P. CIAMPOLINI, I. DE MUNARI, D.M. KRISTALY, J. MELLIN, S. MORARU, G. VESPASIANI. ***The HELICOPTER project: Continuous monitoring for early detection of age-related diseases.*** *Gerontechnology 2016;15(suppl):148s*; doi:10.4017/gt.2016.15.s.900.00 **Purpose** Early diagnosis of age-related diseases, based on constant monitoring of health information, is a key to 'ageing at home' policies. Clinical sensors exist, suitable for self-checking of relevant parameters: however, compliance with routine checks is often poor, due to boredom or carelessness. In this paper, a strategy for indirect monitoring of health condition, requiring less participating effort to the end user, is presented. **Method** A highly heterogeneous sensing network is deployed in the end-user living environment, including: clinical devices (measuring blood pressure, body weight, blood sugar and oxygen concentrations), environmental devices (room presence, bed/chair occupancy, toilet usage, fridge or pantry access, etc.) and wearable devices (accounting for physical activity evaluation, fall detection and carrying identification information). All of them cooperate within a multi-standard wireless network, open to ZigBee and Bluetooth connections. Data are transferred to a remote service center, where models are continuously evaluated, searching for behavioral anomalies. The system is individually tuned upon some weeks of 'silent' user monitoring: the system learns from actual data, providing the reference framework for anomaly detection. Patterns of anomalies are then combined in a probabilistic model, based on Bayesian Belief Networks (BBN), which evaluates the likeliness of some ill conditions. A simple example may concern the congestive heart failure (CHF) condition, which often manifests itself with a number of behavioral symptoms, which can be inferred through behavioral insights: reduced mobility, sleep and feeding habit disturbances, changes in diuresis and toilet pattern, etc. Different models, suitable for different diseases symptoms, have been built and tuned upon consulting of medical expert. Of course, outcomes of such models (being mostly based on indirect indicators) are not claimed to be accurate diagnoses, but, should a given probability threshold be exceeded, they merely elicit a 'diagnostic suspicion', suitable for drawing the caregivers and medical attention. Hence, a hierarchical approach is followed: data coming from the home sensors are continuously monitored and processed by BBN agents. If a 'diagnostic suspicion' is raised, the end-user is addressed to the most appropriate set of home clinical sensor measurements, to strengthen the behavior-based suspicion with more direct and objective measurements. Clinical data are then acquired and fed back to the model, to corroborate or disconfirm the suspicion. In the former case, the user is addressed to his care system for actual diagnosis. Such an approach has been named 'automatic triage', underlining its supporting role in the actual clinical diagnosis, which is still demanded to GP (General Practitioner) in charge. User interaction develops along different lines: the primary end-user interacts with a simple (android) tablet app, providing information about proper system functioning, motivational advices and questions (automatically generated by the system to integrate the sensor-based picture). Caregivers (formal and informal) have their own app, through which they receive 'attention' warnings, based on both technical and health concerns. Professional users (GPs' and formal caregiver) access a web-based 'dashboard', allowing them to inspect more closely the behavioral profiles, including quantitative outcomes of BBN agents, i.e., the actual probability of each monitored diagnosis suspicion, together with the detailed log of involved sensor (information unsuitable for being expressively shown to the end-user). **Results & Discussion** The approach described above has been developed and implemented in the framework of the AAL-JP project HELICOPTER[1], funded by AAL-JP and by participating National Agencies. Prototypes of the system have been implemented and are currently tested over a set of about 30 pilot homes, based in Sweden and in the Netherlands. Currently, home sensor networks, internet infrastructure, models have been functionally validated. Although the project size is not suitable for a full-scale clinical trial, data are being accumulated, suitable for a proof-of-concept validation of the 'automatic triage' concept.

References

1. http://www.HELICOPTER-aal.eu/; retrieved September 23, 2016

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Address: University of Parma, Parma, Italy;
E: paolo.ciampolini@unipr.it