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ERGONOMICAL GUIDE FOR PERSONAL ASSISTANTS

Degree Programme in Physiotherapy

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Satakunnan ammattikorkeakoulu  
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Ergonomics is an important topic for every profession, even more in health care where musculoskeletal disorders are the most common reason for sick leaves and early retirement. Education on the subject, has also prove to reduce the number of sick leaves and the costs related to them.

For that reason, this thesis aims to prevent injury in health care professions, especially personal assistance and at the same time reach the foreigner work force in Finland who does not have access to most of the information because of the language barrier. In this thesis, the most common movements in which clients need assistance are explained based on literature and with techniques to facilitate those movements.

The outcome of this thesis is a short manual containing those methods and images than could serve as a guide at work.

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## 1 INTRODUCTION

From the 1 of September of 2009, having a personal assistant became a right for those who have severe disabilities, this law was created with the purpose of enabling people with disabilities to have independent living and functioning equally in society, even when not having help from family members. Personal Assistance job has been growing since then, employing around 25000 people of different backgrounds in Finland. Being a personal assistant does not include nursing work, however it might include nursing tasks in cases where clients use medical equipment. Formal education for personal assistants is available but not mandatory at the moment. (Julkisten ja Hyvinvointialojen Liitto web page, 2019).

Having reliable information on client handling, promotes safety and well-being for both clients and knowledge about body mechanics and proper use of one's own body helps prevent injuries. (Website of the Finnish Institute of Occupational Health. Website of the Agency for Integrated Care, Singapore 2020) Client's independency in every activity is important, as excessive assistance has been noticed to affect in the client own ability to be active. Therefore, the patient is encouraged to activate as much as possible because it promotes health. At the same time, it reduces the physical burden on assistive personnel. (Tamminen Peter and Wickström 2013)

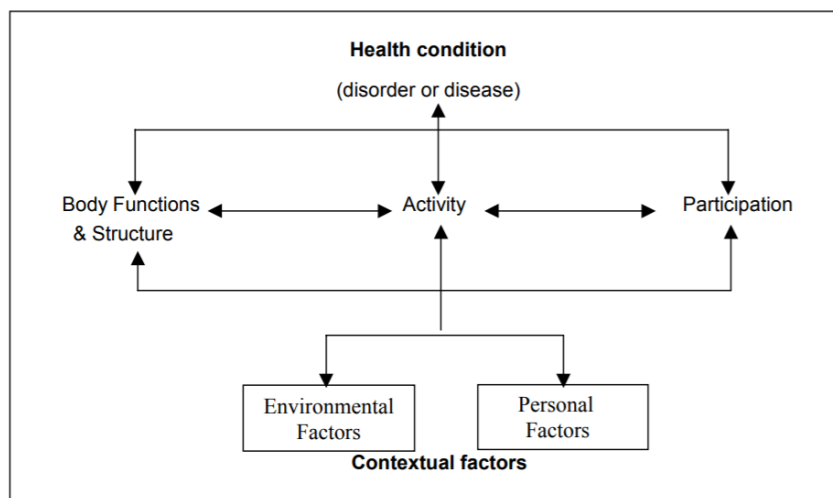
## 2 AIM AND OBJECTIVE OF THIS THESIS

The aim of the thesis is to prevent work related injuries which are currently one of the main causes of sick leaves in personal assistants' jobs.

The objective of this thesis is to provide personal assistants with an overview of ergonomics and safe client transfers in a short concise manual based on literature, easy to read and in more than one language. This, attending to the needs of information and ergonomical education for those who are starting personal assistant jobs, have not had previous health care education and are not native Finnish speakers.

## 3 DISABILITY

According to the International Classification of Function, Disability and Health (ICF), Disability occurs when disfunction exists in one or more of the levels mentioned in the ICF model (i.e. impairments, activity limitations and participation restrictions) (Picture 1) (Towards a Common Language for Functioning, Disability and Health ICF. 2002, 10)



Picture 1: ICF Model (Towards a Common Language for Functioning, Disability and Health ICF. 2002, 9)

The Finnish Disability Services and Assistance Act says that a person with disability is someone who, due to an injury or illness, has long-term difficulties performing normal life functions. (Disability Services and Support Act Section 2) This Act promotes the ability to live and work as an equal member of society and to prevent and eliminate the disadvantages and obstacles caused by disability. (Disability Services and Support Act, Section 1) A person with a disability shall be provided with rehabilitation, counselling, adjustment and other necessary services such as transportation, day care, personal assistance and accommodation in order to carry out normal life activities. (Disability Services and Support Act, Section 8)

Personal assistance is the aid provided to a person with severe disabilities at home and outside home with daily activities, work and study, hobbies, participation in society and maintaining social interaction. The purpose of personal assistance is to support severely disabled people to make their own choices while performing the mentioned activities. (Disability Services and Support Act Section 8c) Each employer defines what his needs are in and out of home, e.g. daily tasks such as dressing, eating, self-hygiene, home cleaning, taking care of kids, etc. Out of home activities might include, shopping, hobbies, work place or at-school assistance, socializing, etc. (Paivanen K. et al 2012, 5) Usual domestic work, medical treatments or nursing job are not part of a personal assistant's tasks; however, the position may include assistance related to these activities. (Paivanen K. et al 2012, 7)

As any other profession, personal assistance comes with its own risks work related injuries (falls, slips, bites); environmental factors (poor air quality, poor illumination, noise, heat, cold) Chemical and biological agents (bacteria and viruses, mold, dust, excretions); Mental load (harassment, inappropriate treatment, threat of violence, authoritarian management) and Physical load (uncomfortable postures, transfers, heavy loads, repetitive movements), it is fundamental to recognize those risk factors in order to create safer work environments. (Paivanen K. et al 2012,13-14)

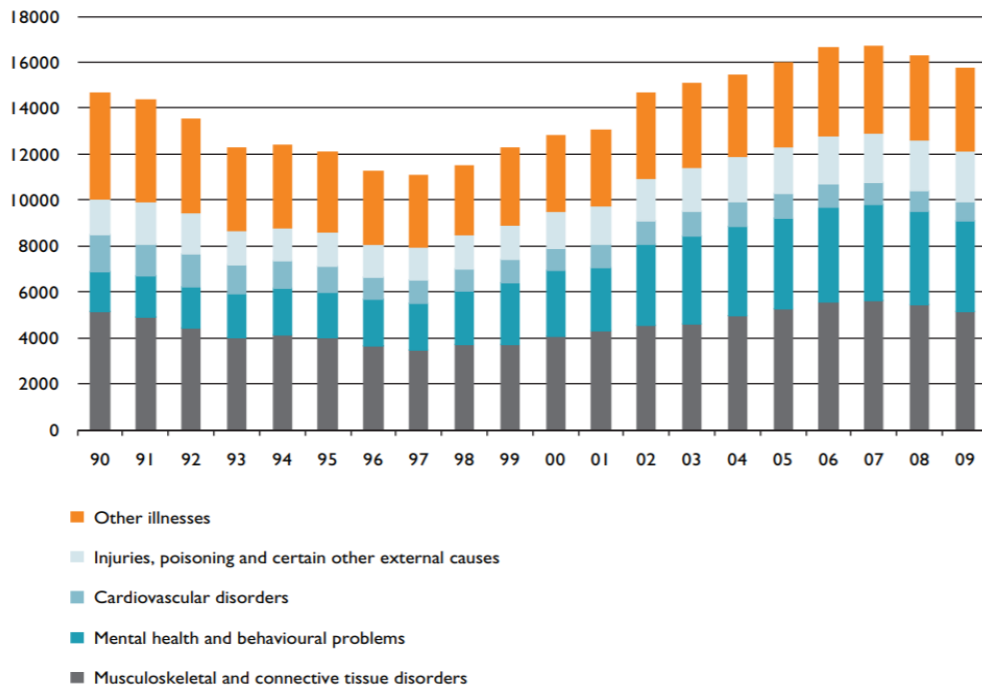
## 4 ERGONOMICS

Ergonomics is the practice of acknowledging interaction between humans and their surroundings in order to enhance wellbeing and good performance. The main focus of ergonomics is human being, and several aspects are considered including posture, movement and environment. Risky, uncomfortable scenarios at work and daily activities can be prevented by acknowledging physical and mental abilities. These elements have a great influence in efficiency, security and health. (Dul Jan et al. 2001, 1,2.)

To an appropriate extent, load is beneficial to the body, but if it is excessively high or it persists for a very long time, the effects will become negative. Various musculoskeletal disorders, such as fatigue, rigidity, pain in the body, and aching pains, are common in many industries. (Tamminen-Peter and Wickström 2013, 11) Caregivers work is both physically and mentally burdensome, walking, bending and assisting transfer of patients, increase the incidence and severity of symptoms. Also, long-lasting, minor overloading can lead damage to tissues and the symptoms caused by those damages. Psychosocial and psychological factors also affect the symptoms and their duration. (Tamminen-Peter and Wickström 2013, 11)

Client handling refers to activities such as lifting, transferring and repositioning a patient, which are commonly done by health care workers. Musculoskeletal diseases are common among health care workers and are primarily related to client handling and worsened by various factors in the workplace such as force, repetition or maintaining awkward postures. (Web page of Ontario Ministry of Labor, 2019) In many countries, diseases of the musculoskeletal system and psychological illnesses are the most important cause of absence due to illness and occupational disability among health workers. (Table 1) (Dul Jan et al. 2001, 2)

Table 1: Sickness allowance days compensated by illness 1990-2009

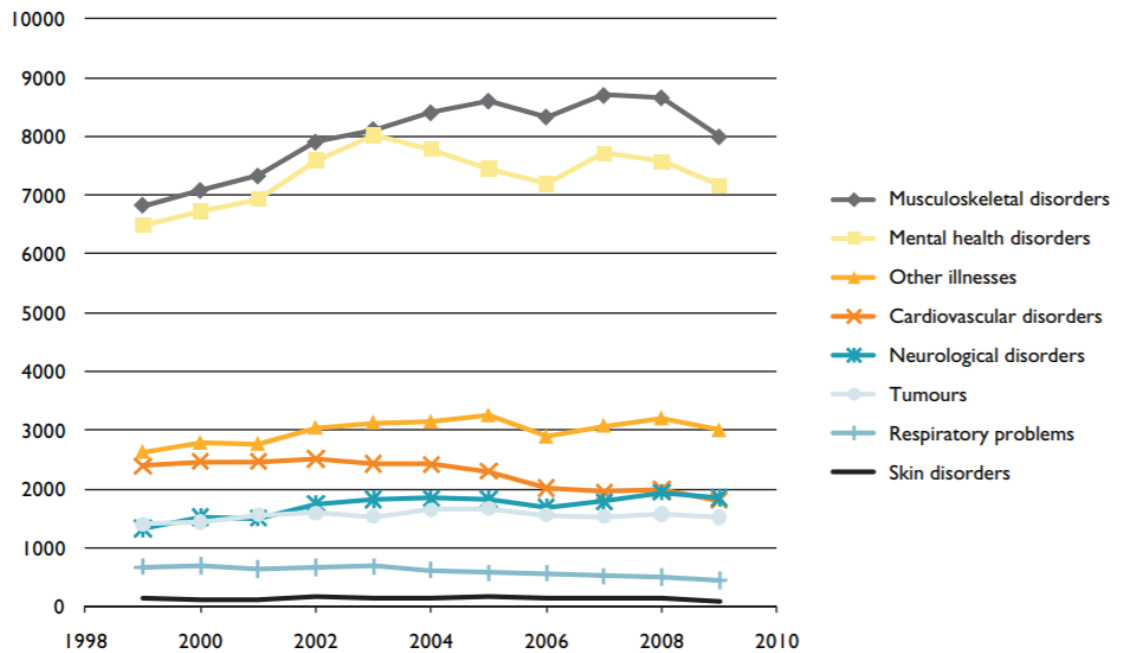


(Occupational Safety and Health in Finland. Ministry of Social Affairs and Health 2010, 25)

In Finland sick leaves in 2018 was around 6.3 days. Female workers on average take two days more sick leave than male workers. The most common causes of sick leave are musculoskeletal disorders (36%), mental health disorders (22%) and injuries/poisonings (13.6%). (WHO: National Profile of Occupational Health System in Finland, 34) Musculoskeletal disorders are one of the main causes of pain, decrease in functional capacity, disability and retirement. (Table 2) More than one million Finns have a chronic MSD and another million suffer temporary musculoskeletal disorders. The costs caused by MSD's ascend to around 2 billion euros a year. (WHO: National Profile of Occupational Health System in Finland. 39, 40)



Table 2: Number of Employees retiring on a disability pension by illness in Finland 1999-2009



(Occupational Safety and Health in Finland. Ministry of Social Affairs and Health 2010, 27)

#### 4.1 Biomechanics

Biomechanics study the various parts of the body influencing and developing forces and their effects, both the internal forces produced by muscles and the external forces that act on the body. The knowledge of the basic concepts of biomechanics helps to understand the laws of basic movement and facilitates understanding the principles of assistive equipment. (Tamminen Peter and Wickström 2013, 78. Hall Susan 2019)

##### 4.1.1 Center of gravity (COG)

It is the point in the body where the whole-body weight is thought to be concentrated. In anatomical position the center of gravity is thought to be roughly in the front of the L3 vertebrae. However, the precise location of it in the human body changes depending

on the different positions of the body and the differences in structure between individuals thus, in some positions for example, when bending, the center of gravity may also be located outside the body. (Tamminen Peter and Wickström 2013, 78)

#### 4.1.2 Base of support (BOS)

Stability and balance in any position or during movement are influenced by the base of support and the location of the center of gravity in relation to the support. The body's base of support is the area under the body parts touching a surface and the space between these contact points. When standing on the floor, the support surface is the area beneath and between the soles of the feet. Balance can be improved by increasing the support surface, for example by changing the position of the feet or by using an assistive device such as a walking stick. (Tamminen Peter and Wickström 2013, 79)

#### 4.1.3 Balance

In order to maintain balance, it is essential to keep the center of gravity inside the base of support. Balance, also known as equilibrium, is achieved when all the forces in the body are cancelled by each other creating stability. The balance of the body can be improved by lowering the COG, for example by bending the knees. (Tamminen Peter and Wickström 2013, 79)

#### 4.1.4 Forces

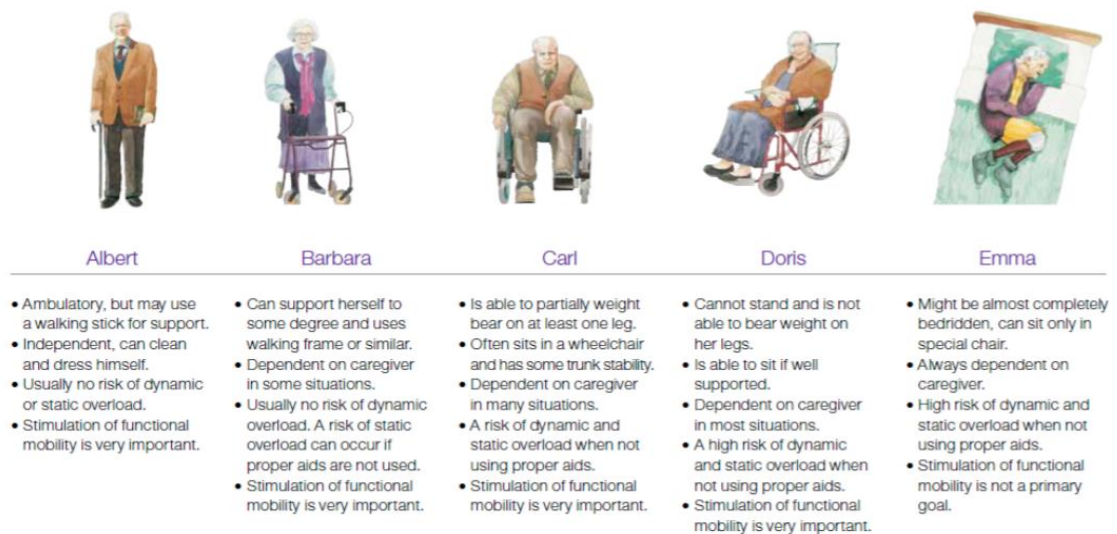
We can think of force as a push or pull that acts on a body. Magnitude, direction and point of application constitute forces. Some examples of forces acting on a body can be air, water resistance or even the body weight itself. (Hall 2012, 63)

## 5 ASSISTIVE DEVICES IN CLIENT TRANSFERS

The purpose of assistive and transfer devices is to maintain functioning and independence, promote participation in society and decrease physical strain between caregivers. They can also aid in impairment prevention and secondary health conditions. (WHO web page, 2019. U.S. Department of Health & Human Services web page 2019) Several studies support that education on safe patient handling, the use of assistive devices and handling equipment reduces work related musculoskeletal disorders, personnel absenteeism and the costs related to them. Furthermore, the reduction in workers medical compensation and indemnization expenses recover the initial investment for equipment and training costs in approximately 3.75 years. (Nelson, Matz et al 2005, 728,730)

### 5.1 Mobility Assessment

Different types of assistive devices are available and can be useful depending on the level of functionality of clients, the ARJO Mobility Gallery is a useful tool for this purpose (Picture 2), helping care givers encouraging the actual mobility and taking in consideration passivity. It is important to keep in mind individuality and adapt to the circumstances of each client. (Hallstöm et al 2015, 3)



Picture 2: The Five levels of mobility, Arjo Mobility Gallery. (Hallström et al. 2015, 2)

## 5.2 Assistive Devices

There is a wide variety of assistive devices in the market made for hospital environment, many of these are also recommended at home. The use of assistive devices improves the working positions of caregivers and reduces the risk of musculoskeletal diseases in caregivers. (Tamminen-Peter and Wickström 2013, 50)

**Support Handles** can be used in the toilet, aisle and room. Helpful for sitting, standing up or moving from bed to wheelchair. (Picture 3) (Tamminen-Peter and Wickström 2013, 42)



Picture 3: wall, electric bed and toilet handles (Butrón I. 2020)

**Sliding boards** are simple tools that help move from one level to the other. Traditionally they are made of plywood but nowadays they are made of plastic and there are many different lengths and shapes available. (Picture 4) (Tamminen-Peter and Wickström 2013, 40)



Picture 4: Sliding board (Butrón I. 2020)

**Turners** facilitate the transfers from bed to wheelchair, it gives support to legs, knees, arms and can aid repositioning farther back in a wheelchair. (Picture 5) (Tamminen-Peter and Wickström 2013, 42)



Picture 5: Turner (Butrón I. 2020)

**The bed rope ladder** can help with pulling oneself in an upright position, independently on the bed. (Picture 6) (Tamminen-Peter and Wickström 2013, 43)



Picture 6: Bed rope ladder (Butrón I. 2020)

**Bed sheets** can be a very helpful tool for both the patient's self-help and the caregiver's assistance. Sheets made with satin fabric in the center eliminate friction, and facilitate movement from side to side, turning or moving higher in bed. (Picture 7 & 7a) (Tamminen-Peter and Wickström 2013, 39)



Picture 7

Picture 7a

Picture 7: Front of a bed sheet made of anti-sliding material (Butrón I. 2020)

Picture 7a: Reverse of the same bed sheet with handles and satin fabric in the center. (Butrón I. 2020)

**Electric beds.** Being able to adjust the height of the bed can be helpful for example when getting in and out of bed or transferring to a same height chair or wheelchair. (Picture 8) (Web site of Assisitive Technology Australia 2019)



Picture 8: Electric bed (Butrón I. 2020)

### **Wheelchair**

Excessive weight bearing or fast turning could be also a cause of injury and musculo-skeletal disorders, for that reason some cautions should be considered while assisting a client on a wheelchair. (Weston and Khan 2017) Back must be maintained in an upright position with a natural spine curve, the handles with a firm grasp and both arms slightly extended without reaching. Walk with a slow steady pace with the chair, avoiding gravel or other difficult paths. The strength to move the wheelchair, as any

other move explained in this manual should come from the lower limbs. (Picture 9)  
(Website of the Department of Human Services, Government of South Australia)



Picture 9: Wheelchair (Butrón I. 2020)

If there is need to cross a threshold, stop the wheelchair and apply pressure with the foot at the tipping lever situated next to the back wheel, the front wheels will elevate slightly, keep moving forward with the chair.

While going up an incline ramp, stand close to the wheelchair, keep back straight, hold handles tight and push with lower limbs. (Website of the Department of Human Services, Government of South Australia)

When going down an incline ramp, stand close to wheelchair, hold handles firmly, lean back slightly and walk down slowly.

If the ramp is very steep it is advisable to go down backwards, to prevent the wheelchair user to fall forward. (Website of the Department of Human Services, Government of South Australia)

## 6 CLIENT TRANSFERS

The transfers in this manual are intended for people that need assistance, but with fair mobility. The general guidelines of maximum weight lifting is 25kg for men and 16kg for women, if lifting above shoulder height the maximum changes to 10 kg for men

and 7 kg for women. Attempting to realize manual transfers for clients with low mobility can cause severe injuries. (Website of Workplace Safety Advice UK, 2020)

## 6.1 Previous considerations

Before starting, it is important to review the client's medical status and functional abilities, encourage them to be as independent as possible and avoid excessive loads on your own body, if they are not able to stand on their feet, don't do manual lifts, instead, use assistive devices as much as possible. Plan, create a safe environment without obstacles and keep close all the devices to be used, if more than one person is assisting define what each other's role will be. Communicate with your client, tell him what he is going to do and how you will assist, be clear and concise. (Tamminen-Peter and Wickström 2013, 82)

## 6.2 Transfer

Wait for the client to start the movement, if verbal guidance fails combine verbal control with touch and motion. Instead of lifting roll or slide, produce strength with the lower extremities while keeping shoulders and arms relaxed, avoid holding your client from the clothes or armpits, instead be as close as possible without limiting the movement and assist with a wide and soft palm grip from the hips, back or where the movement feels jammed. Good body control is fundamental, keeping the back as straight as possible and avoiding spine rotation while lifting. (Tamminen-Peter and Wickström 2013, 82,83)

### 6.2.1 Moving up in bed

The client pushes himself up with the legs and pulls up with his hands from the bed end while the assistant supports the feet and helps activation by pushing the legs against the mattress. (Picture 10) (Tamminen-Peter and Wickström 2013, 87, 88)





Picture 10: Moving up in bed (Butrón I. 2020)

The assistant puts his arms under the client's pillow and shoulders to remove the friction while client pushes himself up with the feet. Assistant keeps the back and arms straight and shoulders relaxed, the movement is done by shifting the weight to the back leg. (Picture 11) (Tamminen-Peter and Wickström 2013, 87, 88)



Picture 11: Helping a client up in bed by removing friction on the back (Butrón I. 2020)

### 6.2.2 Rolling to one side

The client is guided to hold from the side rail. Flexes the client's knees and assists turning by the shoulder and/or hips. (Picture 12)



Picture 12: Rolling to one side (Butrón I. 2020)

Holding the side rails and with knees flexed, client is assisted to turn by pulling the blanket underneath his body. Assistant is holding the blanket at shoulder and hip height and stands with one leg slightly in front of the other, shoulders are relaxed, and arms don't bend, movement is done by shifting weight to the back leg. (Picture 13) (Tamminen-Peter and Wickström 2013, 90)



Picture 13: rolling to one side assisted by pulling blanket (Butrón I. 2020)

### 6.2.3 Sitting up

Once the client is lying on the side, reach one arm under his shoulder blades and the other behind the knees, assistant pulls the client up by doing a weight shift. Client can help or do the movement independently pushing himself up with one hand against the

bed or holding the bed handle. (Picture 14) (Tamminen-Peter and Wickström 2013, 96. Web site of the Agency for Integrated Care, Singapore 2020)



Picture 14: Sitting up (Butrón I. 2020)

#### 6.2.4 Standing up

A wheeler can be a good tool to help a client stand up, put the brakes and check that it's far enough, apply slight pressure on the knee while giving a soft push to the back. (Picture 15) (Tamminen-Peter and Wickström 2013, 99. Web site of the Agency for Integrated Care, Singapore 2020)



Picture 15: Standing up (Butrón I. 2020)

### 6.2.5 Walking with assistance

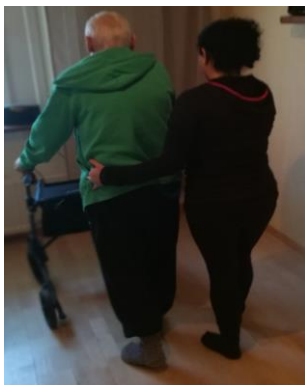
Walking requires weight control and balance on one leg while the other foot takes a step. When there is not enough strength it is easily to shake and feel fearful.

There are many ways to assist walking. The best way depends on the patient, so investigating and experimenting is a good start. On the first technique the assistant walks on one side the patient, slightly behind him and supports the patient from the waist with one hand, the second hand of the assistant gives support to the patients' hand, holding it softly but firmly. (Picture 16) (Tamminen-Peter and Wickström 2013, 112)



Picture 16: Walking together supported by hand and waist (Butrón I. 2020)

A method used when the client uses an assistive device is holding the waist with both hands. (Picture 17) In both cases, the assistant walks at the same rhythm than the client, this gives a sense of safety and helps with balance. (Tamminen-Peter and Wickström 2013, 112)



Picture 17: Walking together with assistive device supported by the waist. (Butrón I. 2020)

## 6.2.6 Standing up after a fall

If a client falls, don't try to stop the fall, instead lower him gently to the floor.

Once on the floor ask him to roll on his side, then onto his knees. Bring a chair close to him and ask him to support from the chair to stand up. The assistant can help by guiding the patient's hips, while standing up. (Picture 18)

(Agency for integrated Care Singapore Web page 2020. Tamminen-Peter and Wickström 2013, 114, 115)



Picture 18: Standing up after a fall. (Butrón I. 2020)

## 7 THESIS METHOD AND PROCESS

This is a practice-based research thesis, an investigation initiated with the goal of acquiring new learning, partially by practice and partially by the results of it (Candy L. 2006, 1), this thesis includes research, experience on the personal assistance field and a manual as an outcome of the three of them. It was written throughout the last trimester of year 2019 and the first of 2020 (Table 3)

Table 3: Thesis Process and dates

Process	Date
Deciding Topic of Thesis	October 2019
Thesis plan presentation	October 2019
Research and writing	October 2019-February 2020
Thesis Presentation	3 <sup>rd</sup> of March 2020
Maturity Exam	3 <sup>rd</sup> of March 2020

## 8 DISCUSSION

The activities of a Personal Assistant go hand in hand with the ICF model.

When there is a health condition that limits activities of daily living or participation, personal assistants work together with their employers and become their hands, feet, eyes and voice, assistants also have an important role helping with integration. Assisting with sitting, standing, transfers, etc. are common in this job, if a client has a severe impairment or lack of mobility, these tasks might be highly physically loading and not every household owns lifting and transfer devices, therefore assistants end up figuring out how to do transfers and lifting without appropriate knowledge, causing injuries that can become recurrent if not treated properly, affecting their own functioning and in consequence high expenses on sick leaves and doctor visits.

The idea came from the author's personal need of guidance at work. After a series of injuries from transferring clients in a non-ergonomical way and trying to find information, it was realized that most of the information that official institutions, unions and hospitals provide is in Finnish language.

The manual shows examples of devices commonly used at home and gives a short explanation of the correct way to use them, it also talks about care givers ergonomics and safety while assisting transfers. The next step to this manual would be to translate it to Spanish language hoping it could help other foreigners in their jobs and daily lives.

## REFERENCES

Arjo Huntleigh 2016: <http://www.arjohuntleigh-medicaldirectory.co.uk/Product/Get-Document/Mobility%20Gallery.pdf>

ARJO web page 2019: <https://www.arjo.com/int/insights/mobility-gallery/>

Candy, L. (2006). Practice Based Research: A Guide. Creativity and Cognition Studios Report. 1

Daynard D., Yassi A., Cooper J.E., Tate R., Norman R., Wells R. Biomechanical analysis of peak and cumulative spinal loads during simulated patient-handling activities: a substudy of a randomized controlled trial to prevent lift and transfer injury of health care workers. *Applied Ergonomics*. Volume 32, Issue 3.2001, Pages 199-214, ISSN 0003-6870, [https://doi.org/10.1016/S0003-6870\(00\)00070-3](https://doi.org/10.1016/S0003-6870(00)00070-3).

Disability services and assistance Act. FINLEX <http://www.finlex.fi/fi/laki/ajantasa/1987/19870380?search%5Btype%5D=pika&search%5Bpika%5D=Henkil%C3%B6kohtainen%20apu>

DUL, J. and Weerdmeester, B., 2001. *Ergonomics for beginners: a quick reference guide*. 2nd ed edn. London : New York: Taylor & Francis.

Hall S.J. What Is Biomechanics?. In: Hall S.J. eds. *Basic Biomechanics*, 8e New York, NY: McGraw-Hill; 2019. Available : <http://accessphysiotherapy.mhmedical.com/content.aspx?bookid=2433&sectionid=191508967>.

Hall S.J. *Basic Biomechanics*, 6e New York, NY: McGraw-Hill; 2012.

Hallström K., Waaijer E., Guthknecht T. Functional Healthcare Design for Mobilisation and Ergonomics Based on Patient Mobility. *Proceedings 19th Triennial Congress of the IEA, Melbourne 9-14 August 2015*. Available: <https://www.iea.cc/congress/2015/196.pdf>

Human Ergology Society, International Ergonomics Association 2017. *Ergonomic Checkpoints in Health Care Work*. Available: <https://www.iea.cc/upload/Ergonomic%20Checkpoints%20in%20Health%20Care%20Work.pdf>

Li J, Wolf L, Evanoff B. 2004. Use of mechanical patient lifts decreased musculoskeletal symptoms and injuries among health care workers *Injury Prevention* 10:212-216. Available: <https://injuryprevention.bmj.com/content/10/4/212>

Nelson A, Matz M, Chen F, Siddharthan K, Lloyd J, Fragala G. 2005. Development and evaluation of a multifaceted ergonomics program to prevent injuries associated with patient handling tasks. Available: <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1058&context=veterans>

Parviainen K., Väli-Heikkilä R., Bäcklund S., Toikkanen T., Tiri M., 2012. *Henkilökohtaisen avustajan opas*. Julkisten ja hyvinvointialojen liitto.

Tamminen-Peter, L., Wickström, G., 2013. Potilassiirrot : taitava avustaja aktivoi ja auttaa. Helsinki: Työterveyslaitos.

Työterveyshuoltolaki. Opas työterveyshuoltolain soveltajille. Helsinki, 2004.136 s. (Sosiaali- ja terveysministeriön oppaita, ISSN 1236-116X; 2004:12)ISBN 952-00-1556-6.

U.S. Department of Health & Human Services. Accelerating adoption of assistive technology to reduce physical strain among family caregivers of the chronically disabled elderly living at home. Appendix B. Family caregiver guide to assistive technologies and home modifications. 2012. Available: <https://aspe.hhs.gov/report/accelerating-adoption-assistive-technology-reduce-physical-strain-among-family-caregivers-chronically-disabled-elderly-living-home/appendix-b-family-caregiver-guide-assistive-technologies-and>

Web site of Julkisten ja Hyvinvointialojen Liitto, referred the 20.10.2019 [www.jhl.fi/](http://www.jhl.fi/)

Web site of The Ministry of Social Affairs and Health, Occupational Safety and Health in Finland, referred the 20.10.2019 <https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/71607/URN%3ANBN%3Afi-fe201504224086.pdf?sequence=1>

Web site of Assistive Technology Australia 2019, referred the 30.01.2019. Available: <https://at-aust.org/>

Web site of Ontario Ministry of Labour, Training and Skills Development, referred the 11.12.2019 <https://www.labour.gov.on.ca/english/hs/pubs/clienthandling.php>

Web site of the Agency of Integrated Care, Singapore 2019, referred the 11.02.2020 <https://www.aic.sg/>

Web site of the World Health Organization, referred the 11.12.2019. Available: <https://www.who.int/disabilities/technology/en/>

Website of the Department of Human Services, Government of South Australia, Use of a wheelchair - SWI 009 2013, referred the 31st Jan 2020 <https://dhs.sa.gov.au/about-us/publications/safe-work-instructions/use-of-wheelchair>

Website of the Finnish Institute of Occupational Health. Referred the 11.02.2020. <https://www.ttl.fi/en/>

Website of the World Health Organization, National Profile of Occupational Health System in Finland (2012) WHO Regional office for Europe, referred the 3.11.2019 [http://www.euro.who.int/\\_data/assets/pdf\\_file/0016/160522/e96482.pdf](http://www.euro.who.int/_data/assets/pdf_file/0016/160522/e96482.pdf)

Website of the World Health Organization, Towards a Common Language for Functioning, Disability and Health (ICF Beginner's Guide), 2002, referred the 11.12.2019 <https://www.who.int/classifications/icf/icfbeginnersguide.pdf>

Website of Workplace Safety Advice UK, 2020, referred the 7.2.2020 <http://www.workplacesafetyadvice.co.uk/>



Weston E., Khan S., Marras W. 2017. Wheelchair pushing and turning: lumbar spine and shoulder loads and recommended limits, *Ergonomics*, 60:12, 1754-1765, DOI: 10.1080/00140139.2017.1344445