A BEACON BASED AAL SYSTEM FOR PEOPLE WITH DEMENTIA

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The global demographic change is described as a social challenge due to increasing life expectancy and falling birth rates. The effects of the demographic development and the aging society are especially noticeable in the health care market, as an increasing number of older people will lead to a greater need for nursing and medical care. In order to reduce these costs, particularly in long-term care, technological aids are becoming increasingly important. Through the integration of innovative technology in everyday life, e.g. with Active and Assisted Living (AAL) solutions, the desire for a self-determined and autonomous lifestyle can be fulfilled even into old age. The main focus of this paper is to present the conception and development of an assistance system consisting of a smartwatch, Estimote beacons, contact sensors and a smartphone application to support the daily structure of people with dementia.

Introduction

The target group for the system presented here is mainly defined as people with Alzheimer's disease. Alzheimer's disease is the most common form of all dementias and is characterized by amyloid and neurofibrillary bundle deposits, activated microglia cells and synapse and nerve cell losses.

These changes can lead to memory disorders, restrictions in visual-spatial thinking and speech impediments. As the disease progresses, difficulties often arise in coping with everyday activities. Instrumental Activities of Daily Living (IADLs), such as making phone calls, shopping and drug management, are often first affected by the disease. In the advanced stages of Alzheimer's dementia, the Activities of Daily Living (ADLs), are also affected. How fast a person's dementia progresses, depends on the individual and especially on the form of the disease.

The system wants to offer a remedy especially for deficits in spatial thinking and drug management, aiming to support the affected person as well as their relatives. With the help of the smartphone application, relatives are able to label the beacon with any customized text. If the person with dementia, wearing the smartwatch, is close to the beacon, which can be easily mounted within the apartment or house, the text is read out by the watch using a text-to-speech engine. In addition to the room or context-based assistance, the smartwatch also reminds the user of appointments or of taking their medication. The system integrated contact sensors trigger alarms on the smartwatch, if, e.g., the refrigerator or the front door are not closed within a certain period of time.

User Centered Design Approach

Understand the context of use

As the initial step of the work presented here, expert interviews were conducted with specialists from the field of geriatric psychology in order to gain a better insight into the topic of dementia.

Specify the user requirements

With the help of a questionnaire, the issues that arise in everyday life were ascertained in order to concretize and define the functions of the system to be developed. For the documentation of the requirements, a persona and use cases were generated.

Produce design solutions & prototype

An essential task in this process is to check whether the concept still complies with the requirements and needs of the users. To facilitate this control, a mock-up should be generated which will be used as the basis for the final evaluation phase.

Evaluate against requirements
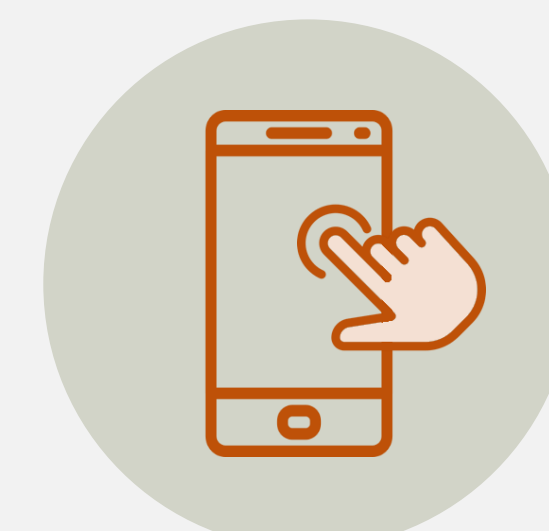
A usability test was conducted with primary (affected) as well as secondary users (relatives) to test the Android based smartphone and smartwatch application in terms of usability and technology acceptance.

Results

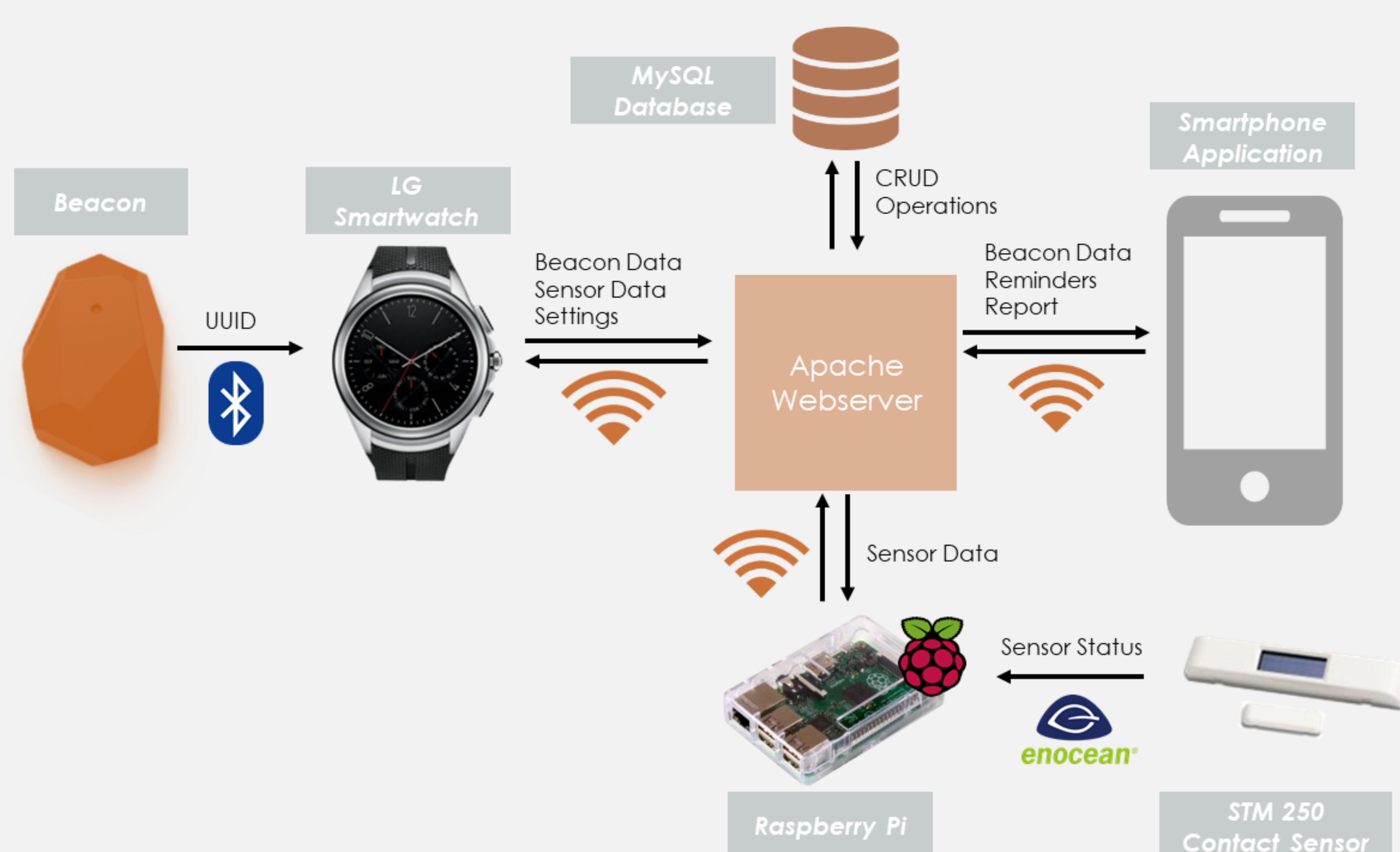### Technical implementation

Figure 1: The architecture of the system
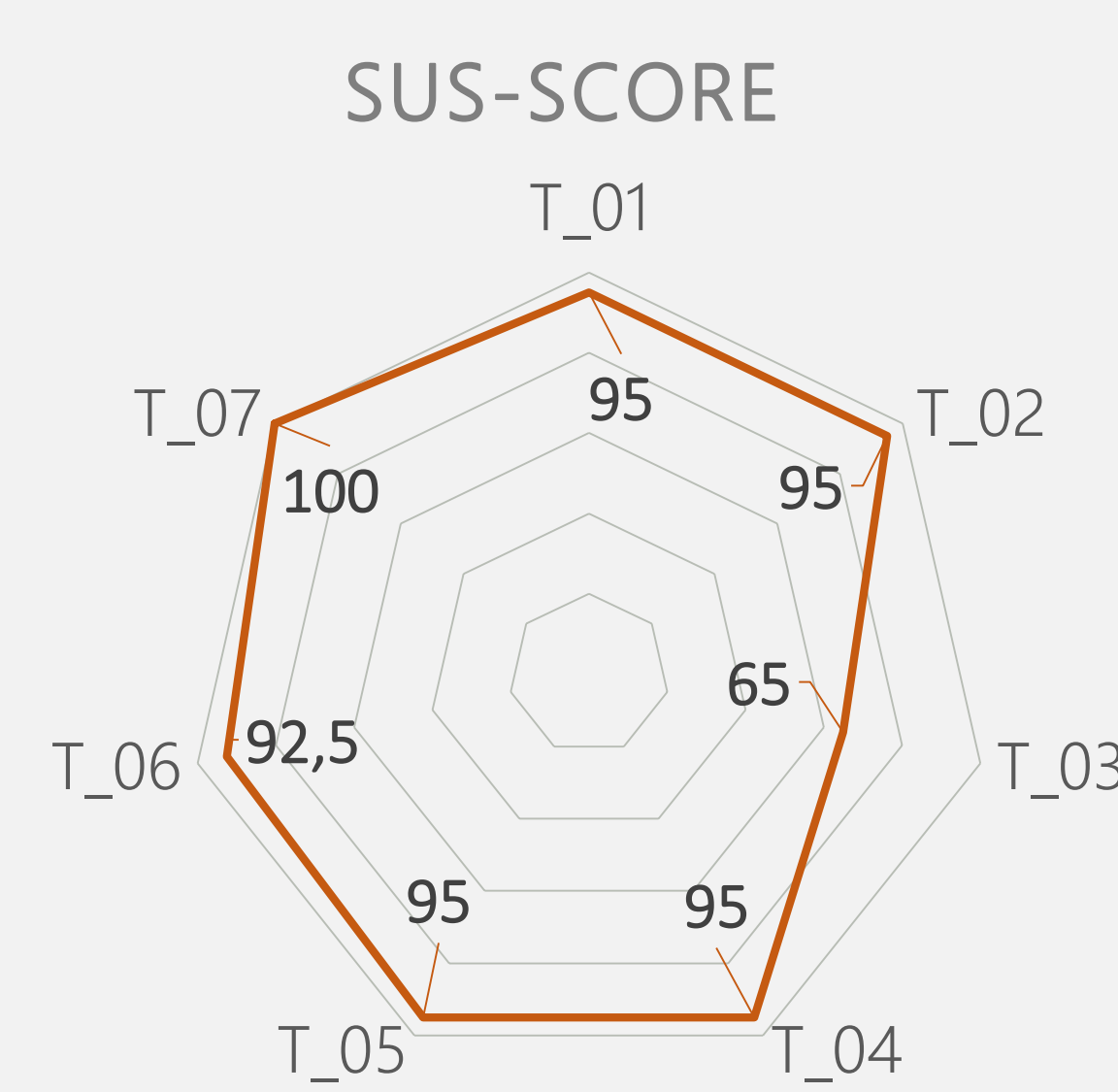
System evaluation

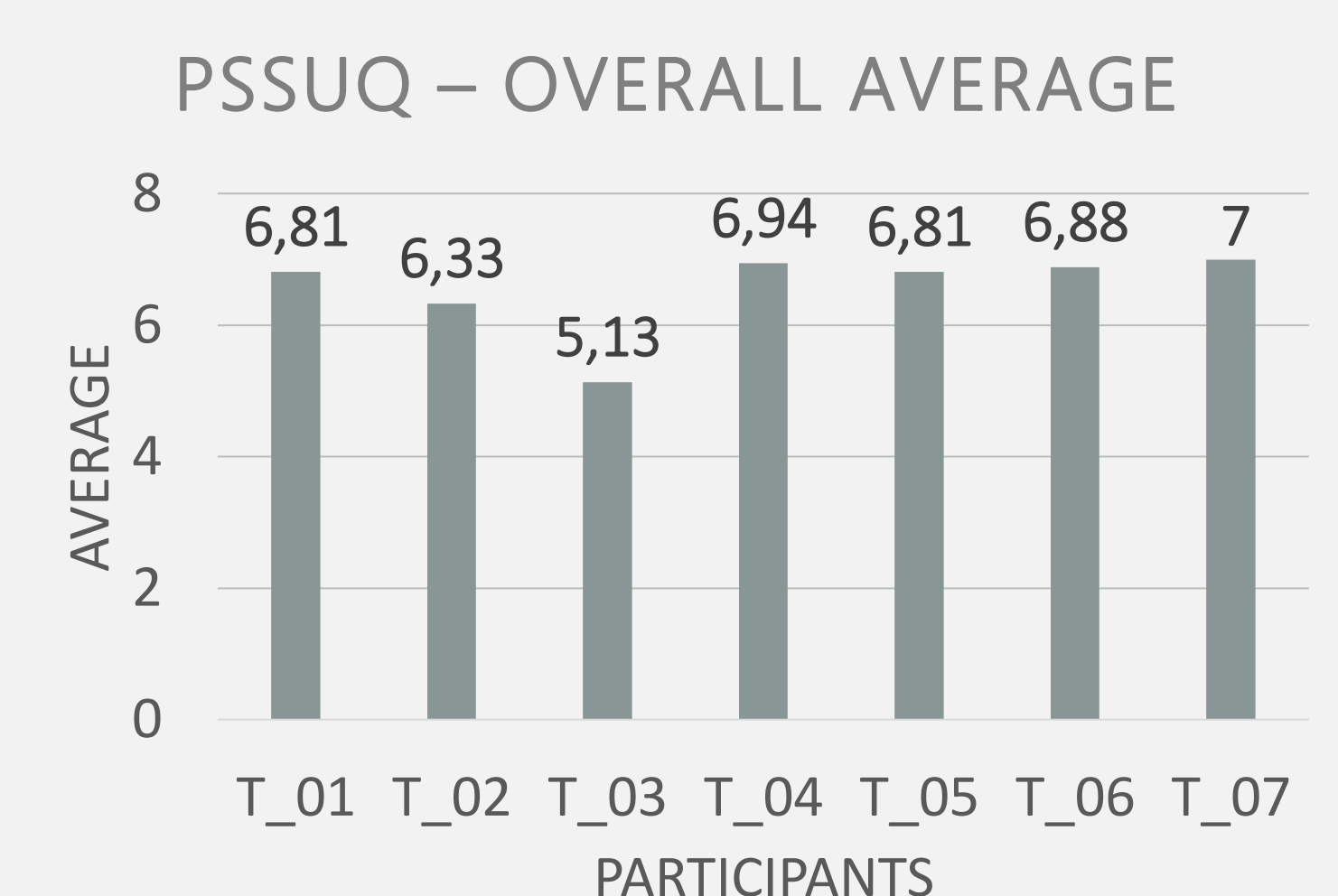Figure 2: Results of the SUS questionnaire for seven test participants

Figure 3: Overall average of PSSUQ for seven test participants

Discussion & Conclusion

Within this project, an assistance system for people living with dementia was planned, developed and evaluated using the UCD approach. In addition to the technical implementation, it was shown that a module system, consisting of a smartwatch, Bluetooth beacons and sensors, can easily be integrated into the home environment and, thanks to the implemented functionality, can serve very well as support in everyday life. The system was designed according to the needs of potential users, which were collected in focus groups and expert interviews, and the prototype was tested in seven usability tests for user friendliness, wearing comfort and technology acceptance. During the testing phase, the necessity of such assistance systems was confirmed, as difficulties in structuring everyday life already arise in the early stages of dementia. With the help of these systems, not only those affected themselves can profit, but also their relatives should find support in a situation which is not always easy.

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