O R I G I N A L   P A P E R

Mobile Elderly Living Community (MELCO):
The Development of the Social Community Model: a Case Study

Christiana Kouta, PhD
Assistant Professor, Department of Nursing, School of Health Sciences Cyprus University of Technology, Limassol, Cyprus

Charis Kaite, PhD (c)
Cyprus University of Technology, PhDcandidate, Department of Nursing, School of Health Sciences, Cyprus University of Technology, Limassol, Cyprus

George Samaras, PhD
Department of Computer Science, University of Cyprus, Nicosia, Cyprus

Correspondence: Christiana Kouta, Assist. Professor, Dep. of Nursing, School of Health Sciences, Cyprus University of Technology, 15 Vragadinos Street 3041-Limassol, Cyprus. Email: christiana.kouta@cut.ac.cy

Abstract

Background: Elderly prefer to be in their own homes rather than being in hospital or residential homes. Communication between elderly and community nurses is essential in caring and mutual interaction and modern technologies like MELCO provides the elderly the feeling of independence and safety.
Aim: The aim of this paper is to describe the development of the social community model within the objectives of the MELCO project and its application within the community.
Methodology: Three axes were taken in consideration: a) ontology, b) ecological theory and c) social network and information systems analyses for the development of the social community model. Four elderly women participated as a case study in piloting the mobile virtual system. The participants also responded to a short closed ended questionnaire.
Results: The analysis of the questionnaire and the discussions with the participants showed that elders found the mobile system useful, easy to use and expressed the actual use of this would help them maintain active. Participants concern of social isolation or dependency on others seems to be trounced through the use of the mobile technology.
Conclusions: MELCO social community model is a centric network that enables effective management and collaboration of social and health care teams around the elderly in the community. The teams are virtual, dynamic and collaborative.

Keywords: elderly, communications, health professionals, community nursing.

Introduction

Care of the older people has become a key issue in Europe, due to the increasing growth of the elderly population. Care involves range forms of care such as home nursing care, community care, residential care and hospitalization. Elderly prefer to be in their own homes and communities rather than being in hospital or residential homes (US Department of State, 2007). Combining technological aids and mobile technologies facilitates independent living for all in the home and in temporary living environments (Mokhtari & Ali, 2007).

Successful ageing includes happiness, relationships between desired and achieved goals, self concept, well being, social functioning, social integration and so on (Havighurst, 1968 cited in Bowling & Dieppe, 2005). It also includes a broad array of dimensions of sense of value, physical, functional, psychological, intellectual, social and spiritual health for older people (Matsubayashi et al., 2006).

Further, determinants of active ageing include among others: health (physical activity, proper medication use), physical environment. (fall prevention) social environment (social support, life-long learning), economic (pension, family dependency) (World Health Organization, 2002).

The Commission's action plan in 2007 aims to enable a better quality of life for older people with significant cost-savings in health and social care and to help creating a strong industrial basis in Europe for ICT and ageing. Among the areas of user needs that the action plan addresses is ageing wellness at home and in the community {SEC (2007) 811}.

Different efforts have been undertaken in the last years at international level regarding the development of ICT-based solutions supporting the ageing people such efforts are mainly interested in either:

a) providing technologies for "independent living" inside the home of the elderly person (e.g. Persona, n.d., MPOWER, n.d.) or

b) propose an isolated technological solution for a disability (SHARE-IT, n.d.) or

c) the development of technological platforms disregarding the overall social environment of the user (Helal et al., 2005).

In Cyprus, DITIS (Networked Collaboration Supporting Healthcare Teams) is a network of medical collaboration and a system that supports the dynamic creation, management and co-ordination of virtual collaborative medical teams, for the continuous treatment of patients at home and specialist healthcare centers. A virtual healthcare team to provide dedicated, personalized and private service to home under the direction of the treating specialist. The virtual team will be (virtually) present to support the patients. DITIS is currently supporting mainly the activities of the Cyprus Association of Cancer Patient and Friends. DITIS is being extended to collaborate with other cancer health care entities, such as Bank of Cyprus Oncology center (DITIS: Networked Collaboration Supporting Healthcare teams, 2003).

Virtual communities emerged from the intersection of human needs and technology. Advances in computer networks and ubiquitous computing suggest the opportunity for more advanced care approaches including comprehensive status monitoring, other forms of assistance such as reminders, but also the creation of the opportunity for the elderly becoming involved in a community, i.e. reducing their feeling of loneliness (Camarinha & Afsarmanesh, 2002; Chingell Ho & Schraefel, 2000).

Developing the MELCO Social Community Model- an elderly centric network that enables the effective management and collaboration of social virtual care teams-three axes were taken into consideration:

a) ontology,

b) ecological theory,

c) social network and information system analyses (Information Continuance System Model, International Classification of Functioning Disability).

A pilot study was also conducted with selected group of elderly from the day care center in order to explore the acceptability of the system.

Ecological Theory

Ecological theory suggests that interactions with others and the environment are key elements to socio-cultural development and one may experience more than one type of environment including: the microsystem, the immediate environment in which a person is operating. At this level relationships have impact in two directions both away from the elderly and toward the elderly; the mesosystem, two microsystems interacting, such as the connection between home and church; the Exosystem, which is the larger social system within which the elderly does not function directly; the Macrosystem, the larger cultural context (e.g. subculture) and the Chronosystem, the pattering of environmental events and transitions over the course of life (e.g. death of significant others, physiological age changes) (Bronfebenner, 1994).

Social Network and Information Systems Analysis

A social network is a set of actors and the relations that hold these actors together (Cho et al., 2002). While developing the MELCO Social Community Model (SCM), the behavior of the elderly users must be taken into consideration and be given special attention. The Information system continuance model focuses on the user's post-acceptance (physiological motivation, e.g. confirmation and satisfaction) while ex-post perceived usefulness and user satisfaction (Bhattacherjee, 2001). MELCO-SCM intends to be applicable to the majority of the elderly population and relevant across cultures and heterogeneous populations. For this purpose, International Classification of Functioning, Disability and Health (ICF) was used in order to create a more integrative understanding of health forming of a comprehensive profile of users instead of focusing on ones health condition (WHO, 2009).

The main domains as related to ICF are:

1. Body Function and Structures (very specific recording of detailed functional abilities and impairments). For the purpose of the current project body function is related to person's mobility. Monitoring services were developed for the early detection of limitations in mobility and physical fitness of the elderly. The system will be based on a common communication platform that concentrates a number of wireless sensors that provide real time monitoring of geo-position (GPS) and physical conditions of the elderly.

2. Activities and Participation: this domain describes individuals' functioning as a whole person, as opposed to function and structure of his/her body part, ranging from basic (dressing, eating) to complex (work and civic activities). Activities (as WHO defines it) are what people can do inherently without assistance or barriers. Participation involves community integration.

Classification of Activities and Participation related to ICF:

a) Learning and applying knowledge (providing basic information such as telephone numbers for basic needs e.g. drug store)

b) Communication: The main idea is that the elderly person will be in the centre of the services, making him/her both a consumer and a producer of assistance, that actively promotes and provides all the means necessary for an active independent living. A virtual community is built around the elderly person and unifies different communities that can assist, collaborate and actively communicate with the elderly to improve his daily life in an ad-hoc and informal way through the use of assistive ICT technologies (Golemati et al., 2007).

c) Interpersonal Interactions/Community, Social Civic life: After identifying elderly needs, each individual will have a unique personalized profile of abilities, special needs and preferences. Elderly would be in a position to choose whether they want to be involved in events such as cultural events, choirs and have visits at elderly day care center and also be in a

position to choose with whom they want to interact with. Elders' participation can be increased with accessible environments and through using ICT devices (Velez et al., 2006).

d) Interpersonal Interactions/Community, Social Civic life: After identifying elderly needs, each individual will have a unique personalized profile of abilities, special needs and preferences. Elderly would be in a position to choose whether they want to be involved in events such as cultural events, choirs and have visits at elderly day care center and also be in a position to choose with whom they want to interact with. Elders' participation can be increased with accessible environments and through using ICT devices (Velez et al., 2006).

Table 1: Domains of ICF in relation to MELCO domains

ICF AND MELCO'S DOMAINS	
ICF	**MOBILE ELDERLY LIVING COMMUNITY**
Learning and Applying Knowledge	**Information and Learning (e.g. basic information to drug store, bank, social services etc.)**
General Tasks and Demands	--------------------------------
Communication	**Friends, significant others, family members, etc. Elderly in the center of services.**
Movement	**Mobility (e.g. going to shops or supermarket)**
Self Care	**Care and Wellness (e.g. guidance to weather conditions)**
Domestic Life Areas	-------------------------------
Interpersonal Interactio	**Personal Interests and Activities**
Major Life Areas	--------------------------------
Community, Social and Civic Life	**Personal Interests and Activities**
------------------	**Privacy (e.g. data protection)**

Fig 1: MELCO'S Social Model Ontology
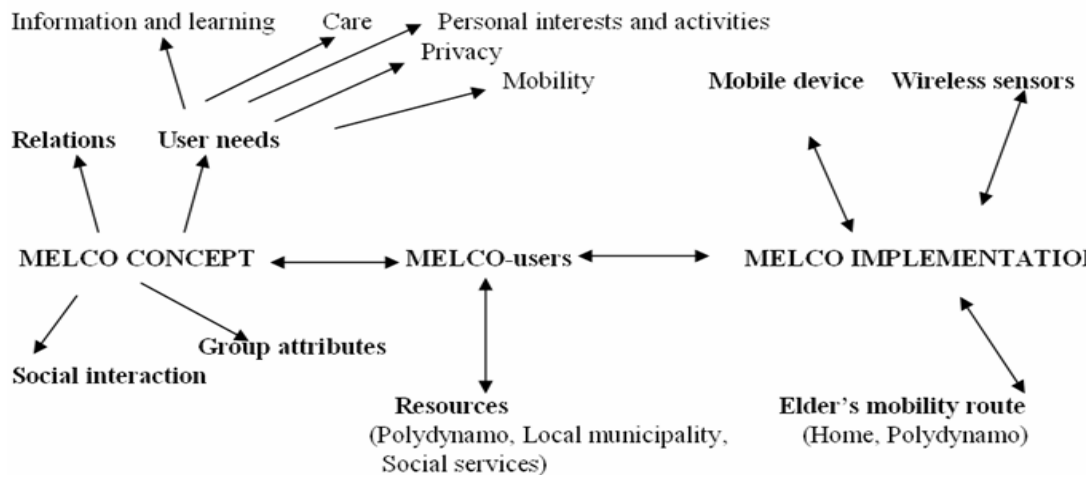
Case Report

In this project the background, theories and models used, they also formed the methodology applied. Furthermore, a pilot study was conducted with primary objective: a) to organize and execute a system trial and b) validate and assess the system with respect to user acceptance and technical viability.

The procedure included:

a) a detailed explanation of the system, its objectives and systems interface,

b) guided use of the devices from a research team member for familiarization of the participants with the system,

c) response to simple short questionnaire and d) discussion for special user needs and comments from the participants.

A purposive sample- case was used with four women aged 65-75 visiting the particular day center, with no communication difficulties.

Data were collected in June 2009 from the pilot study mainly from a questionnaire that was developed from the study partners using a 4 yes or no questions, 1 question relevant to

the level of difficulty of the system scoring in a four Likert scale and 1 question in relation to the satisfaction of the participants from the size of the screen in a three Likert scale. Also discussion comments of the participants were taken in consideration. Further, the comments and suggestions of the participants during the discussion step as far as their user needs were taken under consideration.

The four case study participants were informed prior to the study. Their participation was voluntary and given consent by attending the whole procedure.

Discussion

Piloting this system has shown that elders found the system useful, easy to use and expressed the actual use of service would help them maintain active. Although there familiarity to the use of mobile phones was limited to dialing numbers and answering their mobile phones, the participants expressed their interest to participate in the study and learn how to engage modern technologies in their everyday lives. Moreover, participants concern of social isolation or dependency on others

seems to be trounced through the use of the mobile technology.

MELCO´s Social Community Model

The proposed model integrates original constructs from the above mentioned information science, sociological and psychological theories. The model is an elderly centric network that enables the effective management and collaboration of social care teams around the elderly. Such teams are virtual (they assist and provide care to the elderly without being together physically), dynamic (care is provided by getting different people together as needed and chosen) and collaborative.

The Ontology of the MELCO social community model

The components of MELCO's ontology are described below:
Individuals-users: registered members of the society. The system will store a user profile for each member containing both personal data and information needed during the authentication phase. For instance, the ontology of a user profile would follow the above ontology:

a) user identity,

b) characteristics-capabilities,

c) preferences,

d) activities,

e) motion state in order to create a dynamic profile.

Other parameters that are used are:

- personal information (name, birthday),

- general characteristics (physical factors, weight and height, physical abilities: reading, speaking and so on (Noy & McGuiness, 2001).

For example, in order for Mr. C. to have a personalized profile of abilities, special needs and preferences, an ontology must be formed. Monitored users which carry the sensors e.g. accelometers do not have to be hospitalized, nor be transferred in a health center, or stay in their homes in order to be monitored. One part

of MELCO community is to promote social integration. The main tasks to be performed by the monitoring system would be a) data acquisition from the accelerometer, b) delivery of appropriate alerts to relevant members through the mobile device (smart-phones, PDAs supporting wifi or GPS) which will provide the user with an interface to the system/services and connection point to wireless sensors (geo-position GPS).

The mobile device will provide an anywhere and any time monitoring of the elderly users. It can constantly track users as long as it is being carried and a computer based control center transfers and displays alarms to the connected physicians, community nurses or significant others of the elderly via wireless connection to mobile devices. Regarding to which component would perform which task we can state that:

1) the data acquisition of the information concerning physical status is done by the sensors (e.g. accelerometer) in the mobile device,

2) there are two possibilities of where to perform the data analysis and the alarm generation: in the control center (local area connection) or in the mobile device itself

3) the notification of the alarms to the physician would be located in the control center, those alarms should be sent from the mobile device in case they were generated there.

Classes: Elders are the aggregate unit of elders' aged 65-75 visiting the elderly day care center Senior Citizens Center and receive services or participate in programs offered by the center. Actors (elders) exchange one or many resources with each other, which then allow them to be connected in the social network. Resources that would be exchanged between elders of the elderly day care center center include data, information and services.

Group/Attributes: A group represents a collection of users with a common interest. A software may be included in the system for collaborative work and a group of collaboration tool for both fixed and mobile computing units (Velez et al., 2006). Groups would be created. For example

a) the appointment scheduler module; the appointment scheduler aids the elderly to organize appointments with other Virtual Team members based on their individual schedule. The user selects the time, place and preferred members. Their schedules are then checked and if they are available the systems proceed to the arrangement,

b) the group leisure activities module; creates meeting groups for leisure activities based on request of a member. The elderly user can invite members of his Virtual team group to share activities with him. The user creates an invitation for the activity and members are invited to join. Based on their response, an activity group can be created e.g. playing cards.

Relations: Elders that maintain the relation are said to maintain a tie. The strength of their tie may range from weak to strong, which depends on the number of resources they exchange, the frequency of exchanges and the intimacy of exchanges.

Restrictions: All data transmission within the system's subsystems would be secured and a password would be used for each user in order for assertions to be accepted as input and secure privacy settings.

Events: Meaning the changing of attributes or relations. By interacting with each other, elderly relations would be altered such as exchanging information.

In the context of MELCO, usage behavior involves information sharing (e.g. daily weather updates, exchange of knowledge), information adoption (using knowledge) and the sustainability of the community (in this case is partly virtual) on both supply and demand of information. The implemented information and learning services have been validated through user scenarios. Further, daily weather updates and suggestions such as recommended clothes, accessories or activities.

Elderly support is provided by his/her assigned virtual social care team, through close interpersonal, meaningful and positive social connectivity affected by the quality, quantity, frequency, diversity and reciprocity of social contacts as well as the possibilities and opportunities for establishing them.

Quality of health and successful ageing is connected with the ability to function autonomously, within a given social setting. If elderly maintain socially and intellectually active are considered healthy. Nursing researches indicates that elderly describe health as a "state of mind" and emphasize psychological attributes, social relationships and attitude toward life, rather than merely physical state.

Information Communication Technology and especially Mobile Elderly Living community enables elderly: a) to communicate, b) gather information and c) interact with distance services quickly and more easily without the limitation of time and place.

In nursing, communication between elderly and nurse is essential in caring and mutual interaction via ICT is essential thus

a) it increases accessibility to nursing care,

b) gives more direct communication with clients,

c) saves time to district nurses, d) provides increased knowledge of and control over the elderly situation and gives elderly the feeling of safety while enhancing their independency.

Mobile elderly living community can not replace physical presence, but can be seen as a complement to nursing care at home with an emphasis to elderly socialization.

MELCO supports a client oriented process and can significantly contribute toward better quality of home health care. MELCO leads toward better evaluation and quality control in nursing encouraging further research and development in the field. Given small changes could be introduced to other fields of nursing as well.

Implications to Community Nursing

The use of MELCO in Community health increases accessibility to home and nursing

care through a more direct communication with elderly and creates a more trusting relationship, as well saves working time, reduces home visits and phone calls. Furthermore, it supports family caregivers by reducing isolation and maintaining the sense of presence through providing easier access to healthcare professionals. Community nurses through MELCO would have a more realistic view of the situation of the elderly while it is easier to determine whether the condition of the elderly is critical. MELCO could facilitate the management of monitoring the physiological signs (patient´s blood pressure etc.) as well as enabling diabetics to monitor blood sugar level and receive advisory text message from the nurse responsible. Therefore, it would help in coping with stress since it reduces the stress of everyday working life of community nurses and makes working situation safer in the sense that they will have immediate and effective communication with elderly even away.

Conclusion

MELCO system seems to improve quality of life of elderly people, by stimulating and prolonging independent and active living in an outdoor environment, while promoting at the same time seamless integration and interaction of different people from all ages at any time and any place providing daily activity monitoring. Further, MELCO shifts the focus to home-based care and community care. Consequently, MELCO may influence the physical and psychological health of the elderly.

The developed MELCO Social Community Model is a centric network that enables the effective management and collaboration of social care teams around the elderly. The teams are virtual (they assist and provide care to the elderly without being together physically), dynamic (care is provided by getting different people together as needed and chosen) and collaborative. Pilot analysis of the model has shown that the elders found the system very useful, easy to use and expressed the actual use of the service would help them maintain an active living in the community.

The presence of a virtual social care team by elderly encourages and supports active participation, communication, socialization, mutual assistance and self-organization of the elderly, promoting seamless integration and interaction of different people from all ages at any time and any place providing daily activity monitoring. Therefore, MELCO successfully improves

a) the quality of life of the elderly who can remain in their home environment and feel safe in case of a change in their condition the social care team will be virtually present to support them,

b) reduces the burden of carer,

c) improves nursing care,

d) helps in the economy of resources,

e) limits the period that some clients with chronic conditions need hospitalized or community care,

f) reinforces the collaboration of the multidisciplinary team and encourages and supports active participation, communication, socialization and collaboration of the elderly.

Aknowledgments

References

Bhattacherjee, A. (2001). Understanding Information systems continuance: An expectation-confirmation model. MIS Quartely 25, 351-70.

Bowling, A., and Dieppe P. (2005). What is Succesful ageing and who should define it? British Medical Journal Dec 331(7531)1548-51. doi: http://dx.doi.org/10.1136/bmj.331.7531.1548

Bronfenbrenner, U. (1994). Ecological models of human development. In International Encyclopedia of Education, Vol 3, 2nd. Ed. Oxford: Elsevier. Reprinted in Gauvain, M. & Cole M. (Eds), Readings on the development of children, 2nd Ed. (1993). Freeman, NY, 37-43

Camarinha-Matos, L. and Afsarmanesh, H. eds. (2002). PRO-VE'02 – 3rd IFIP Working Conference on Infrastructures for Virtual Enterprises. Sesimbra, Portugal © IFIP

Chingell M., Ho J., and Schraefel, M.C. (2000). Towards an Evaluation Methodology for the Development Research Oriented Virtual Communities IEEE. Available on line at http://eprints.ecs.soton.ac.uk/8797/1/WETICE2000-CHSch.pdf (Accessed August 20,2012)

Cho H., Stefanone M. and Gay, G. (2002). Social Information Sharing in a CSL Community. In ed., Gery S. (Ed) Proceedings of 2002 ACM CSCL Conference, 43-53.

COM(2005) 229: i2010 flagship initiative "on the needs of the ageing society, more specifically on caring for people in an ageing society and addressing technologies for wellbeing, independent living and health"

CONFIDENCE (n.d.). Available on line at http://www.confidence-eu.org/ (Accessed August 20,2012)

De Witt,L. (2009). Many older people felt that electronic care surveillance increased their safety and enabled them to live alone in their homes Evidence Based Nursing 12,32. doi: 10.1136/ebn.12.1.32

DITIS: Networked Collaboration supporting Home Healthcare Teams (2003) University of Cyprus website. Available on line at http://www.ditis.ucy.ac.cy/overview/overview.htm (Accessed September 25, 2012)

Haigh K.Z., Kiff L.M. and Goeffrey H. (2006). The Independent LifeStyle Assistant: Lessons Learned. Assistive Technology 18, 87-106.

Helal A., Mann W., Elzabadani H., King J., Kaddourah Y. and Jansen, E. Gator (2005). Tech Smart House: A Programmable Pervasive Space. IEEE Computer 38, 50-60.

INHOME project. An intelligent interactive services Environment for assisted living at home (n.d.). Available on line at http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCN=11108299 (Accessed August 20, 2012)

Matsubayashi, K., Ishine, M., Wada, T. and Okumiya, K. (2006). Older Adults. Views of successful aging-comparison of older Japanese and Americans Journal of American Geriatrics Society 54, 184-7. doi: 10.1111/j.1532-5415.2005.00575_15.x

Golemati, M., Katifori, A.., Vassilakis, C., Lepouras, G. and Halatsis, C. (2007). Creating an Ontology for the User Profile: Method and Applications. Available on line at http://oceanis.mm.di.uoa.gr/pened/papers/11-onto-user-final.pdf (Accessed August 20, 2012)

Mokhtari, M. and Ali, F.M. (2007). User needs and usage analysis in smart environment for people requiring assistance. Topics in Geriatric Rehabilitation 23, 52-9.

Mon Ami project (n.d). Available on line at http://www.monami.info/ (Accept August 25, 2012)

MPOWER project (n.d.). Available on line at http://www.sintef.no/Projectweb/MPOWER/ (Accessed July 25, 2012)

Netcarity Project (n.d.). Available on line at http://www.netcarity.org/Objectives.84.0.html (Accessed September 20, 2012)

Noy N.F., and McGuinness, L. (2001). Ontology Development 101: A Guide for Creating your first Ontology, Stanford Knowledge Systems Laboratory Technical Report KSL-01-05. Available on line at http://protege.stanford.edu/publications/ontology_development/ontology101-noy-mcguinness.html (Accessed October 25,2012)

Persona (n.d.). Available on line at http://www.aal-persona.org/ (Accessed October 20, 2012) Persona Perceptive Spaces promoting Independent Aging Deliverable 2.1.1 (2008). Report describing values, trends, user needs and guidelines for service characteristics in the AAL Persona Context. Available on line at http://www.aal-persona.org/deliverables/D2.1.1-Values,%20trends,%20user%20needs%20and%20guidelines%20for%20service%20characteristics%20in%20the%20AAL%20Persona%20context.pdf (Accessed September 20,2012)

Rose, M. (1991). Evolutionary Biology of Aging. Oxford: Oxford University Press.

{SEC(2007)811} Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2007). Ageing Well in the Information Society An i2010 initiative Action Plan on Information and Communication Technologies and Ageing. Available on line at http://eur-lex.europa.eu/LexUriServ/site/en/com/2007/com2007_0332en01.pdf (Accessed October 20,2012)

SHARE-IT project (n.d.). Available on line at http://shareitproject.org/ (Accessed September 30, 2012)

Social Welfare Services (2005). Cyprus National Action Plan for the Elderly. Ministry of Labor and Social Insurance/Cyprus Social Welfare Department.

US Department of State (2007). National Institute on Ageing. Why population ageing matters: A global perspective. Available on line at, http://www.nia.nih.gov/sites/default/files/WPAM.pdf (Accessed July 20,2012)

Velez, J., Barros, B. and Verdejo, F. (2006). A Framework to define web-based communities. International Journal of Web Based Communities 2, 339-359.

Vouyioukas, D., Maglogiannis, I. and Papas, V. (2007). Pervasive E-health Services Using the DVB-RCS Communication Technology. Journal of Medical System 31, 237-246 doi: 10.1007/s10916-007-9061-4

World Health Organization (2002) Active ageing: a policy framework. A contribution of the World Health Organization to the Second United Nations World Assembly on Ageing. Madrid, Spain.

World Health Organization (2007) Definition of an older or elderly person . Available on line at http://www.who.int/healthinfo/survey/ageingdefnolder/en/index.html (Accessed September 20,2012)

World Health Organization International Classification of Functioning, Disability and Health (ICF, 2009) Available on line at http://www.who.int/classifications/icf/en/ (Accessed August 1,2012)