MedWeight Smart Community: A Social Approach

Giannis Meletakis, Rania Hatzi, Panagiotis Katsivelis, Mara Nikolaidou, Dimosthenis Anagnostopoulos, Costas A. Anastasiou, Eleni Karfopoulou and Mary Yannakoulia

1 Introduction

Information and Communication Technology (ICT) is literally changing every aspect of our life [1]. This entire new age has affected a great number of different domains providing new widely accepted tools and visions for everyday communication and collaboration among participants. A great impact on this growing area has been accomplished from on-line social networks, as they have been established as a prominent model for communication and interaction between individuals, as well as among members of communities or organizations. There is no questioning

G. Meletakis (✉) · R. Hatzi · P. Katsivelis · M. Nikolaidou · D. Anagnostopoulos
Department of Informatics and Telematics, Harokopio University, Athens, Greece
e-mail: meletakis@hua.gr

R. Hatzi
e-mail: raniah@hua.gr

P. Katsivelis
e-mail: pkatsiv@hua.gr

M. Nikolaidou
e-mail: mara@hua.gr

D. Anagnostopoulos
e-mail: dimosthe@hua.gr

C.A. Anastasiou · E. Karfopoulou · M. Yannakoulia
Department of Nutrition and Dietetics, Harokopio University, Athens, Greece
e-mail: acostas@hua.gr

E. Karfopoulou
e-mail: ekarfop@hua.gr

M. Yannakoulia
e-mail: myianna@hua.gr

L. Ismail and L. Zhang (eds.), *Information Innovation Technology in Smart Cities*,
https://doi.org/10.1007/978-981-10-1741-4_11

of on-line social network success, as social networks have been playing a significant role in the development of human society over decades [2].

Despite the human social nature, the concepts of community development and community participation took shape in the 1950s [3]. Nowadays, it is assumed that citizen participation is a desired and necessary part of community development activities. Participation means that people are closely involved in the processes that affect their lives. As mentioned in [4] citizen's participation is the process that can meaningfully tie programs to people. Furthermore, sense of community is a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members needs will be met through their commitment to be together [5]. There is no doubt that promoting the participation of community members is the main pillar in any modern community development program [6].

Communities around the world are responding to the participants needs by discovering new ways of using information and communication technologies (ICT) for economic, social and cultural development [1] establishing a new concept called "Smart Communities". In Smart Communities Guidebook, developed by California Institute for Smart Communities (1997) at San Diego State University, the concept of Smart Community is presented as a community in which government, business and residents understand the potential of information technology, and make a conscious decision to use that technology to transform life and work in their region in significant and positive ways [7]. In present, the Smart Community concept is known and used all over the world under different names and in different circumstances [1]. In any case, it is considered an imperative constituent of the smart city environment. Could modern social network technology serve the concept of smart communities? May current popular social networks promote the creation and support of smart communities? Are there any limitations in social network interaction model hindering smart community support?

These are the questions we are dealing with in this paper in our effort to promote a smart community targeting weight maintenance support, called MedWeight. Social network technology was employed to support MedWeight community. The requirements imposed by such a community on social network technology and the necessary extensions to the social network interaction model in order to support smart communities were discussed in [8]. Based on these extensions, Medweight social network platform was developed. In this chapter, we focus on MedWeight community perspective and the experience obtained by community members during the development and usage the MedWeight platform. The basic challenges on choosing smart community direction are discussed, requirement imposed are explained and key issues on its adaptation for the interaction between nutrition experts and community members trying to maintain their weight are explored.

The rest of the paper is organized as follows. Background and motivation for Medweight community leaders on choosing the establishment of smart community technology to support volunteers for weight maintenance is explained in Sect. 2. Section 3 outlines technological key challenges in supporting MedWeight smart community and corresponding extensions proposed to the social network model.

MedWeight social network, developed to support the community, from the participant perspective, is presented in Sect. 4. Conclusions and future work reside in Sect. 5.

2 Background—Motivation

It is a common true that the Internet and Web technologies have helped many of us communicate more easily and effectively. Web 2.0 applications and platforms, such as wikis, blogs and social networks, enable people to communicate directly and without space or time limitations. Although social technology does not affect the interdependency between people, it strongly enhances the probability that people who are interdependent, in the sense that they could share common interests, learn about each other and eventually start a relationship. In any case, enhancing accessibility may have a positive impact in maintaining, enriching and building communities [9]. Thus, social technology may definitely contribute in promoting the Smart Community concept.

Social support, as perceived in the context of smart communities, is defined as the resources or aids exchanged between individuals through interpersonal ties [10]. This is one of the key benefits that users perceive from on-line social networking [11]. As indicated in [12], Social Network users perceived a greater level of emotional support and companionship than did general Internet users at a level that was almost equivalent to the amount that married or cohabiting Americans normally perceive from their live-in partners. The same view appeared in [13] where the results shown that the positive affect felt by social network users after on-line social networking was positively associated with perceived companionship support, appraisal support, and life satisfaction. In the same study [13] was noticed that it is the quality of interaction that matters in establishing social support and psychological well-being, but not the frequency or amount of social networking use.

Social technology has empowered patients to share their information and experiences and also to gain access to others information [14]. As indicated in [15] the proliferation of the Internet for acquiring information on health and developing e-health has gained a lot of attention in recent years. Data in the European Union show that when searching the internet for a specific injury, disease, illness or condition, 36% of the responders searched for testimonials or experiences from other patients and 10% looked for emotional support in dealing with the specific health issue [16].

According to [17] the key factors of on-line health support communities high popularity are:

- any time support overcoming time boundaries
- anywhere support overcoming distance boundaries that might be associated with traditional face-to-face support provision

- establishment of "safe" environment for individuals with stigmatizing or disfiguring conditions to obtain support
- anonymization makes it easier for individuals to discuss sensitive or embarrassing topics, and may increase honesty, intimacy and self-disclosure
- larger broad of experiences and opinions may be offered than face-to-face support groups

The majority of existing social health related applications are targeting on-line health care and support communities. They consist mainly of medical blogs and micro-blogs [18], wikis [19] and media sharing sites [20]. Social networking sites are also available [21]. Social technology may also bring a new dimension to health care as it offers a medium to be used by the public, patients, and health professionals to communicate about health issues with the possibility of potentially improving health outcomes [22]. There are several examples of social media applications targeting evaluation and reporting of real-time diseases, catalyzing outreach during (public) health campaigns and recruitment of patients to on-line studies and in clinical trials [23].

Despite the fact that most efforts in weight management have been focused on weight loss, it is now evident that weight loss maintenance in formerly obese/overweight individuals represents possibly the greatest challenge, both in terms of physiology and behavior, in overall weight control. However, what is the impact of technology? Could social technology contribute to establish a smart community helping its members in their effort to lose weight and maintain weight loss [24]? Who should be part of this community? Should weight management experts also participate to provide professional advice or should the community only persist of people interested in weight management?

As indicated in [25], the contribution of social technology seams helpful, since the participants of the study were almost five times more likely to perceive Encouragement support for their weight loss efforts if they used the social media tools at least once a week. In addition, this study [26] showed that an Internet weight maintenance program could sustain comparable long-term weight loss compared with a similar program conducted in person and over the phone. On the opposite side, in [27], the arm with social media demonstrated no difference in perceived support compared to in-person therapy and it also had the highest rates of attrition.

A recent review of the existing studies suggests that social networks may be effective in improving nutrition knowledge or key behaviors in weight control, such as eating behavior or physical activity, thus promoting body weight change and overall feeling of well-being [28]. In fact, it has been shown that web based interventions may be equally effective with face-to-face interventions in changing dietary behaviors, such as fruit and vegetable consumption, or physical activity levels [29] or maintaining weight loss [30]. Furthermore, when targeting specific populations, such as adolescents, the available data suggest that computer-based interventions may be superior in improving nutrition knowledge, as compared to traditional means of education. The essential components of a successful web-based

intervention for weight control have not been fully established. As weight loss or maintenance is a matter that depends mainly on behavior change, it has been shown that web based interventions incorporating components of behavioral theory, counseling or self-monitoring may be superior, compared to education alone [30].

To this end, in the following we explore the potential of using social networking technology to build a smart community for weight management.

3 MedWeight Project

The MedWeight project was established as part of a research study related to weight maintenance by the Department of Nutrition and Dietetics at Harokopio University of Athens (http://medweight.hua.gr/en/index.php) two years ago. A similar study for weight maintenance exists in the National Weight Control Registry, US (NWCR) [31]. Its main aim is to collect information on common behaviours among its members that predict long-term weight maintenance status. Assessment is performed mainly through paper work that is send to the potential participants by mail. Our ambition was to advance this perspective by including not only assessment but also interactions between all users, i.e. health professionals and patients [32]; and to advance the assessment procedures by utilizing social networking technology.

MedWeight community consists of more than 1000 volunteers involved in the study and Nutrition experts and researchers, advising them. The goal of this community is to help volunteers maintain their weight and follow-up people encountering weight problems. Both other volunteers and nutrition experts are assisting them in this effort.

Volunteers include both successful losers and weight loss regainers. Their interaction may be of interest, as the assistance they provide to each other is achieved mainly through communication between them. Helpful information and guidance by the nutrition experts related to issues of interest in MedWeight community is also provided to volunteers. The prospect of participant's mutual support for health issues through direct communication was the main motivation for establishing Med-Weight community.

As such, the community should explore all available technology to help its members serve their purpose. As in face-to-face support groups, the community should consist of people interesting in maintaining their weight and experts helping them. In contrast to what is normally the case in existing social networks, where all participants are treated as equal and have exactly the same capabilities and rights, in this smart community environment participants should be able to differentiate their behaviour in the community based on their role, as in the real world, when attending a support group for example.

The main feature, differentiating it from other similar efforts on health issues, is the fact that both volunteers and nutrition experts participate in the community, having different roles and capabilities as in real life. In existing on-line communities either patients or doctors participate, having exactly the same privileges and

capabilities (as for example patientslikeme.com for patients or twitterdoctors.net for medical professionals). Such a feature enables the volunteers to behave in on-line MedWeight community as they would a real-world support community, receiving similar services and perceiving their support community the same way as they would in the real-world. Thus, MedWeight obtains the characteristics of a true smart community, as prescribed in [7].

4 Supporting Smart Communities Through Social Networking Technology

The typical social network model, as supported by popular social networks, such as Facebook, Twitter and Google+, dictates that all participants are (a) described by the same characteristics, (b) belong in the same category and (c) are related to others with one unique relation type (e.g. friendship in Facebook or Follower in Twitter). Available social networking platforms do not support the participant's discrimination in different types, being unable to disseminate the produced information according to their category.

In the following, we briefly present the extended social network interaction model proposed in [8] to explore requirements imposed by MedWeight smart community. The proposed extensions are summarized in Fig. 1 and analytically discussed in the following. In the figure, proposed entities are depicted as cyan rectangles. Our vision is that our proposed model and corresponding social networking platform could be utilized from other communities as well [33].

These are the main characteristics added to the typical social network model:

- Role definition support to reflect the role each participant plays in the community
- Relation definition support to reflect the different relation developed between of community members having different roles
- Information dissemination advancement based on roles and relations
- Group management advancement based on roles and relations
- Application execution based on roles and relations

4.1 Roles, Relations and Groups

Realizing that there was a major need to differentiate between participants to reflect their role and capabilities/responsibilities in the community, the concept of Role was introduced. It enables to manage information dissemination among participants, indicate responsibilities and enables different ways of describing participants

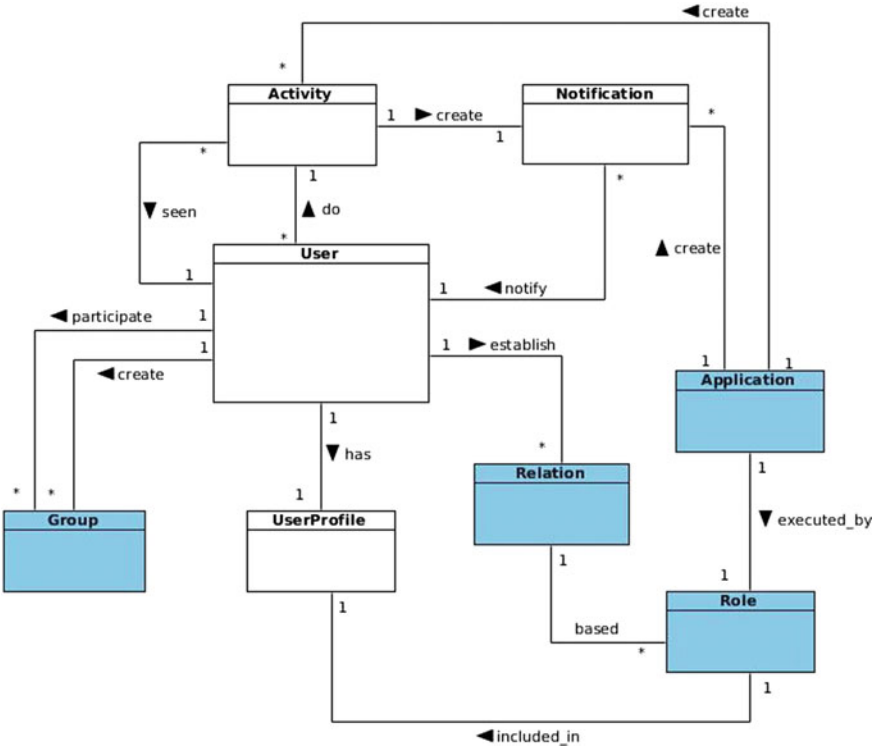

Fig. 1 Extended social network model

(for example the profile data of a Nutrition Expert may vary from those belonging to a volunteer).

Establishing relations with others is one of the main options given to social network participants. There are two general types of relations: mutual (bidirectional) and one-way (unidirectional) [34]. Our proposed model could support the dynamic creation of relations of both types between participants, based on the predefined user roles. Relations can be either unidirectional, indicating that a community member receives information from another member, or bidirectional, indicating that the members interact.

The combination of roles, relations and streams does not fully facilitate fine-grained content propagation; therefore, a more elaborate mechanism for content delivery is proposed, through groups, as supported in the typical social networking interaction model.

4.2 Information Dissemination and Application Execution

The most common operation that a participant performs in a social network is publishing content, which can be of a variety of types, such as links, texts, files, multimedia etc. Published information is propagated in the form of a stream to all participants related to the publishing entity, who receive notifications and updates about the publication, urging them to review it and possibly contribute to it, as dictated by the notion of collaborative content in Web 2.0 [35].

In communities, specific streams should be defined based on participant roles and relations. Apart from the member relations, the social aspect of the community should not be dismissed; therefore, each member may develop a social relation with any other member of the community, regardless of their roles in it. At the same time, a clear separation between them should be maintained, thus a more complex propagation mechanism is introduced incorporating more than one discrete streams. The combination of discrete participant roles, multiple streams, extended relations and rules governing the propagation of content successfully achieves the separation between information shared between community members.

In addition to sharing content and notifications through discrete streams and groups, the proposed social network model supports the provision of specific activities and enables its participants to complete specific actions in collaboration with other participants.

Actions may be provided by cooperating applications executed in a specific participant profile. In order to ask for services rather than information from another participant, a more sophisticated communication mechanism is required, facilitating information exchange between applications executed on different participant profiles.

5 MedWeight Smart Community

The MedWeight Smart Community was built, based on the extended social network model, to support MedWeight Project. It is currently deployed using Python and Django (https://www.djangoproject.com) web application framework, while the user interface, in this phase, supports only the Greek language.

There are two distinct roles and two relations supported in MedWeight community:

- *Volunteer*: a person who takes part in the study and wants to benefit from Med-Weight community to maintain weight. Most likely volunteers have been in a diet and would benefit from expert advice to maintain their weight.
- *Dietitian*: an expert scientist that provides advice, services and feedback to participants of the role Volunteer.
- *Consultant Relation*: a unidirectional relation from a volunteer to a dietitian, which enables volunteers to use dietitians to obtain expert advice.

- *Fellow Relation*: a bidirectional relation, defined between volunteers, which enables them to share experiences and information related to Med-Weight community.

Roles and relations are defined through MedWeight administration platform, as depicted in Fig. 2.

The interaction between MedWeight participants is performed mainly by publishing content either in their profile or in interest groups they may create. They may declare its visibility, as in any social network. Furthermore, they may execute applications, as discussed in the following.

The main view of a Volunteer participant profile is shown in Fig. 3. Please have in mind that MedWeight platform has a Greek language interface, as it targets Greek audience. Thus, explanation comments are embedded in the figure to make it understandable by an international audience.

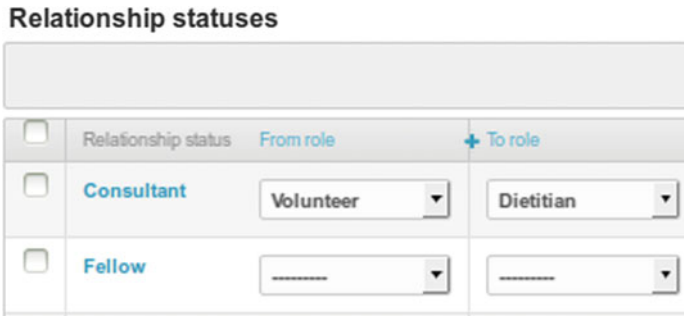

Fig. 2 Defining relations using MedWeight administration interface

Fig. 3 MedWeight participant profile view

The content that is published by MedWeight community members in their profile is visible to all other community members related to them, either by consultant or fellow relation. In order to succeed the optimal dissemination of information, there are several given options to users related to 'visibility' of the publication such as private, public, visible to a specific participant, visible to all of them, as shown in Fig. 3.

Through the corresponding option in the right, bottom part of Fig. 3 (red rectangle), a recommendation mechanism was designed in order to match volunteers with similarities in order to promote their interaction. This process pursues to detect other volunteers with same info in their profile. Volunteers may search members of the community based on specific criteria they may combine.

Groups may be created and managed by both Volunteers and Dietitians. Based on the creator role, Medweight platform applies different group access policy. Groups created and managed by volunteers enable posting by all participants. Groups created by Dietitians have a more restricted policy, as in those groups only "expert" opinions should by posted. Only dietitians, authorized by the creator of the group, post content in it, although all Medweight participants may read this content.

Applications may also be executed with MedWeight Social Network platform. As an example, the *weight maintenance* application is briefly presented. It involves a private interaction between the volunteer and his/her dietitian consultant. Volunteers may daily register measurements of their weight, running such an application in their profile. With each measurement, the application calculates certain dietetic factors, such as Body Mass Indicator. The dietitian consultant monitors these factors, when accepting to act as a consultant. If any of these factors have exceeded a certain limit, a notification is issued to dietitian profile. Consequently, the dietitian can provide personalized feedback and expert advice to the volunteer, though the application, also running in his/her profile.

Medweight platform is used by half of the 1000 volunteers involved in the Medweight study and nutrition experts and researchers advising them, during the last 10 months. The platform was well accepted by participants, which had no problem using it. Detailed data on its impact in helping volunteers maintain weight loss is part of an on-going research and will be available on a pilot basis, after completing the first year of its usage.

6 Conclusion

MedWeight smart community was build to support volunteers trying to maintain weight loss by allowing them to be members of a community composed by both other volunteers and nutrition experts, taking into consideration the way support groups are formed in the real-world. To support MedWeight smart community, a corresponding social network platform was built, extending the typical social network model to support roles, relations and complex content dissemination policies.

Future work includes the extension of MedWeight Smart Community to provide a variety of applications allowing participants to use external services and the support other communities as well.

Acknowledgements The research presented in the paper is part of the work conducted in the project Med-Weight Study: Lifestyles for Weight Loss Maintenance funded by Coca-Cola Foundation. We would like to give special thanks to all the volunteers and dietitians participating in MedWeight Smart Community.

References

1. Lindskog H (2004) Smart communities initiatives. In: Proceedings of the 3rd ISOneWorld conference, pp 14–16
2. Xia F, Ma J (2011) Building smart communities with cyber-physical systems. In: Proceedings of 1st international symposium on from digital footprints to social and community intelligence (pp 1–6). ACM (September)
3. Murthy CA, Chowdhury N (1996) In search of optimal clusters using genetic algorithms. Pattern Recogn Lett 17(8):825–832
4. Spiegel HB (1969) Citizen participation in urban development, vol 2. Cases and programs
5. McMillan D (1976) Sense of community: an attempt at definition. George Peabody College for Teachers
6. Zomorrodian AH, Gill SS, Samaha AA, Ahmad N (2013) Quantitative models for participation evaluation in community development: a theoretical review. World Appl Sci J 25(2):314–322
7. Canada I (1998) Smart communities: report of the panel on smart communities. Information Distribution Centre, Communications Branch, Industry Canada, Ottawa
8. Meletakis G et al (2015) Building MedWeight smart community using social networking technology. In: 11th international conference on innovations in information technology (IIT), IEEE, pp 332–337
9. De Vos H (2004) Community and human social nature in contemporary society. Analyse & Kritik 26(1):7–29
10. Cohen S, Hoberman HM (1983) Positive events and social supports as buffers of life change stress. J Appl Soc Psychol 13(2):99–125. [Online] Available: http://dx.doi.org/10.1111/j.1559-1816.1983.tb02325.x
11. Park N, Kee KF, Valenzuela S (2009) Being immersed in social networking environment: facebook groups, uses and gratifications, and social outcomes. CyberPsychol Behav 12 (6):729–733
12. Hampton K, Goulet LS, Rainie L, Purcell K (2011) Social networking sites and our lives. Retrieved 12 July 2011 from, 2011
13. Oh HJ, Ozkaya E, LaRose R (2014) How does online social networking enhance life satisfaction? The relationships among online supportive interaction, affect, perceived social support, sense of community, and life satisfaction. Comput Hum Behav 30:69–78
14. Hajli MN (2014) Developing online health communities through digital media. Int J Inf Manage 34(2):311–314
15. Rains SA, Karmikel CD (2009) Health information-seeking and perceptions of website credibility: examining web-use orientation, message characteristics, and structural features of websites. Comput Hum Behav 25(2):544–553
16. Eurobarometer F (2014) European citizens digital health literacy. A report to the European Commission, 2014

17. Coulson NS (2013) How do online patient support communities affect the experience of inflammatory bowel disease? An online survey. JRSM Short Rep 4(8):2042533313478004
18. Kovic I, Lulic I, Brumini G (2008) Examining the medical blogosphere: an online survey of medical bloggers. J Med Internet Res 10(3)
19. Heilman JM, Kemmann E, Bonert M, Chatterjee A, Ragar B, Beards GM, Iberri DJ, Harvey M, Thomas B, Stomp W et al (2011) Wikipedia: a key tool for global public health promotion. J Med Internet Res 13(1)
20. Adlassnig K et al (2009) An analysis of personal medical information disclosed in youtube videos created by patients with multiple sclerosis. In: Medical Informatics in a United and Healthy Europe: proceedings of MIE 2009, the XXII international congress of the European federation for medical informatics, vol 150. IOS Press, 2009, p 292
21. Bender JL, Jimenez-Marroquin M-C, Jadad AR (2011) Seeking support on facebook: a content analysis of breast cancer groups. J Med Internet Res 13(1)
22. Moorhead SA, Hazlett DE, Harrison L, Carroll JK, Irwin A, Hoving C (2013) A new dimension of health care: systematic review of the uses, benefits, and limitations of social media for health communication. J Med Internet Res 15(4)
23. Grajales FJ III, Sheps S, Ho K, Novak-Lauscher H, Eysenbach G (2014) Social media: a review and tutorial of applications in medicine and health care. J Med Internet Res 16(2):e13
24. Dais A, Nikolaidou M, Alexopoulou N, Anagnostopoulos D (2008) Introducing a public agency networking platform towards supporting connected governance. In: Electronic government. Springer, Berlin Heidelberg, pp 375–387
25. Hwang KO, Etchegaray JM, Sciamanna CN, Bernstam EV, Thomas EJ (2014) Structural social support predicts functional social support in an online weight loss programme. Health Expect 17(3):345–352
26. Harvey-Berino J, Pintauro S, Buzzell P, Gold EC (2004) Effect of internet support on the long-term maintenance of weight loss. Obesity Res 12(2):320–329. [Online] Available: http://dx.doi.org/10.1038/oby.2004.40
27. Cussler EC, Teixeira PJ, Going SB, Houtkooper LB, Metcalfe LL, Blew RM, Ricketts JR, Lohman J, Stanford VA, Lohman TG (2008) Maintenance of weight loss in overweight middle-aged women through the internet. Obesity 16(5):1052–1060. [Online] Available: http://dx.doi.org/10.1038/oby.2008.19
28. Maher CA, Lewis LK, Ferrar K, Marshall S, De Bourdeaudhuij I, Vandelanotte C (2014) Are health behavior change interventions that use online social networks effective? A systematic review. J Med Internet Res 16(2):e40
29. Neuenschwander LM, Abbott A, Mobley AR (2013) Comparison of a web-based vs in-person nutrition education program for low-income adults. J Acad Nutr Diet 113(1):120–126
30. Neve M, Morgan PJ, Jones P, Collins C (2010) Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: a systematic review with meta-analysis. Obes Rev 11(4):306–321
31. Wing RR, Phelan S (2005) Long-term weight loss maintenance. Am J Clin Nutr 82(1): 222S–225S
32. Karfopoulou E, Anastasiou CA, Hill JO, Yannakoulia M (2014) The medweight study: design and preliminary results. Mediterr J Nutr Metab 7(3):201–210
33. Hatzi O, Meletakis G, Katsivelis P, Kapouranis A, Nikolaidou M, Anagnostopoulos D (2014) Extending the social network interaction model to facilitate collaboration through service provision. In: Enterprise, business-process and information systems modeling. Springer, Berlin, Heidelberg, pp 94–108
34. Li Y, Zhang Z-L, Bao J (2012) Mutual or unrequited love: identifying stable clusters in social networks with uni and bi-directional links. In: Algorithms and models for the web graph. Springer, 2012, pp 113–125
35. Andersen P (2007) What is Web 2.0? Ideas, technologies and implications for education. JISC Bristol, UK 1(1)