interventions by better understanding how humans can improve their gait stability will likely reduce the intervention time needed to have a meaningful effect on falls risk and may therefore lead to lower overall costs for implementing these interventions. This may also positively influence the second challenge - ensuring sufficient adherence to the interventions to reach the minimum effective dose. It is well known that many adults do not participate in enough regular physical activity to meet the various national and international guidelines, and therefore exercise-based fall reduction interventions may be more likely to have better adherence when they are of shorter duration or frequency. As mentioned throughout this dissertation, training involving only one to four sessions of large, sudden balance disturbance in a secure environment have demonstrated long term improvements (up to 1.5 years) in reactive

balance control during walking. Improving our understanding of how these effects occur and how to best exploit them by manipulating our training protocols is therefore highly relevant for society-wide implementation.

Relevance to Groups outwith the Scientific Community

As described in **Part Six** of this dissertation, fall risk assessment and intervention among medical and health care practitioners may be lacking in a number of areas. Most general practitioners report not assessing their older patients' risk of falls unless a fall has already occurred, and physiotherapists' assessment of reactive postural control appears to be lacking. However, as these professions typically represent a first point of contact regarding the health and mobility of older adults, they should be target groups for knowledge transfer. If improvements can be made in the assessment and early intervention of reactive balance control at these levels by utilising the knowledge generated by this dissertation and other similar research, declines in balance control in older adults may be delayed at the community level.

In addition to medical and health care practitioners, older adults themselves are a target group for knowledge translation. By increasing awareness among older adults about what can be done to reduce falls risk and improve gait stability, this can also stimulate those individuals to seek out opportunities with their healthcare providers or take steps to reduce their own risk through various exercise or non-exercise-based interventions. Finally, the current results and research on exercise-based falls reduction more broadly should be of interest to organisations involved in healthcare and public health policy. Following building scientific evidence, a number of national physical activity guidelines have recently included resistance exercise as an important physical activity component, especially for older adults. Similar emphasis on increasing the amount of challenging and, when feasible, reactive balance training among older adults could have a positive effect on awareness, policy and practice with regards to falls prevention.

Knowledge Translation and Innovation

In recent years, the number of companies that produce technologies designed for testing and training mobility has increased and, of particular relevance for the work in this dissertation, an increasing number of commercially available treadmill-based systems that can apply controlled perturbations to balance during walking are becoming available. Many of these devices come with built in programmes for testing and training balance control and the results of this dissertation and related work may help to improve the accuracy, validity and effectiveness of these programmes. However, as such devices are only feasible options for larger or wealthier organisations, another important commercial area for knowledge translation are companies that produce relatively inexpensive tools and products that are feasible for the typical physiotherapy practice or rehabilitation centre. In this regard, translation of the underlying principles of the work is critical, especially regarding the retention and transfer of adaptations in gait and balance. Finally, organisations that develop interventions for specific clinical populations (for example, the

vestibular implant for people with bilateral vestibulopathy) can be guided in their development of such interventions by an improved understanding of the various components of balance control during walking, by more specific gait and balance testing protocols for their target groups and by investigating which components can be successfully improved through intervention.

Implementation

The first step to translating scientific knowledge is through the publication and dissemination of the work to the scientific community and the public. The majority of the work in this dissertation has been published in peer reviewed journals and in all cases, an open access version of each article has been made available (either the preprint, accepted or published versions). **Parts One, Six and Seven** of this dissertation are licensed under the CC BY 4.0 License (which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited) in the hope that the information presented can be more easily and freely shared and applied. The work has been presented and discussed at national and international scientific conferences as well as conferences with a more clinical perspective intended for health care professionals.

Additionally, the author has participated in industry-initiated workshops aiming to share knowledge about the use of technology in the context of assessing and training gait and balance control and has also given presentations for companies themselves. In the near future, public summaries of the work in this dissertation and its relevance to various products for assessing and training balance will become available on the respective company websites. Such initiatives are intended to bring the end users of the products, as well as the developers, closer to the results of the relevant research. The author will continue to work closely with these companies as the research in this area continues.

Finally, outreach activities for the general public will take more precedence in the future. Openly available summaries of current research activities and public presentations for older adults, patient groups and healthcare practitioners will be planned in order to stimulate a direct link with the researchers that initially will help increase awareness of recent developments but will also stimulate feedback channels to help direct and inform future research that accounts for challenges faced in practice.

Personal Perspective

Almost every published scientific article concerning balance or gait stability begins with a paragraph on the problem of falls. I wonder how often we as researchers actually translate the knowledge we have gained from research to practice, or at least bring it to a point that others can translate and apply the work to address this problem, and how often it is simply an easy justification for our work? Developing sophisticated protocols, parameters and devices to train and assess gait stability is no doubt of fundamental importance but they will have no impact on the wider societal problem of falls unless they can be applied on a broad, public scale, either directly or indirectly. The current incentive system in science may cloud this bigger picture, with publications often being viewed as end products that

gather citations and further funding, rather than vehicles of knowledge translation for application in broader contexts. I challenge myself and my fellow researchers in this field to frequently reflect on this and to ask ourselves if we are translating the knowledge we have gained, or if we are just padding our CVs? Speaking for myself, I would be utterly ashamed looking back in 30- or 40-years' time if I could not clearly see how my research had helped us to understand and address the problem of falls.

To this end, I believe that open science practices and active community engagement can go a long way. As many groups for whom this research is relevant do not have academic institutional access to paywalled literature, open access publication of research is vital for successful knowledge translation, as is the dissemination of knowledge through other accessible means such as social and traditional media and open workshops and presentations. Open data, software, code and methodology while perhaps of less direct relevance to knowledge translation for the public, help the scientific community evaluate, improve upon and accelerate what is being researched, which will lead to faster and more robust scientific progress that can be translated. Finally, frequent and direct contact with the public, with health care practitioners and with societies and companies to disseminate new knowledge and discuss their needs and challenges will help improve the translation of past, and translatability of future, research.

Concluding Remarks

Research on falls prevention is, almost by definition, tied to valorisation. Similarly, research on balance and gait that aims to inform, and lead to improvements in, exercise-based falls risk assessment and reduction is closely linked to valorisation. However, it is vital that we as researchers realise that this does not occur automatically. We should actively pursue channels for translating knowledge gained through research to the public, to healthcare practitioners, to companies and to organisations. Only with this translation of knowledge can we justify using the broader societal issues caused by falls as a rationale for our research.