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Using information and mobile technology improved elderly home care services



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Available online 27 February 2016

KEYWORDS

Elderly home care;
Long term care;
Health Information
Technology;
Mobile Technology;
Genetic algorithm;
Usability

Abstract

Background: Many international studies recognized that home care services for elderly can reduce a health system's financial burden while maintaining high quality standards of patient care. Nevertheless, published research also reports that first-line care or in-charge nurses often face many challenges while delivering the home care services. To deal with the challenges, researchers have suggested applying information and mobile communication technology (IMCT) to enhance the utilization of elderly home care services.

Methods: We used a Service Oriented Architecture (SOA) to design the system structure and applied an IMCT to develop a mobile roaming sessions of the home care management system to help first-line nurses efficiently deliver care services while implementing functionality. The system includes three main modules: work scheduling, care service, and patient management. The work scheduling module used genetic algorithms to automatically generate monthly work schedules for nurses. Finally, we interviewed several users to understand the system usability.

Results: We conducted a user experience interview to document and analyze the feasibility and efficiency of the system. The results showed that users found the system very useful in improving the home care services. Particularly, the care scheduling, care management, tour planning, and service logging functions are the most useful features of IMCT tools for improving the home care services. However, the small mobile phone screen and function integrations were main constraints in the system usability.

Conclusions: We applied IMCT to develop a mobile roaming sessions of home care management system to help first-line nurses efficiently deliver care service. The SOA approach

Abbreviations: API, Application Programming Interface; CRM, Customer Relationship Management; GA, Genetic Algorithm; GCA, Genetic Clustering Algorithm; GMCA, Genetic Medoid Clustering Algorithm; IMCT, Information and Mobile Communication Technology; IT, Information Technology; MTSP, Multiple Travelling Salesman Problem; RARwGA, Random Assorted Recombination Genetic Algorithm; SED, Sum of Euclidean Distance; SOA, Service Oriented Architecture

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<http://dx.doi.org/10.1016/j.hlpt.2016.02.004>

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successfully allowed us to combine existing information applications in a hospital to the *ad hoc* reporting in a home care management system. The system cost effectively improved elderly care services for small- to medium-sized home care centers.

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Background

According to the United Nations Population Fund (UNFPA) report, the number of older persons (over 60 years of age) had increased to over 810 million by 2013. It is projected to reach two billion, with one in five persons in the world aged over 60 years by 2050 [32]. Population ageing poses a significant challenge for the health care systems in many countries in the world. For instance, in Taiwan, people over 65 years old accounted for 11.2% of the entire population and consume around 30.7% of government health care expenditures [21]. In Canada, older Canadians (> 65 years old) comprise 14% of the population and this age class spends ~45% of government health care budgets [9].

Home care generally refers to supportive care provided in the patient's residential home by licensed healthcare professionals. Many publications recognized that the onsite health care services for elderly can reduce financial burden while preserving care quality [13,18,24,4]. For example, Sullivan [31] compared costs of providing treatment at home to alternative settings including hospitals and nursing homes in BC, Canada. The study found that home care costs were significantly less compared with similar nursing facilities. In fact, the average savings ranged from 25% to 60%. Additionally, Paul et al. [23] study also showed that outpatient (home) nursing care was more cost effective than inpatient nursing care. In regards to care quality, Shyu and Lee [26] found that providing home care was more suitable for patients that were seriously ill rather than in-house nursing-home care for patients not seriously ill with any prescribed services after discharge from the hospital. Furthermore, in many Asian countries, such as Taiwan, most elderly people desire to stay in their homes with family as long as possible despite a potential need for hospital services.

Many studies report that nurses often face many challenges in their service delivery with a lack of continuous professional training, scarcity of technology investments to support complex care needs, and increasing time pressure and client demands while deliver the home care services [27,6,8,10]. These factors affect the provision of care quality negatively [3,12,18,34].

In Taiwan, home healthcare services are reimbursed by the National Health Insurance (NHI) program. Currently, most of the professional home healthcare were provided by community home nursing care institutions [7]. Patients need to fulfill three criteria to receive home healthcare services. The criteria are: (1) limited ability of self-care, (2) definite medical or nursing care needs, and (3) chronic conditions requiring long-term nursing care. Registered nurses need to complete additional training courses to become practice home healthcare nurses [7]. Similar to many other home

healthcare workers in the world, home healthcare nurses in Taiwan faced high work stress which may affect service quality. Six factors lead to the stress: insufficient ability, stressful reactions, heavy workload, trouble in care work, poor management, and working time problems [14].

Many published literature suggest that information and mobile communication technology (IMCT) can improve elderly home care services [11,17,19,28,30]. Especially, when it comes to information exchange, knowledge sharing and documentation at the point-of-care the IMCT can be an enabling technique [33]. Using IMCT, first-line nurses can provide timely access related to care knowledge for patients with challenging illnesses or diseases.

However, many small- to medium-sized home care centers have limited funds to construct comprehensive information infrastructure and invest in advanced IT facilities to support care services. Instead, they tend to integrate existing hardware and software to develop a multi-system platform to perform the tasks [15]. Similar to many other home care centers, first-line nurses' workload can dramatically increases due to increasing service demands, and thus affecting the quality of care services.

The objective of this study is to develop an efficient and cost effective mobile session roaming home care management system to improve elderly care services for small- to medium-sized home care centers with a limited budget. First, interviews will be conducted with end users to understand user requirements. Next, a prototype will be designed and implemented to test the utilization of the system. Finally, we will conduct a user experience interview to assess usability and workflow feasibility of the system.

Methods

User requirement analysis

In this study we used a Taiwan medium-sized home care centre (i.e. X-hospital, which will remain anonymous in this study) as a case study. In order to provide the best solution to the home care delivery issues of X-hospital, we formed a focus group and conducted a open question interview with the manager, the computer center director, the head nurse, and two home care nurses to understand the current key service issues for the hospital. Also, we reviewed several existing commercial products to understand if they can be useful for the care center.

Based on the interview results, we drew the functional requirements as described in Section 2.2. Furthermore, the study found that the off-the-shelf products did not fit the care center's requirements. Those software are either too expensive or do not provide all required functionalities (e.g. without Chinese interface).

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