How to Guide the Use of Technology for Ageing-in-Place? An Evidence-Based Educational Module

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Abstract. Aim: Technology is suggested to support ageing-in-place. For care- and technology professionals working with older persons it is important to know how to facilitate the use of technology by older persons. This paper presents the translation of the results of a field study into multilevel and multidisciplinary educational material. Method: During home visits, community-dwelling seniors were interviewed regarding reasons for their level of technology use. All types of technology that could support activities of daily living, were included. Resulting themes formed the basis of the development of personas and scripts for education. Next, lecturers from vocational and higher technical and care education developed an evidence-based educational module from the perspective of professional service provision. Results: 53 older adults were interviewed. The level of technology use is influenced by six themes: challenges in the domain of independent living; behavioural options; personal thoughts on technology use; influence of the social network; influence of organisations; and the role of the physical environment. Four personas were developed, one of which was featured into a film, with twelve separate scenes. For each scene, lessons were developed that consisted of specific questions (first level), in-depth questions (second level) and suggestions for classes (for lecturers). Three personas were translated into case histories. Conclusion: Older adults' perceptions and use of technology are embedded in their personal, social, and physical context. To improve successful technology use to support ageing-in-place, professionals from the domain of care and technology can be trained to be aware of these factors.

Keywords: Technology acceptance · Older adults · Education · Professional service

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1 Introduction

1.1 The Need for Technology

Projected survival the age of 80 has shown marked improvements, and, therefore, it is a challenge how to accommodate and care for an ageing population [1]. As a response, policy makers and professionals, who provide services to older adults with chronic conditions, have placed greater emphasis on stimulating and supporting older persons to stay in their own homes as long as possible [2, 3]. Technology is one of the possibilities suggested to support ageing-in-place for older persons [4]. Examples of technologies are alarm systems, and several tools in the context of eHealth for self-management of chronic conditions, such as diabetes and chronic heart failure [5]. At the same time, the implementation of technology for the purpose of ageing-in-place is often unsuccessful [6, 7].

1.2 Acceptance of Technology

One of the reasons for the limited implementation of technology for ageing-in-place, is that older persons do not accept all technology that is available or offered to them [5]. Themes found in literature associated with acceptance in older persons are concerns regarding technology such as costs, privacy issues and usability; expected benefits of technology, especially increased safety and usefulness; their perceived need for technology, for instance, as related to their health status; available alternatives to technology such as help given by family, social influence (family, friends and professional caregivers); and personal characteristics of older adults themselves, such as the wish to stay in their own homes [5]. Most of the literature on technology acceptance focuses on the pre-implementation phase and mainly considers technology for safety purposes, and, in to a lesser extent, technology for social interaction and support of activities of daily living (ADL) [5]. Other types of technology, such as mobility supporting or household technology, are rarely addressed. More importantly, research to guide factors that influence the post-implementation phase of acceptance and the actual use of technology, is scarce or even non-existent.

1.3 Implications for Professionals and Professionals' Education

For professionals working with older persons, both care professionals and technology providers/installers, it is important to know how to facilitate and stimulate the use of technology by older persons, in order technology to contribute to ageing-in-place. The use of technology in care situations is, for most care professionals, not a topic they are thoroughly acquainted with. Most care professionals have not been educated to explore and use the possibilities of care technology, and do not tend to stimulate the use of technology in their work [8]. Not only care professionals, but also family (informal carers) and technology providers/installers [9] need to get accustomed with a different way of working: together, they form the system in which technology will or will not work for older persons. This also implies that technology implementation converges with social innovation, as work processes will change and new forms of cooperation

will evolve [10]. This means that, in the context of making ageing-in-place with technology successful, many professionals from different domains will work together with older adults and their relatives. At this moment, to our knowledge there are no specific evidence-based tools for educational purposes helping (future) professionals to improve technology use by older adults.

The study presented here explored reasons for the use of technology by older persons and transformed the model that evolved into material for the education of care and technology professionals in vocational and higher education.

2 Method

2.1 Introduction

For the purpose of this study, i.e., to design evidence-based educational material to educate professionals to introduce and support technology use for ageing-in-place, three steps were followed. First, interviews were held with older persons living in their own homes, in order to determine factors and the interplay between factors that influence the use of technology. Second, this knowledge and the 'typical cases' were used as a basis to describe personas. Third, an expert group of lecturers in health- and social care, engineering and education, developed the outline for scripts together with the researchers. One script was elaborated into a film and supported by educational materials.

2.2 Interviews

Semi-structured interviews were held at home with 53 older adults. Inclusion criteria were: about 70 years of age or older, living independently, not cognitively impaired. Purposive sampling was used to include different living- and health situations, as well as use of and experience with technology. For more information on sampling, see Peek et al. [11]. Interviews lasted between 90 and 150 min and included visiting the rooms of the house to see which technology was in the house and which was used (or not used) and why. Information on demographic, social and health issues was gathered, as well as on technology use. All technology that was used in or around the house, that used electricity and was in one way or the other, supportive of ADL, was included in this study. Frequency of technology use (for instance, on a daily base), and reasons for using the technology, stopping the use, or contemplating future purchases, were discussed. As a member check, each participant received a summary of the interview [11]. Interviews were always conducted and analysed with two researchers each time (peer-review), using open, selective and thematic coding techniques [11, 12].

2.3 Developing Personas

The researchers who visited the participants and carried out the interviews, also developed the personas. In user-centred design and marketing, personas are fictional characters created to represent the different user types that might use a tool, for

Table 1. Distinctive characteristics for the development of personas.

Technology-related characteristics	Attitude toward technology (including need, interest, willingness to invest)
	Beliefs about technology (including competence, consequences of use)
	Physical characteristics of house and garden relevant for technology use (including Wi-Fi, infrastructure, town/village)
Personal and contextual characteristics	Living situation and marital status
	Physical appearance
	Education
	Financial situation
	Health status
	Social network
	Basic needs (including safety, security, autonomy)
	Frequent activities

instance, a website. Although personas are fictitious, they are based on knowledge of real users and, therefore, require thorough knowledge of users. For the creation of personas, it is advised to interview users in their context [13]. Also in health care, this method has been introduced with the purpose to design intervention programmes [14].

Starting point for the development of the personas was that they had to cover the majority of the factors found in the 53 older persons interviewed and were distinct from each other in aspects such as living and financial situation, educational level, sex, health, basic needs, hobbies, and attitude toward technology. In Table 1, these aspects are summarised.

2.4 Design of the Outline of Scripts

In an expert group of lecturers (n = 12) from two different levels (vocational and higher education), and three different domains (social care, health care and engineering), an outline for the didactic concept was formed. The conditions for this outline were formulated as follows: first, the factors that had emerged from the interviews had to be covered by the educational material; this was a prerequisite, because the educational material was to be evidence-based. Second, as inter-professional education is important in order to prepare students for real-life situations in health care [15], the lessons had to be based on material that was recognisable for all levels and all professions. And third, the material should be a source of inspiration for lecturers, not a checklist, and lecturers should feel invited to use the material as they consider appropriate.

2.5 Development of the Final Scripts and Film

After designing the outline, small expert (sub)groups (n = 2–3) developed specific educational material for different levels and different domains, based on the same

fundament, namely the outline of the scripts that were based on the four personas. Thus specific and customised education was developed both for social and health care workers and engineers, on different levels (vocational and higher education). What was developed in these subgroups, was discussed and synthesised into one multi-dimensional module. Apart from that, the scripts were discussed with a professional film director. From one of the scripts a complete film was produced.

3 Results

3.1 Results from the Interviews: Factors Influencing Technology Use

Participants had a mean age of 78 years, 68% female and 71% living alone, while 64% received home care (for details, see Peek et al. [11]). Technologies found and discussed with participants were: technology for personal care (e.g., washing machine, microwave), entertainment appliances, home automation, assistive devices, fitness technology, ICT,

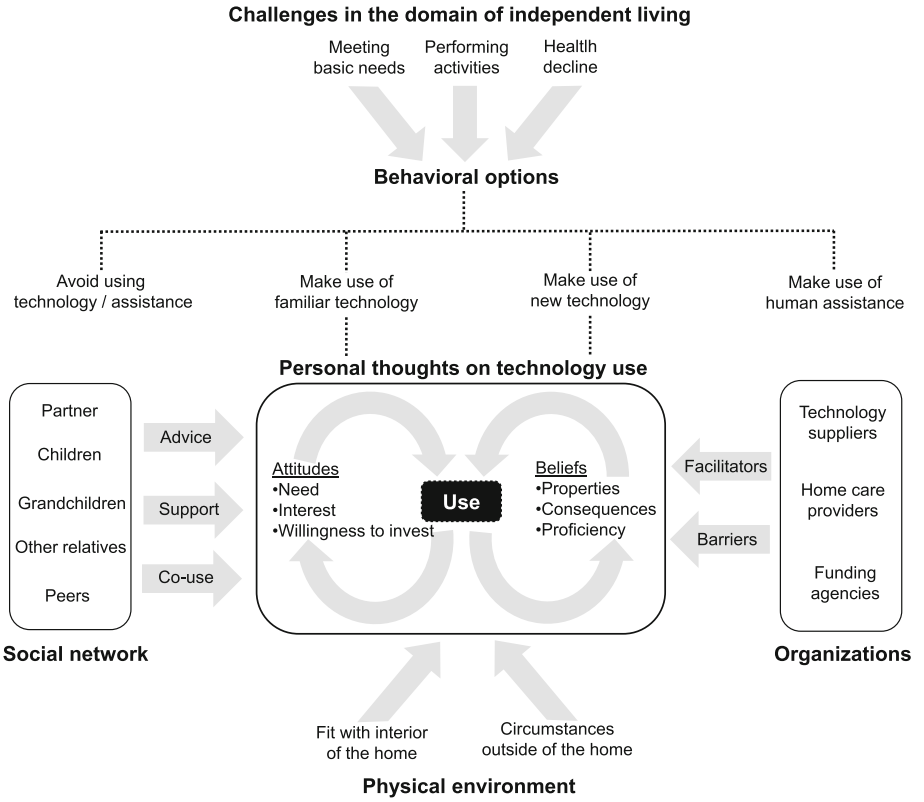

Fig. 1. Conceptual model of factors influencing the level of technology use of older persons who are ageing-in-place (source: Peek et al., Older Adults' Reasons for Using Technology while Aging in Place. Gerontology, 2015, p. 231).

telephones, and transportation devices. Of these, assistive devices were the most often used (used on a daily base), and of technology for personal care, the number of devices per person was highest [11].

Emergent themes related to technology use of this wide range of devices were: challenges in the domain of individual living, behavioural options, personal thoughts on technology use, influence of the social network, influence of organisations and influence of the physical environment [11]. These themes are summarised in Fig. 1 (Conceptual model of factors influencing the level of technology use of older persons who are ageing-in-place). Details on themes and citations of participants can be found in Peek et al. [11].

3.2 Personas

The technology related characteristics and the personal and contextual characteristics of the participants from the interviews were modelled by the researchers in four personas. Together, these personas cover the factors of the conceptual model that was developed. The resulting personas are summarised in Table 2, 'Summary of four personas'.

Table 2. Summary of four personas

Fictional name	Peter	Charles	Maria	Corry
Age & sex	75, male	85, male	78, female	69, female
Living situation & marital status	Married, living together	Widower, living alone	Married, living together (husband 10 years older)	Widow, living alone
Education	Higher technical education	Lower education	Lower vocational education	Secondary school, secretary during working life
Financial situation and attitude	Can support themselves, not always room for extra expenditures	Good pension as a result of sale of company, but doesn't want to spend if not necessary	Frugal. Depends on social security for health care	No financial complaints. Likes luxury and occasionally, to buy on impulse
Health (and health issues)	General health okay. Some arthrosis and hypertension. Some deterioration, especially in the evenings	Has fallen last year, some pain in left hip as a result, perhaps in need of hip replacement. Wants to postpone this	Cares for husband with chronic health problems. Much stress. Has diabetes	Experienced cardiac attack four months ago. She feels good without any consequential complaints

(*continued*)

Table 2. (*continued*)

Health perception	Doesn't feel impaired in ADL as a result of health issues. Doesn't like talking about his own health	Doesn't like going to the GP. Wants to make his own plans	Always worrying and caring for others. No time to worry about herself	'Use it or lose it' and 'cheer up' are her slogans. She has always been physically active
Social network (including size; important others)	Social contacts are okay (leave out: has to have certain level). His wife also leads an active life. No children	Has one daughter who worries about the safety her father. He fell over recently which feeds the worries	Husband needs much care, can stay on his own for about an hour. One daughter living at an hour driving distance	Has a daughter and two grandchildren that she takes care of twice a week. Lost contact with her son. Grandchildren help her with 'ICT troubles'
Characteristic basic needs (e.g. independence, safety, social contacts, leisure)	Leisure and things to kill time are important since he was pensioned off	Doesn't seek social contact (considers this as being mostly gossip)	Needs her rest, occasionally an outing. Would like her daughter to visit her more frequently, but is afraid to ask	Limited social contacts, apart from her daughter and grandchildren
Activities frequently performed (e.g. as hobby's)	Often goes out with his wife, but also to the bridge club. Lately long distance rides occur less frequently	Likes to watch TV, especially documentaries about nature and history. Often doing small jobs in the home. Has a special shed in the garden for this	Goes for swimming once a week. Would like to go out more often	Uses her laptop for games and pleasure. Goes out occasionally for a weekend 'shopping'. Loves taking care of the grandchildren, but is often very tired afterwards
Attitude toward technology (need, interest, level of	Was always interested in technology. Had worked at 'Philips' (electronics	No special idea or feelings about technology. Technology has to be	Her husband used to buy and install technology. Disturbed by young people	Is interested in technology, especially for 'fun'. Admits not to be able to do without.

(*continued*)

Table 2. (*continued*)

preparedness to invest)	company). Wants to know how technology works and is willing to pay for it and invest energy. For him, technology and health care are not related though	useful. Only spends money on technology if useful	who 'only care for their mobile phone'. She can use all household devices, no need for more	Doesn't think about care technology
Convictions about technology; consequences of the use of technology; skills, characteristics of technology	Considers himself competent in using new technology. Likes to help other persons in using technology. Considers technology important to stay socially connected, such as banking, genealogy research, news)	Technology should be useful or is considered nonsense. Used, in his former business, many (mechanical) tools, but didn't grow up using digital technology	She has little self-confidence in using (modern) technology. Considers household devices as 'totally normal' though as everybody has them	Loves to sit behind her computer. Not afraid to use technology, but sometimes she gets 'stuck' and needs support

3.3 Scripts

The result of the inter-disciplinary expert group meetings was that, in order to create a real-life situation usable by all disciplines, the professional service provision in meaningful and recognisable situations are to be the core of the scripts.

First, this resulted in defining the workflow of activities, in which all professions played a minor or major role. Before being able to define roles, professionals from different domains had to understand each other's roles and language unity was developed. In Fig. 2 ('Workflow of subsequent activities in technology use for support of ageing-in-place by health- and social as well as engineering perspective'), the result is demonstrated. In the first part of the activities 'workflow (Fig. 2, upper part), the care professionals play a major role, whereas in the second part (Fig. 2, lower part), engineers are in the lead. During 'realisation' all professionals are involved. In practice,

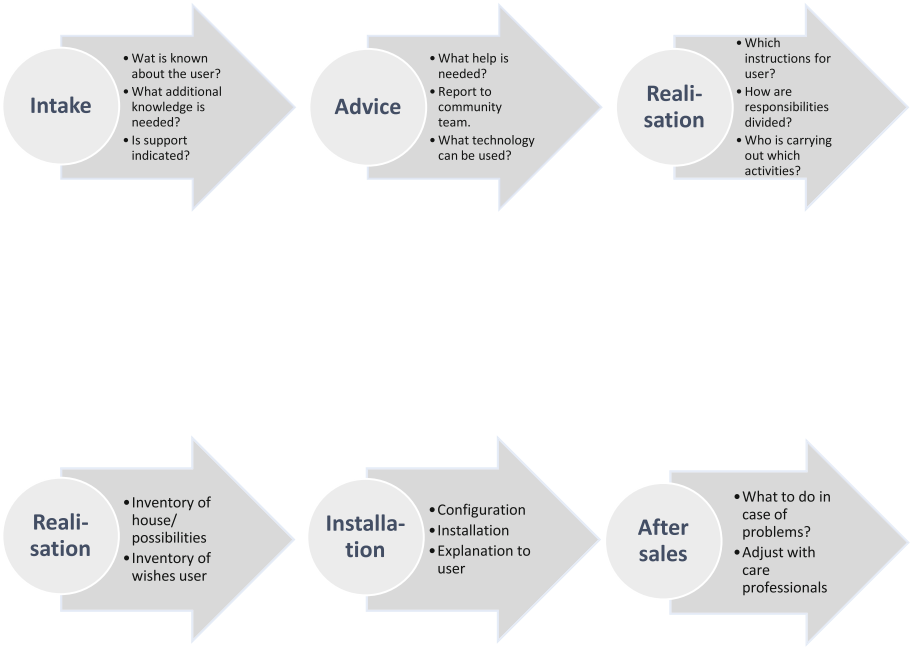

Fig. 2. Workflow of subsequent activities in technology use for support of ageing-in-place by health- and social as well as engineering perspective

and, therefore, also in education, it is important that professionals from both domains are aware of each other's roles.

At each step in the workflow, experts indicated how roles would be divided. For the intake, both vocational and higher educated care professionals are involved. Advice is given by higher educated care professionals, whereas during realisation, both levels are again involved. For the realisation and after-sales steps, both levels of engineering are involved, whereas, the installation is performed by vocational educated engineers.

3.4 Educational Material

Scripts were discussed with a professional film director and discussed with the expert group. This resulted into one detailed script (persona: Charles). This script was divided into 12 separate scenes. For each of these scenes, the expert group developed an educational handout. On one side of this (A4 size) sheet, questions for students are presented, in three different levels of difficulty. The other side contains the model presented in Fig. 1 ('Conceptual model of factors influencing the level of technology use of older persons who are ageing-in-place (source: Peek et al., Older Adults' Reasons for Using Technology while Aging in Place. Gerontology, 2015, p. 231)). Lecturers can use these sheets as such, or use them to inspire the discussion with their students after viewing the scene.

The other three personas are described in one outline each as a case history, with suggestions for questions for students. Of these cases, short film impressions were made.

Finally, a lecturers' instruction guide was made that can also be used by informal caregivers. And, a separate conversation guide for professionals for discussing technology with older persons. All material was presented open access [16].

4 Discussion

4.1 Summary of Results

Six themes dominate the use of technology in older, community-dwelling persons. These themes are: (1) challenges in the domain of individual living, (2) behavioural options, (3) personal thoughts on technology use, (4) influence of the social network, (5) influence of organisations, and (6) the physical environment. In this project, we developed educational material as part of a research project on technology use for ageing-in-place. This resulted in a multi-disciplinary, multi-level module comprising four personas (three presented as cases with questions) and a film, divided into 12 scenes, each enriched with work sheets to inspire the lessons. Additional, a lecturers' guide and a conversation guide for professionals were developed.

4.2 Implications

For technology to support ageing-in-place, factors influencing ageing in place have to be considered in order to promote and support actual use of technology by older persons. This means that in health- and social care, as well as in the domain of installers and technology providers, professionals should address these factors during the entire workflow of service provision. The conversation guide offers opportunities to facilitate this conversation. The educational material offers opportunities to address aspects of barriers for technology use in older adults with students of different backgrounds. In this way students can be more prepared and educated in a realistic manner to their future profession.

4.3 Strengths

The educational module that was developed, is a result of close cooperation between lecturers and researchers. The project, which lasted for four years all together, is an example of how research can have direct implications for practice and education. In most projects, research and education are separate processes. By combining and relating research results to educational possibilities from the start until the end of the process, relevant material could be developed. The module has been used already in vocational and higher education, and in post-initial education. Another strong point of this research project, was the close cooperation between lecturers and researchers of different domains, both from the health- and social care sector, as well as the technology sector.

4.4 Weaknesses

One weakness of the study is that, because of costs only one script has been developed into a film with 12 separate scenes. The other personas and scripts were used as cases and were not translated into film material. On the other hand, this offers future lecturers a range of freedom to use them within their own didactic models. Also, although already used, the educational module has not been formally evaluated. Finally, challenges regarding technology use and acceptance are also relevant for other contexts and professions, that not yet have been addressed. Professionals addressed in this project were mainly nurses and professionals in social care, and engineers. For allied health professions such as physiotherapists and speech therapists, specific educational material should be developed, addressing the specific contexts in which they work.

4.5 Recommendations

It is recommended to evaluate the educational module, both in the vocational school- and higher education environment, and in practice. Specific educational material, addressing relevant contexts of other professionals working in care, especially allied health professions, should also be developed.

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References

1. United Nations: World population ageing (2015). http://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2015_Report.pdf. Accessed 22 Jan 2017
2. Arai, H., Ouchi, Y., Yokode, M., Ito, H., Uematsu, H., Eto, F., Oshima, S., Ota, K., Saito, Y., Sasaki, H., Tsubota, K., Fukuyama, H., Honda, Y., Iguchi, A., Toba, K., Hosoi, T., Kita, T.: Toward the realization of a better aged society: messages from gerontology and geriatrics. Geriatr. Gerontol. Int. **12**, 13 (2015). doi:10.1111/j.1447-0594.2011.00776.x
3. Vasunilashorn, S., Steinman, B.A., Liebig, P.S., Pynoos, J.: Aging in place: evolution of a research topic whose time has come. J. Aging Res. **12**, 16–22 (2012)
4. Reeder, B., Meyer, E., Lazar, A., Chaudhuri, S., Thompson, H., Demiris, G.: Framing the evidence for health smart homes and home-based consumer health technologies as a public health intervention for independent aging: a systematic review. Int. J. Med. Inform. **82**, 565–579 (2013). doi:10.1016/j.ijmedinf.2013.03.007

5. Peek, S.T.M., Wouters, E.J.M., van Hoof, J., Luijkx, K.G., Boeije, H.R., Vrijhoef, H.J.M.: Factors influencing acceptance of technology for aging in place: a systematic review. Int. J. Med. Inform. **83**, 35–48 (2014). doi:10.1016/j.ijmedinf.2014.01.004
6. Michel, J.P., Franco, A.: Geriatricians and technology. J. Am. Med. Dir. Assoc. **15**, 860–862 (2014). doi:10.1016/j.jamda.2014.09.016
7. Wilson, C., Hargreaves, T., Hauxwell-Baldwin, R.: Smart homes and their users: a systematic analysis and key challenges. Pers. Ubiquitous Comput. **19**, 463–476 (2015). doi:10.1007/s00779-014-0813-0
8. Nieboer, M.E., van Hoof, J., van Hout, A., Wouters, E.J.M.: Professional values, technology and future health care: the view of health care professionals in The Netherlands. Technol. Soc. **39**, 10–17 (2014). doi:10.1016/j.techsoc.2014.05.003
9. van Hoof, J., Kort, H.S.M., Rutten, P.G.S., Duijnstee, M.S.H.: Ageing-in-place with the use of ambient intelligence technology: perspectives of older users. Int. J. Med. Inform. **80**, 310–331 (2011). doi:10.1016/j.ijmedinf.2011.02.010
10. Joyce, K., Loe, M.: A sociological approach to ageing, technology and health. Sociol. Health Illn. **32**, 171–180 (2010). doi:10.1111/j.1467-9566.2009.01219.x
11. Peek, S.T.M., Luijkx, K.G., Rijnaard, M.D., Nieboer, M.E., van der Voort, C.S., Aarts, S., van Hoof, J., Vrijhoef, H.J.M., Wouters, E.J.M.: Older adults' reasons for using technology while aging in place. Gerontology (2016). doi:10.1159/000430949
12. Boeije, H.R.: Analysis in Qualitative Research. Sage, London (2010)
13. Calabria, T.: An introduction to personas and how to create them (2004). http://www.steptwo.com.au/papers/kmc_personas/. Accessed 20 Jan 2016
14. Barbera-Guillem, R., Poveda-Puente, R., Neumann, S., Becker, H., Ramírez, M., Wienholtz, A., Schaedler, I.: Example of the application of the PERSONA methodology in the definition of needs and requirements for the WeTakeCare system. Stud. Health Technol. Inform. **217**, 917–922 (2015). doi:10.3233/978-1-61499-566-1-917
15. Reeves, S., Zwarenstein, M., Goldman, J., Barr, H., Freeth, D., Hammick, M., Koppel, I: Interprofessional education: effects on professional practice and health care outcomes. Cochrane Database Syst. Rev. **23**, CD002213 (2008). doi:10.1002/14651858.CD002213.pub2.16
16. Langer thuis, wat haal je in huis (2016) https://fontys.nl/Over-Fontys/Fontys-Paramedische-Hogeschool/Onderzoek-1/Projecten/Langer-thuis-wat-haal-je-in-huis.htm. Accessed 6 Jan 2016