



ProFouND: Prevention of Falls Network for Dissemination

DELIVERABLE D 4.2

FIRST EVIDENCE SYNTHESIS AND GENERIC GUIDANCE

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1 Description of deliverable, tasks and Milestones for WP4

Objectives:

A central objective of ProFouND is to construct a system for providing customised information to users, e. g. for health care provider organisations, health or social care professionals, NGOs, or older people themselves. WP4 will provide the content for the ProFouND Fall Prevention App PFPApp. This will be done by constructing a library of evidence based best practice objects (as if they were component atoms which can be assembled into full guidance) for each domain of the customisation tool, based on reviews of evidence. WP4 will also be responsible for ensuring that these objects are available in the various languages used by partners.

The deliverable for WP4 month 19 was the following:

D4.2) First evidence synthesis and generic guidance [Month 19]
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WP4 has performed the following task described in the DOW the first 19 months:

<p>Task 4.1: WP4 will draw on existing systematic reviews and evidence syntheses to identify and operationalize best practice in requisite areas and will put specific attention onto how to implement evidence and overcome barriers to innovation in practice as recommended in Journal of Safety Research Special Issue Vol42, N6, 2011. We will start in areas where the evidence is strong and relatively clear cut, regarding strength and balance exercises, medication review, environmental modification for specific high risk groups etc. In these cases we will present specific recommendations of best practice and guidance of how to implement this in practice. Where evidence is lacking or poorer we will where possible undertake our own review and synthesis, and failing that undertake consensus exercise using (e.g.) Transparent Expert Consultation techniques successfully used in previous fall prevention and research method guidance. However, we know from reviews already undertaken that the evidence base for ICT and other technologies being effective in falls prevention/detection is emerging is meagre. Thus we will initially focus on where evidence is strong and only provide recommendation related to technology when the evidence in this area is better. We will use ICT to provide training in effective solutions and in the use of potential ICT solutions to detection/management and prevention. Our first guidance will be aimed at professional groups. [M1-M19]</p>

<p>Task 4.2: We will unashamedly go for some quick wins in producing guidance. Thus the first guidance will be generic but customisable by each partner to their own house style. This will be based on the review and evidence synthesis undertaken as part of Task 4.1 and will comprise e.g. service level decision and risk assessment algorithms. Translation of this material will be the responsibility of partners, but we will explore crowd sourcing and automated options. [M1-M19]</p>
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WP4 has reached the following Milestones the first 19 months:

2 Development of deliverable

2.1 Introduction and aims

Up to 2005 the European thematic network ProFaNE (Prevention of Falls Network Europe) was the key resource for fall prevention not only in Europe with more than 4,000 regular users. In the last ten years several countries and organizations have developed valuable new resources on fall prevention. Several systematic reviews and meta-analysis have covered this area. Examples for these activities are the Cochrane Reviews (last update in 2012 and next update expected in 2015), the website of the Centre of Disease Control and Injury Prevention in Atlanta (USA) and similar activities in Canada and Australia. Having this in mind the ProFouND consortium aims to build a repository and more important to extract and compress consensus information for practitioners to enhance uptake and adherence. In order to disseminate evidence based knowledge to the service level the consortium decided therefore to keep the messages as comprehensive and short as possible. Another decision taken in order to maximize uptake was to use the 2012/2013 Cochrane Reviews on fall prevention as the main resource and only add other sources when absolutely needed.

2.2 Writing process

The work package leaders agreed on the topics for the facts sheets and the format in the March 2014 meeting. After the initial search a first version of the generic guidance and the fact sheets was circulated in spring 2014 for comments by the consortium. During the network meeting in Vilanova the concept was presented. Revised versions of the guidance and factsheets was circulated amongst the work package leaders in August 2014. For each subject an external expert was identified and was approached in September 2014.

- Exercise: Cathie Sherrington
- Vision: Stephen Lord
- Bone health: Ian Cameron
- Vitamin D: Ian Cameron, Sirpa Hartikainen
- Footwear and protective clothing: Hylton Menz
- Home and environment: Lindy Clemson
- PERS and other ICT-devices: Helen Hawley-Hague, Elisabeth Boulton

Drafts were sent to experts for comment and amendment, as an iterative process until a 'final' version of each factsheet was agreed. These penultimate 'final' versions were sent to an independent external reviewer for comment. Revisions based on this review were circulated to WP leads before uploading for dissemination.

It is expected that other topics will be proposed by the partners and associates. If useful these can be produced once consensus has been reached in the consortium. Other modifications might occur with the publication of new systematic reviews such as the expected Cochrane Reviews.

One major topic is the fact sheet on risk assessment algorithms. In this area the current approaches are unsatisfactory. The sensitivity and specificity for fall prediction is unsatisfactory. The AUC values of commonly used procedures are 0.6 or less meaning that they are clinically not useful. It is

expected that ICT methods will indeed have a major impact in this area and several projects funded by the EC might cause a breakthrough in this area. ProFouND will include these findings as soon as possible to disseminate this knowledge.

2.3 Target audience: professionals

For this deliverable the pre-defined professional target group was service delivery personnel such as health and social care professionals or health care / NGO personnel. The decision taken by the WP leaders was to write the fact sheets and generic guidance in a manner that would allow trans-European uptake and not only for the countries that have already sophisticated fall clinics. At a later stage it is planned to adapt the version for other target audiences.

2.4 Setting: community dwelling older persons

For the 2014 version of the generic guidance and evidence synthesis it was decided that community-dwelling older persons were the most relevant group. At a later stage it is planned to adapt the version for other groups such as acute, subacute and long-term care.

2.5 Adaptation and translation

As stated in the DoW we expect that ProFouND partners and associates will translate the material and customize it to their local branding. Whenever major changes or adaptations will be made these should be pre-discussed with the responsible WP leaders. Translated material will be circulated and uploaded via the project website.

2.6 Format and dissemination

The main resources for the dissemination will be the ProFouND website and the APP. The Factsheets all appear on the website and have a direct link from the homepage as well as featuring under the resources section and tagging system. Other printed versions such as leaflets are encouraged. They are within the responsibility of the partners and associates. This process is supported by the uploaded video material already available via the website. There are no deviations from the DoW.

3 Evidence synthesis

As described before another decision taken in order to maximize uptake was to use the Cochrane Review on interventions for preventing falls in older people living in the community (Gillespie et al., 2012) as the main resource and only add other sources when absolutely needed (e. g. "Falls in Older People. Risk Factors for Prevention." by Lord et al., 2007).

Target group:

Older people living in the community.

Multifactorial interventions:

Multifactorial interventions assess an individual's risk of falling, and then carry out individualised treatment or arrange referrals to reduce the identified risks. Multifactorial interventions often comprise the components described below. They are complex interventions and need to be carried out by specific health care professionals working together in a multidisciplinary process. Overall, current evidence shows that this type of intervention reduces the number of falls but not the number of people falling. This suggests that they are particularly recommended for people who have recurrent falls.

Exercise:

Selected group and home-based exercise containing progressive balance exercises and strength training effectively reduce the number of falls and the number of people falling. The programmes with the best evidence are the Otago Exercise Programme (OEP), Tai Chi, and the Falls Management Exercise programme (FaME -sometimes called PSI). Evidence suggests that new programmes such as Lifestyle integrated Functional Exercise (LiFE) might achieve similar or even better results. Exercise alone has been demonstrated to be effective for persons after a first fall /with lower risk of falling. Overall, exercise interventions reduce fall-related fractures. Exercise must be challenging, progressive and regular (2 hours per week) and the regimen should be adhered to in the long term to be effective.

Medication and medical intervention:

Taking **vitamin D supplements** may be effective in reducing falls in people with low vitamin D levels in the blood before treatment. This needs to be carefully discussed with the responsible physicians.

Some medications increase the risk of falling. Gradual withdrawal of psychotropic medication (e.g. benzodiazepines, Zolpidem) for improving sleep, reducing anxiety and treating depression has been shown to reduce falls.

Insertion of a pacemaker can reduce falls in people with frequent falls associated with carotid sinus hypersensitivity and cardiac dys-/arrhythmias.

Treatment of specific underlying causal factors, specific therapy, medication reviews and prescription modification programmes can also be effective in reducing the risk of falling, e.g. in people who fall because of hypervolemia (restoring haemodynamic stability) or orthostatic hypotension (discontinuing medication).

Home and environment:

Interventions to improve **home safety** appear to be effective for people at high risk of falling, particularly those with severe visual impairment. They should be carried out by suitable qualified health care professionals- usually occupational therapists.

Feet and Footwear:

Feet and Footwear assessments followed by podiatric care, foot and ankle exercises and provision of appropriate footwear can reduce the number of falls in people with disabling foot pain.

Vision and vision aids:

Adjustment of optical aid / eyeglasses (wearing single lens instead of multifocal glasses when outdoors) and cataract surgery can reduce falls.

Implementation guidelines for fall prevention interventions:

Falls are everyone's business as there are multiple factors associated with them. Therefore establishing links between acute, community and primary health and social care services, the voluntary sector, charities and private companies is very important.

It is beneficial to assess the older person in their own environment as you are more likely to identify underlying problems and understand their needs.

If the team assessing the older person also carries out the interventions, success and uptake is more likely (Gates, Fisher, Cooke, Carter, & Lamb, 2008).

Follow-up any referrals to other services to ensure action has been taken, communication with all other services is important.

Further information (e.g. leaflets) should be discussed with the older person and personalised to their needs (not just handed out).

One size does not fit all. Ensure that the older person knows that the intervention is tailored to their needs. They are more likely to be motivated to comply with it.

Older people may have specific goals they want to achieve. Assisting them to set these goals and then work towards them will help them understand the importance of the changes they want to make and increase their confidence (Hawley-Hague et al., 2013)

Older people can be easily put off engaging in a falls prevention programme if something goes wrong e.g. transport does not turn up, they were not told a session was cancelled. Ensure good communication is maintained at all times.

Where your intervention is provided in a group environment, encourage group interaction and feedback on success and achievements, it will help motivate participants to stick with any changes they have made (Hawley-Hague et al., 2013)

Engage family members and friends where possible as these can be a key source of support (Hawley-Hague, et al., 2013; Yardley et al., 2008; Yardley, Donovan-Hall, Francis, & Todd, 2007).

Give feedback to the older person's general practitioner, as positive affirmation from them can support action from the patient (Horne, Skelton, Speed, & Todd, 2010).

Ensure you follow the older person up either by phone call or preferably in person to monitor their progress. Give feedback on their progress, highlighting what they have achieved, it will help with motivation and it will also provide evidence for commissioners (funders).

When promoting your service focus on the positive action that older people can take to promote healthy ageing, rather than falls prevention itself (Yardley et al., 2008, 2007).

Here are some suggestions:

If an older person is highly fearful of falls and pro-actively seek advice about preventing falls then you can talk to them about risk management and prevention of falls. For all other older people **do not** initially talk about risk and reducing their risk of falling, they are unlikely to identify themselves as being at risk. You may want to invite them to an ‘ageing well’ assessment rather than a ‘falls’ assessment.

Instead talk about:

- How strength and balance training will improve their function e.g. Getting up and down stairs more easily and how it will help them to maintain their independence.
- How practising techniques for getting down and up from the floor means that they can play with their grandchildren.
- How being given a full health assessment and tailored advice gives them the knowledge and opportunity to take control of the situation and promote their own health and well-being (for the future if they do not see an issue now).
- How interventions you can offer will help them to manage their health conditions e.g. osteoporosis, arthritis, Parkinson’s, stroke.
- Consider getting other older adults who have had positive experiences of your service to share their thoughts and support others, peer support can be very effective (Dorgo, King, Bader, & Limon, 2011; Laventure, Dinan, & Skelton, 2008).

What did not work?

There is no evidence of an effect of cognitive behavioral interventions on the rate of falls. Trials testing interventions to increase knowledge and educate about fall prevention alone did not significantly reduce the rate of falls.

Links and Resources

www.profound.eu.com

Other ProFouND Factsheets:

- Exercise
- Vision
- Bone health
- Vitamin D
- Footwear and protective clothing
- Home and environment
- PERS and other ICT-devices

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Footwear as a risk factor for falls and what can be done to prevent falls and injuries including protective clothing (hip-protectors)

Footwear is very personal and can be culturally determined. Inappropriate footwear can increase the risk of slips, trips and falling or certain shoes can decrease the base of support. An increased risk of falls has been linked to poor fitting shoes, slippers with a lack of heel support and high heeled shoes. Hip protectors can reduce the risk of fracture for older people living in nursing or residential care settings but has little effect for community dwelling older people.

What works?

- Footwear counselling- where older people are counselled on the specific identified hazardous features of their footwear and are provided with a handout on what constitutes a safe shoe. This includes footwear with low heels and firm slip-resistant soles for both inside and outside the home (Spink et al, 2011).
- There is some evidence for the use of a non-slip device (Yaktrax® walker) on outdoor shoes in hazardous winter conditions (Gillespie et al, 2012). There is a reduction in rate of falls in people for people with disabling foot pain receiving “multifaceted podiatry” (customised orthoses, footwear review, foot and ankle exercises, fall prevention education, and “usual podiatry care”).
- Protective clothing such as hip protectors for older persons with high risk of fracture

Caution

- Inappropriate footwear has been defined as a heel height >4.5 cm, or any two of the following:
 - no fixation
 - no heel counter
 - a heel counter that could be compressed greater than 45 degrees
 - a fully worn or smooth sole
 - or a shoe heel width narrower than the participant’s heel by at least 20% (Menz & Sherrington, 2000).
- Older people may not want to wear appropriate footwear or hip protectors because they do not fit with their personal identity. Having to wear sensible and practical footwear or hip protectors can identify them as ‘a faller’ and may cause issues with self-esteem and stigma.
- Risk of falling has been associated with going barefoot or wearing socks only.

Who can help older people with footwear

- Podiatry services
- Orthotists / pedorthists
- Trained nursing staff
- Orthopedic specialist for severe deformities

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Poor balance, muscular weakness and sedentariness are risk factors for falls.

Many older people experience **balance deficits** and a **reduction in muscular strength and power**. These are the two most important modifiable risk factors that can be influenced by a regular training programme. Programmes must be tailored to the individual (see summary) in order to be effective and to reduce the risk of falls.

What works?

Exercise is included in nearly all effective multiple interventions. To engage older people the emphasis should be primarily on strength and balance and healthy active ageing, rather than falls prevention.

Programmes with multiple categories of exercise:

Multiple-component group and home-based exercise programmes (*e.g.* evidence based programmes such as *Otago*, *FaME*, *LiFE*) [see section on evidence based programmes for details], usually containing at least balance and strength training, have been proven to reduce falls. Other categories of exercise that can be included in multi-component exercise interventions but for which the evidence is less strong include *3D training* (constant repetitive unsupported movement through all three spatial planes) like *square stepping*, *flexibility training* or *endurance training*. The *LiFE-programme* (Clemson, 2010) comprises balance and strength exercises embedded into daily activities of living and has been demonstrated effective in reducing the rate of falls.

Programmes with one category of exercise only:

Tai Chi as a group exercise reduces falls, but it appears to be more effective in participants that are not at high risk of falling. *Balance exercises* as well as *gait and functional training* reduce the rate of falls but not the risk of falls, whereas *strength/resistance training* and *general physical activity* (walking) delivered alone are not effective in reducing falls.

Multiple Interventions:

A study with “*multifaceted*” *podiatry* (customised orthoses, footwear review, falls prevention education), including foot and ankle exercises has been demonstrated to be as effective for preventing falls in older people with disabling foot pain (Spink et al., 2011).

Who can help older people with exercise?

Individuals from many professional backgrounds (including physiotherapists, sport scientists and exercise instructors), who are appropriately trained in delivering falls prevention exercise programmes.

Assessment tools

Participants should be carefully assessed before intervention to ensure the correct type of programme is chosen and that the programme is tailored to the older person's needs.

Appropriate **assessment** tools should be chosen to show progress. Suitable tests include:

- *Berg Balance Scale* to assess balance
- *Short Physical Performance Battery* to assess balance and strength
- *Senior Fitness Test* to assess balance, strength and endurance

What does not work?

There is no evidence for *chair-based exercises* in reducing falls. Brisk walking is not recommended for those at high risk of falls and can increase risk of falls for older people (Sherrington et al., 2011). There is also evidence that the presence of walking programs can detract from efficacy (probably too low in intensity, Voukelatos et al, 2014). *Strength/resistance training* and *general physical activity* (walking) delivered alone are not effective in reducing falls. Programmes that are only delivered for a short period of time may increase confidence without sufficiently improving strength and balance and reducing risk.

Summary

In order to be effective, exercise programmes must be challenging, progressive, at sufficient dosage and continued over time, they should:

- Focus on challenging balance and muscle strength and power
- Challenge balance in a standing position and/or gait
- Exercise should be progressive and tailored to participants needs (help them to meet specific goals they have set, designed to consider health conditions).
- Be carried out 2-3 times a week, aiming for about an hour (this may need to be built up over time).
- At least 50 hours of strength and balance exercise should be carried out over a minimum of 6 months. Ideally exercise should be continued for maintenance of reduced risk.
- Be delivered by instructors specially trained in one of the following programmes (Regular contact and feedback from the instructor is helpful):

Evidence based programmes

- **Otago Exercise Programme**

For the exercise booklet in a variety of languages please go to:

<http://profound.eu.com/otago-exercise-program/>

For further information on the Otago Home Exercise Programme, visit

http://www.cdc.gov/homeandrecreationalafety/pdf/cdc_falls_compendium_lowres.pdf

Or

http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_providers/documents/publications_promotion/prd_ctrb118334.pdf

For training in this programme, visit <http://www.laterlifetraining.co.uk/courses/otago-exercise-programme-leader/>

- **Falls Management Exercise programme (FaME)**

For the exercise booklet in a variety of languages please go to:

<http://profound.eu.com/strength-and-balance-home-exercise-booklet-for-older-people-english/>

For further information on the FaME exercise programme, visit

http://www.cdc.gov/homeandrecreationalafety/pdf/cdc_falls_compendium_lowres.pdf

Or <http://www.laterlifetraining.co.uk/fame-rationale-for-an-exercise-programme-to-prevent-falls/>

For training in this programme, visit <http://www.laterlifetraining.co.uk/courses/postural-stability-instructor/>

- **Lifestyle integrated Functional Exercise (LiFE)**

For the exercise protocol please go to:

<http://profound.eu.com/life-lifestyle-integrated-functional-exercise-reducing-falls-and-improving-function/>

Or you can buy the book at

<http://trove.nla.gov.au/work/190816170?selectedversion=NBD52778501>

- **Tai Chi**

You can find out more about Tai Chi, Taijiquan and Qigong across Europe, visit <http://taiji-europa.eu> and <http://www.tcfе.org>

Links and Resources

Links related to exercise and falls

<http://profound.eu.com/>

<http://www.ageuk.org.uk/>

Other resources related to exercise and falls

Videos:

Gait, balance and functional training:

<http://profound.eu.com/video-clip-of-stronger-seniors-balance-exercise-programme-english/>

Strength/resistance training:

<http://profound.eu.com/exercises-online-strengthening-video-english/>

Square Stepping Exercise:

<http://www.youtube.com/watch?v=IfCD7qB2l1k>

Assessments:

<http://profound.eu.com/three-simple-assessment-tests-to-assess-the-patients-risk-for-falling/>

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Home and environment as risk factors for falls and what can be done to reduce these risk factors

There are numerous environmental factors identified from reports on older fallers and structured observations, which have been associated with falls in older people. Recent research considers environmental hazards as a modifiable external factor. The key factor is the relationship between the person's physical competence level and environmental stressors e.g. an older person with some level of compromise of competence will fall at a lower level of perturbation than a younger or fitter older person. The level of risk of environmental hazards is influenced by lifestyle, risk taking, behaviour and exposure to environmental stressors e.g. exposure to icy pavements, rooms with low lighting.

Some home safety assessment and modification interventions have been demonstrated to be effective in reducing both number of falls and number of people falling. They have been included as a component in a number of successful multi-factorial interventions. As a single mode intervention they appear to be effective for people at higher risk of falling particularly those with a previous history of falls, recent hospitalization or severe visual impairment. Home environmental interventions should be implemented by occupational therapists and other trained specialist after a careful assessment of the personal environment.

Important components of environmental modifications (what works)

- Raising awareness of potential hazards considering the person's lifestyle, capacity and daily activities
- Engaging the person in the process of hazard identification and generation of solutions
- Removal of clutter and hazards
- Handrails /holds
- Even and non-slip floorcoverings with optimised levels of friction
- Sufficient light and contrast in dark areas and at night, particularly on stairs and entrances
- Adequate stability of furniture
- Using protective behaviours such as not rushing to answer the phone or using a sturdy step stool with hand hold to reach things up high
- Urban planning considering the needs of older people (places to rest, even pathways/ pavements, ramps etc.)

What did not work?

- Using brief non-validated check lists and not engaging the person in the process of hazard identification and generation of solutions.
- As a single component intervention to everyone – best investment is when targeted at higher risk older people.

Caution

- Fall, injury or fracture in older people is commonly multi-factorial in origin.
- Vigorous people who are active are more likely to fall outdoors doing activities such as climbing ladders or negotiating steps at train stations. Frailer people are more likely to fall during routine daily living activities or walking indoors. Understanding different environment risk profiles will enable more targeted interventions. People's perceptions of risk and their intrinsic risk factors vary considerably and influence how environmental and behavioural strategies are selected and implemented. Ladder safety or discussions about when to ask for help changing a light bulb may be important for one person whereas loose mats and ill-fitting shoes a priority for someone else.
- Compliance barriers to be considered include the cost of changes, acceptance of recommended changes considering the older person's perception of risk and sense of control, and their ownership of solutions. Carers and family members should be engaged in the process whenever possible and may influence follow through.
- Raising awareness of safe walking and mobility strategies when outdoors should not be overlooked.
- Functional vision, balance and lower limb strength, urge incontinence, judgement and risk appraisal can contribute to overall safety. Ensure the person is engaging in some balance challenge exercises relevant for their capacity. Encourage physical activity and consider everyday environmental challenges (such as rising from a low chair can help maintain quad strength).

Who can help older people with home safety

- occupational therapists (interventions appear to be more effective when carried out by an occupational therapist)
- other trained specialist

Assessment tools

- home hazard checklists, such as Westmead Home Safety Assessment
- Falls Behavioural Scale for Older People (FaB)
- Icon-FES

Links related to home and environment

Westmead:

https://www.google.com/url?url=https://www.maa.nsw.gov.au/getfile.aspx%3FType%3Ddocument%26ID%3D44479%26ObjectType%3D3%26ObjectID%3D3919&rct=j&frm=1&q=&esrc=s&sa=U&ei=OQMSVK2qE8HVPlawgNAE&ved=0CCYQFjAC&usg=AFQjCNEL_Ny70wKn-qEEBZDdsKjudqCQ-A

Home Fall Hazards and the Westmead Home Safety Assessment <http://www.therapybookshop.com/>

Falls Behavioural Scale

http://sydney.edu.au/health-sciences/staff/docs/lindy_clemson/FaB_manual_2003.pdf

Icon-FES Iconographical Falls Efficacy Scale

https://www.neura.edu.au/sites/neura.edu.au/files/page-downloads/Icon-FES_10item.pdf

References on home safety and falls

Lord, S. R., Sherrington, C., Menz, H. B., & Close, J. C. T. (2007). *Falls in Older People. Risk Factors for Prevention.* Cambridge: Cambridge University Press.

Gillespie, L. D., Robertson, M. C., Gillespie, W. J., Sherrington, C., Gates, S., Clemson, L. M., & Lamb, S. E. (2012). Interventions for preventing falls in older people living in the community. *The Cochrane Database of Systematic Reviews*, 9, CD007146. doi:10.1002/14651858.CD007146.pub3

Turner, S., Arthur, G., Lyons, R. A., Weightman, A. L., Mann, M. K., Jones, S. J., ... Lannon, S. (2011). Modification of the home environment for the reduction of injuries. *The Cochrane Database of Systematic Reviews*, (2), CD003600. doi:10.1002/14651858.CD003600.pub3

Personal Emergency Response Systems (PERS) and other information and communication technology (ICT)-devices

There are a number of Information and Communication Technologies (ICTs) aimed at falls prevention, fall detection and alarms for use in case of a fall, these can alert professionals or carers (Brownsell & Hawley, 2004) if a fall occurs and include home automation systems. There are also a range of ICT interventions which have been created or adapted to be pro-active in preventing falls, such as those which provide strength and balance training to older adults in the prevention of falls e.g. exergames, Wii-fit, Kinect (C. A. Miller, Hayes, Dye, Johnson, & Meyers, 2012; Williams, Soiza, Jenkinson, & Stewart, 2010).

What works?

- PERS can help to reduce a long lie (lying on the floor for long periods of time can cause serious health complications) and allow help to be brought quickly to the person who has fallen.
- Simple touchscreen interfaces and other easy to use technologies have been more readily accepted than those that are more complex and multi-faceted (Silveira, van het Reve, Daniel, Casati, & de Bruin, 2013).
- Focussing on the possibility of maintaining independence is more likely to lead to successful uptake of PERS and ICT-devices (Hawley-Hague, Boulton, Hall, Pfeiffer, & Todd, 2014).

Caution

- This is an emerging area and the evidence remains weak, but is changing rapidly.
- The main issues with use of ICT devices in the home are related to adoption and use of the systems; older adults need to understand the value and potential of the technologies on offer and receive suitable training and support in using them.
- Evidence is weak around the use of virtual reality and gaming systems for the promotion of physical activity (K. J. Miller et al., 2014). Emerging evidence suggests that games should be designed specifically for older adults (Schoene et al., 2014; Ystmark, 2013).
- Evidence is weak around the effective use of bed alarms in hospitals (Shorr et al., 2012)

Who can help older people with ICT

- Occupational therapists/physiotherapists
- Social care services
- Sheltered and assisted housing
- Providers of telecare and telehealth equipment and services

Further information

Further information on encouraging the use of technologies for falls prevention can be found at: <http://farseeingresearch.eu/2014/07/17/preliminaryguidelines/>

References on ICT

Brownsell, S., & Hawley, M. S. (2004). Automatic fall detectors and the fear of falling. *Journal of Telemedicine and Telecare*, 10(5), 262–266.

FARSEEING Deliverable D5.2 “Validation strategy of the user interfaces, the fall risk assessment service & the exercise guidance service.” (n.d.). Retrieved from http://farseeingresearch.eu/wp-content/uploads/2014/02/D5-2_Final.pdf

Hawley-Hague, H., Boulton, E., Hall, A., Pfeiffer, K., & Todd, C. (2014). Older adults’ perceptions of technologies aimed at falls prevention, detection or monitoring: a systematic review. *International Journal of Medical Informatics*, 83(6), 416–426. doi:10.1016/j.ijmedinf.2014.03.002

Miller, C. A., Hayes, D. M., Dye, K., Johnson, C., & Meyers, J. (2012). Using the Nintendo Wii Fit and body weight support to improve aerobic capacity, balance, gait ability, and fear of falling: two case reports. *Journal of Geriatric Physical Therapy (2001)*, 35(2), 95–104. doi:10.1519/JPT.0b013e318224aa38

Miller, K. J., Adair, B. S., Pearce, A. J., Said, C. M., Ozanne, E., & Morris, M. M. (2014). Effectiveness and feasibility of virtual reality and gaming system use at home by older adults for enabling physical activity to improve health-related domains: a systematic review. *Age and Ageing*, 43(2), 188–195. doi:10.1093/ageing/aft19

Shorr, R. I., Chandler, A. M., Mion, L. C., Waters, T. M., Liu, M., Daniels, M. J., ... Miller, S. T. (2012). Effects of an intervention to increase bed alarm use to prevent falls in hospitalized patients: a cluster randomized trial. *Annals of Internal Medicine*, 157(10), 692–699. doi:10.7326/0003-4819-157-10-201211200-00005

Schoene D, Valenzuela T, Lord SR, de Bruin ED. (2014) The effect of interactive cognitive-motor training in reducing fall risk in older people: A systematic review. *BMC Geriatrics* doi:10.1186/1471-2318-14-107.
Silveira, P., van het Reve, E., Daniel, F., Casati, F., & de Bruin, E. D. (2013). Motivating and assisting physical exercise in independently living older adults: a pilot study. *International Journal of Medical Informatics*, 82(5), 325–334. doi:10.1016/j.ijmedinf.2012.11.015

Williams, M. A., Soiza, R. L., Jenkinson, A. M., & Stewart, A. (2010). EXercising with Computers in Later Life (EXCELL) - pilot and feasibility study of the acceptability of the Nintendo® WiiFit in community-dwelling fallers. *BMC Research Notes*, 3, 238. doi:10.1186/1756-0500-3-238
Ystmark, K. M. (2013). Step-based Exergames Used in Balance Training for Seniors: a Usability Study. Norwegian University of Science and Technology.

Vision as a risk factor and what can be done to reduce these risk factors

Low vision, impaired vision, unfamiliar glasses with a new vision correction or impaired vision affected by medication can increase the risk of older people falling.

Many eye diseases such as cataract, age related macular degeneration, glaucoma and vascular eye disease are common in older people. Age related loss of contrast sensitivity and depth perception can cause balance problems. Impaired vision is an independent risk factor for falls in older people.

When regular wearers of multifocal glasses were given **single lens glasses** falls were significantly *reduced* in the subgroup that regularly took part in outside activities. Conversely, there was a significant *increase* in outside falls in intervention group participants who took part in little outside activity. New environments and a **change in glasses or first prescription of glasses can increase the risk of falls** during the first weeks because of altered and unfamiliar vision. This highlights the education role that optometrists and ophthalmologists can play.

Cataracts have been associated with increased risk of falls and fall related injury. **First eye cataract surgery** is a successful treatment that has been shown to reduce the risk of falling and fall related injuries.

Age related macular degeneration (AMD) is the most common form of age related vision loss in Europe. Currently there is no curative treatment for dry AMD, however compensating strategies have been tested. In people with very low vision and macular degeneration **home visits by occupational therapists** have been shown to reduce falls. A key element is the **adaptation of the home environment**.

For patients suffering from glaucoma, diabetic and/or vascular eye disease or vision loss such as hemianopia no specific fall prevention programs have been tested so far. The treatment should be coordinated using best clinical practice and vision rehabilitation principles.

What works?

- Identifying new visual problems and ensuring eyeglasses are appropriate by testing visual acuity and glasses prescription every year
- Cataract surgery
- Occupational therapy
- Home safety modifications for older people with very low vision such as AMD

Caution

- During the first days and weeks after a vision correction (e.g. new or changed prescription of eyeglasses) risk of falls can increase
- Using multifocal or bifocal lenses in new environment can increase the risk of falls
- There can be side effects of medication affecting visual acuity or adaptation

Who can help older people with their vision

- Ophthalmologists
- Optometrists
- Occupational therapist
-

Assessment tools

- Eye chart for testing visual acuity (e.g. Snellen chart)
- Melbourne Edge Test (MET) for testing contrast sensitivity

Links and Resources

Links related to vision and falls

<http://profane.co/vision-and-falls-prevention-infographic/>

References on falls and vision

Gillespie, L. D., Robertson, M. C., Gillespie, W. J., Sherrington, C., Gates, S., Clemson, L. M., & Lamb, S. E. (2012). Interventions for preventing falls in older people living in the community. *The Cochrane Database of Systematic Reviews*, 9, CD007146. doi:10.1002/14651858.CD007146.pub3

Lord, S.R. Smith, S.T. Menant, C.J (2010) Vision and Falls in Older People: Risk Factors and Intervention Strategies. *Clinics in Geriatric Medicine*, 26(4):569-81.

Low vitamin D levels as a risk factor for falls and what can be done to reduce these risk factors

Taking **vitamin D supplements** may be effective in reducing falls in people with low blood levels of vitamin D. Low blood levels of vitamin D are associated with falls and some fall-related fractures, such as hip fractures.

In most industrialised countries older people have modest to severe vitamin D deficiency. More than 70% of people in their 80s living in northern Europe suffer from vitamin D deficiency. This is caused by a combination of factors such as nutritional deficiency, reduced renal function and skin atrophy. It is aggravated by a reduced sun exposure that is related to being housebound or institutionalised, seasonal (especially autumn/ winter) lack of sun exposure due to weather and lack of sunlight or cultural factors (clothing which covers the skin from the sun). Severe vitamin D deficiency causes myopathy and loss of muscle strength. Moderate deficiencies are linked to osteoporosis and possibly impaired balance due to reduced muscle function.

What works?

Maintaining adequate vitamin D levels throughout the year, especially during winter, this can be achieved by:

- Adequate sun exposure (face and arms) without sunscreen of about 30 min in the middle of the day (depending on clothing, skin type, latitude and season)
- Adequate nutritional intake
 - From cod liver oil and fatty fish such as salmon, tuna or mackerel, beef liver, eggs, sardines and mushrooms
 - When endogenous synthesis is missing (vitamin D from sun exposure), adequate vitamin D intake is estimated as 800 IU per day
- Supplementation with cholecalciferol
 - sun avoiders or those at high risk of deficiency may require 1000-2000 IU per day
 - at least 600 IU per day for people under 70
 - at least 800 IU per day for people over 70
- Supplementation can be taken as a weekly dose in drop form or a daily dose as a sweet. Both options are particularly suitable for older people in long-term care.

Caution

- Overdosage of cholecalciferol is possible (but rare) leading to hypercalcaemia
- Large doses of cholecalciferol for 6 months have been found to be harmful
- Check for contraindications
- Relevant reduction of dermal vitamin D synthesis through sun protection factor > 8

Who can help older people with their low vitamin D levels

- General physician
- Geriatrician
- Bone health specialist /endocrinologist
- Consulting pharmacist

Assessment tools

- Blood levels of vitamin D (Target: Serum-25-Hydroxy-Vitamin D > 20 ng/ml (50 nmol

References on vitamin D and falls

American Geriatrics Society workgroup on Vitamin D supplementation of older adults(2014). Recommendations Abstracted from the American Geriatrics Society Consensus Statement on Vitamin D for Prevention of Falls and Their Consequences. 62 (1) 147–152, <http://onlinelibrary.wiley.com/doi/10.1111/jgs.12631/abstract>

Avenell A, Gillespie WJ, Gillespie LD, et al. Vitamin D and vitamin analogues for preventing fractures associated with involutional and post-menopausal osteoporosis. Cochrane DB Syst Rev 2009;Issue 2. Art. No.: CD000227.
<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000227.pub3/abstract>

Bischoff- Ferrari HA, Dietrich T, Orav EJ, et al. Higher 25-hydroxyvitamin D concentrations are associated with better lower-extremity function in both active and inactive persons aged > or =60 y. Am J Clin Nutr 2004; 80:752-758

Gillespie, L. D., Robertson, M. C., Gillespie, W. J., Sherrington, C., Gates, S., Clemson, L. M., & Lamb, S. E. (2012). Interventions for preventing falls in older people living in the community. *The Cochrane Database of Systematic Reviews*, 9, CD007146.
doi:10.1002/14651858.CD007146.pub3
Osteoporosis Australia (2013). Vitamin D position statement.
[http://www.osteoporosis.org.au/sites/default/files/files/Vit%20D%20Position%20Statemen
t%2010%202013%20V2.pdf](http://www.osteoporosis.org.au/sites/default/files/files/Vit%20D%20Position%20Statement%2010%202013%20V2.pdf)

Bone-health as a risk factor for fall-related injuries / fractures and what can be done to reduce this risk factor

In older people falls and fractures are closely linked and are major causes of morbidity, mortality and economic cost. Low bone mineral density in osteopenia and osteoporosis cause increased bone fragility and are important risk factors for fractures. Low vitamin D status is associated with a variety of negative skeletal consequences including osteomalacia, reduced bone mineral density, impaired calcium-absorption and secondary hyperparathyroidism.

Falls risk should be taken into consideration when assessing whether or not to commence medication for osteoporosis. Such assessment should also alert the physician to the opportunity to target falls risk directly.

What works?

Combined vitamin D (see factsheet vitamin D) and calcium supplementation is effective in reducing *bone loss, falls and osteoporotic fractures*:

- Vitamin D (1000-2000 IU/day; target levels: 50 nmol/l)
- Calcium (1000 to 1500 mg/day; if possible by nutrition intake, rather than tablets)

Nutrition/ lifestyle:

- Adequate calorie intake (Body Mass Index > 20 kg/m²)
- 1 g/kg body weight of protein per day
- Sufficient nutritional intake of Vitamin B12 and folic acid 8, sufficient nutritional intake of Vitamin B12 (2,4 µg/day) and folic acid (400 µg/day)
- Cessation from smoking

Withdrawal of medication altering bone-health:

- Such as, glucocorticoids, glitazone, proton-pump inhibitors and antiepileptics

Evidence-based anti-*osteoporotic* drugs (Bisphosphonates, denosomab, strontium ranelate, parathyroid hormone peptides):

Reduce the risk of vertebral fracture when given with calcium and vitamin D supplements.

Recommended for (see clinical guidelines in resources section):

- Women with a prior fragility fracture, who should be considered for treatment without the need for further risk assessment,
- Fragility vertebral fractures (single level 2 or 3, multiple level 1-3),
- Fragility pertrochanteric fracture,
- Fragility femoral neck fracture and T-score < -2,0 SD, Therapy with glucocorticoids over > 3 month and T-score < -1,5 SD or fragility vertebral fractures,
- Femoral neck T-score less than or equal to -2,5 SD (respectively depending on age and gender)

Identification and treatment of secondary causes of bone loss e.g. hypogonadism (low testosterone levels), reducing glucocorticoid medications, reducing alcohol consumption

Bone-health exercise programs combined with fall prevention/exercise (see factsheet Exercise and Falls):

- Require a duration of 12 month and weight-bearing components to show effects on BMD
- Weight-bearing components are successful in proven osteoporosis and / or after fractures
- Weight-bearing and resistance training with challenging balance exercises enhance bone and muscle health and improve functional ability
- A combination of weight-bearing impact exercise (jogging, stair-climbing, jumping activities) and progressive resistance training (PRT) is effective for maintaining bone mineral density (BMD) and preventing bone loss at clinically relevant sites such as the hip and spine

Who can help older people with impaired bone health?

- General physician, geriatrician, bone health specialist /endocrinologists/specialist osteoporosis nurse.
- Consulting pharmacist
- Physiotherapists, sport scientists and exercise instructors, who are appropriately trained in delivering bone health and falls prevention exercise programs.

Assessment tools

- European and/or national guidance for osteoporosis
- Bone mineral density (BMD) using dual-energy X-ray absorptiometry (DXA)
- X-ray (thoracic and lumbar spine) if vertebral fractures are suspected after clinical examination
- World Health Organization's Fracture Risk Assessment Tool (FRAX®)
- Blood testing for differential diagnosis and specific treatment

Caution

Non-adherence to treatment with specific anti-*osteoporosis* drugs is a substantial problem. Medication can be inconvenient to take and unpleasant.

Links and Resources

Links related to bone-health

<http://www.iofbonehealth.org/europe-guidelines>

<http://www.dv-osteologie.org/uploads/Leitlinie%202014/Entwurf%20Kurzfassung%20DVO%202014.pdf>

The WHO fracture risk assessment tool: www.shef.ac.uk/FRAX

<http://onlinelibrary.wiley.com/cochranelibrary/search>

<http://www.nice.org.uk/guidance/ta160>

<http://www.nice.org.uk/guidance/cg146>

Also see guidelines on osteoporosis collected at <http://profound.eu.com/guidelines/>

References on bone-health

Edwards, M. H., Jameson, K., Denison, H., Harvey, N. C., Sayer, A. A., Dennison, E. M., & Cooper, C. (2013). Clinical risk factors, bone density and fall history in the prediction of incident fracture among men and women. *Bone*, 52(2), 541–547. doi:10.1016/j.bone.2012.11.006.

Gianoudis, J., Bailey, C. A., Sanders, K. M., Nowson, C. A., Hill, K., Ebeling, P. R., & Daly, R. M. (2012). Osteo-cise: strong bones for life: protocol for a community-based randomised controlled trial of a multi-modal exercise and osteoporosis education program for older adults at risk of falls and fractures. *BMC Musculoskeletal Disorders*, 13, 78. doi:10.1186/1471-2474-13-78.

Gomez, F., Curcio, C. L., Suriyaarachchi, P., Demontiero, O., & Duque, G. (2013). Differing approaches to falls and fracture prevention between Australia Health Quality Ontario. (2008). Prevention of falls and fall-related injuries in community-dwelling seniors: an evidence-based analysis. *Ontario Health Technology Assessment Series*, 8(2), 1–78.

Kanis, J. A. McCloskey, E. V. Johansson, H. Cooper C. Rizzoli, R, Reginster, J.-Y (2012). European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporos Int*. DOI 10.1007/s00198-012-2074-y

Rizzoli, R., Bruyere, O., Cannata-Andia, J. B., Devogelaer, J.-P., Lyritis, G., Ringe, J. D., ... Reginster, J.-Y. (2009). Management of osteoporosis in the elderly. *Current Medical Research and Opinion*, 25(10), 2373–2387. doi:10.1185/03007990903169262

Introduction

As part of ProFouND's aim to support the adoption of the evidence base into practice we are providing a range of evidence based resources (delivered through WP3 & WP 4) for health and social care professionals. All of the resources created by ProFouND (e.g. the Factsheets and App) are peer reviewed both by leading experts and health and social care professionals to ensure they are evidence based and usable in practice. However, the ProFouND website is also a source for existing resources including videos, patient information, training material, clinical guidance, policy, websites and best practice examples. People accessing the website should feel assured that everything available on our site is of an agreed standard and therefore we provide the ProFouND quality standard mark. The quality assessment checklist outlines standardised guidance for the review of all resources before they are added to the website. These quality standards will be reviewed regularly to ensure they remain appropriate for the website content.

Quality Assessment Checklist

There is a variety of resources available on the website. For each resource please complete section 1. Then answer the specific questions related to your type of resource.

	Questions	Further information	Quality Review Guidance
Section 1: Evidence base	<p>1. Does the resource contain evidence-based information? Yes No</p> <p>2. Are recommendations in agreement with our falls prevention factsheets Yes No</p> <p>3. Where a strong evidence base is not available/has not been used. Has expert consensus been used? Yes No</p>	<p>Please state references for evidence.</p> <p>Please comment on the consensus process used and the conclusions drawn.</p>	<p>If the resource does not contain evidence based information or is not based on expert consensus then do not give the resource ProFouND quality approval.</p>
Printed Patient Information	<p>Is the font size 14 and above?</p> <p>Is the language easy to understand and does it avoid jargon?</p> <p>Is there a review date stated for when the leaflet should be checked and revised?</p> <p>Does the leaflet/information provided focus on positive action people can take for themselves? (I.e. follow</p>		<p>If the answer to more than 4 of these questions is No then the resource does not get ProFouND quality approval.</p>

	<p>guidance such as “don’t mention the F-word”)</p> <p>Does the information signpost to further information/services for support?</p> <p>How many languages is the information offered in? (List)</p> <p>Is the information available in other formats? E.g. large print, Braille, audio.</p>		
Clinical Guidelines	<p>Have all relevant professions reviewed the guidance?</p> <p>Yes No</p>	<p>Could include: Physiotherapists Sports Scientists Doctors Nurses Ophtalmologists Optometrists Occupational therapist General physician, Geriatrician, Bone health specialist /Endocrinologists/Specialist Osteoporosis Nurse. Consulting pharmacist Podiatrists</p>	<p>If the guideline has not been reviewed by at least several of the relevant professions then the resource does not get ProFouND quality approval.</p>
Policy in the EU	<p>Have all relevant professionals/professional bodies been consulted?</p> <p>Yes No</p>	<p>Could include the following and their relevant professional bodies: Physiotherapists Sports Scientists Doctors Nurses Ophtalmologists Optometrists Occupational therapist General physician, Geriatrician, Bone health specialist /Endocrinologists/Specialist Osteoporosis Nurse. Consulting pharmacist</p>	<p>If the policy has not been informed by at least several of the relevant professions then the resource does not get ProFouND quality approval.</p>

		Podiatrists	
Videos	<p><u>General videos</u></p> <p>Is there good sound quality?</p> <p>Is there good picture quality?</p> <p>Is the video available in more than one language? E.g. suitable for BME populations.</p> <p>Are subtitles available?</p> <p>Is the language easy to understand and does it avoid jargon?</p> <p>Is there accurate description of actions to be taken?</p> <p><u>Exercise videos</u></p> <p>Are participants given adequate safety advice? <i>e.g. Carry out at own risk Seek advice from your doctor before starting. Make sure the floor space is clear. Only do as much as you can, stop if you feel any pain.</i></p> <p>Is the person delivering the exercises adequately trained?</p> <p>Are the exercises delivered suitable for older adults?</p> <p>Are all required components of exercise included (where appropriate)? <i>e.g. Is there an adequate warm-up/cool- down?</i></p> <p>Can the exercises be clearly seen by the viewer?</p>		<p><u>General videos</u></p> <p>If the answer to more than 3 of these questions is No then the resource does not get ProFouND quality approval.</p> <p><u>Exercise videos</u></p> <p>If the answer to any of the following questions is NO then the resources should not get ProFouND quality approval.</p>
Online Learning	Do the learning tools meet set		If the answer to

	<p>aims and objectives?</p> <p>Do the learning tools follow a curriculum?</p> <p>Are the learning tools endorsed by a professional body?</p>		<p>more than one of these questions is NO then the resource should not get ProFouND quality approval.</p>
Best Practice	<p>Does the best practice guidance/example give sufficient detail to ensure it is replicable?</p> <p>Has the best practice guidance/example been evaluated?</p> <p>Does the best practice guidance/example clearly evidence a change in practice?</p> <p>Does the best practice guidance/example describe the issues/difficulties in implementation?</p>		<p>If the answer to more than two of these questions is NO then the resource should not get ProFouND quality approval.</p>
Related websites	<p>Is the website easy to navigate?</p> <p>Is the language used appropriate for the website's target audience?</p>		<p>If the answer to either of these questions is NO then the resource should not get ProFouND quality approval.</p>