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Development of HealthRESPECT; An integrated service model for older long-term care hospital/nursing home patients using ICT

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Abstract

Background: In Korea, fast aging country, an optimal healthcare service model for older adults should be developed. The purpose of this study is to identify the current healthcare system and to develop new healthcare service model using information and communication technologies (ICT) for older patients.

Methods: Qualitative literature review, focus group interview and structured survey were conducted to identify current healthcare systems for older patients. Afterwards, we developed healthcare service model which include contests of comprehensive geriatric assessment, disease management, drug management, rehabilitation and consultation service using ICT.

Result: Sixty (23 hypertension, 18 diabetes and 19 heart failure) articles are reviewed. ICT based chronic disease management models was effective and patients' satisfaction were improved. In focus group interview and structured survey, current patients and medical information transfer between hospitals was inconvenient, costly and time consuming, especially in long-term care hospital (LTCH) and nursing home (NH) and the necessity of service model to manage older patients using ICT was confirmed. ICT based service model for older patients dwelling LTCH and NH was developed (Health-RESPECT) which include evidence based 1) comprehensive geriatric assessment (CGA) and establishment of customized management strategy 2) chronic disease management service with decision support system 3) potentially inappropriate medication management service 4) rehabilitation service and 5) consultation and videoconference service.

Conclusion : This study is meaningful to identify current healthcare systems in older adults and to develop a system to manage older patient living in LTCH and NH using ICT. However, Health-RESPECT service model will need to be validated in further study.

Background

Korea is the fastest aging country in the word with the "baby boomers" growing older; in just 17 years, the ageing population has doubled, from 7% (an ageing society) in 2000 to 14% (an aged society) in 2017 and it is expected to grow up to 20% (a post-aged society) by 2026.[1)] These older individuals have a higher prevalence of chronic medical conditions, along with a higher rate of poor self-reported health status, functional decline, and institutionalization in long-term care hospitals (LTCH) or nursing homes (NH).[2,3)] Thus, the costs of medical care for older adults is expected to increase exponentially, giving rise to the need for alternative, sustainable health and medical systems. However, fragmented medical services in Korea lead to challenges in providing integrated medical services to this population.

The management and care of older adults is a challenge due to their complicated chronic medical conditions, and the wide variation in their functional, cognitive, and socio-economic status.[3)] In Korea, due to the increase in the number of single-person households and in the social activities of women, family support in the care of older adults is difficult. Consequently, older adults are eventually admitted to LTCH or NH that provide both medical and care support. Particularly in Japan, where the ageing

population is over 27%, long term care costs have increased more rapidly than medical costs, especially among older adults living alone.[4)] Thus, we need to respond to the growing demand and expanding costs of healthcare, comprising of medical and long-term care costs, for older adults.

To offer sustainable healthcare systems to support active and healthy ageing Europe has developed and validated the Inclusive Introduction of Integrated Care (IN3CA) project as part of the eHealth Action Plan, that is running from 2012 until 2020. IN3CA uses information and communication technologies (ICT) to enable better and more efficient health care at lower cost and with better continuity of care. The project showed that integrated care with joint care planning, shared clinical records, decision support tools, and care co-ordination through the use of ICT benefited patient experience, use of services, and costs.[5)]

There is great potential for ICT solutions in addressing the present and future health care and long-term care management of older people. ICT can positively affect both intergenerational and partner care by decreasing usability barriers and promoting attractive and collaborative environments for informal care. The ICT platforms and communication channels will also avoid duplication of efforts when dealing with patients' diagnostic, therapeutic, rehabilitation, or monitoring and support needs.

Thus, in this study, qualitative literature review, focus group interview and structured survey were conducted to identify current healthcare systems for older patients globally and in Korea. Then, we developed the Health-RESPECT (integrated caRE Systems for elderly PatiEnts using icT) platform that focuses on provision of care, support and expert consultation for older adults admitted in LTCH or NH and requiring integrated care due to their multiple chronic diseases and functional decline.

Methods

To develop the Health-RESPECT service model, a qualitative literature review of existing ICT technologies or service models for management of older adults and related research was conducted. As research on ICT-based consultation/interprofessional relations for chronic disease management is not sufficient, we included all types of research ranging from randomized controlled studies to observational studies. Under chronic diseases, we included diabetes and hypertension, which are the most prevalent diseases in older adults, and heart failure, which can be the most difficult to manage in long-term care facilities. The PubMed database was searched for relevant articles in English published in the last 10 years from the search date. The search strategies are presented in the Supplementary Material.

Following these steps described above, focus group interview was conducted with medical staff, patients, and their guardians. The interview focused on 1) the current status of co-operative management between institutions, 2) the need for ICT-based integrated service models, 3) the specific contents to be provided by ICT-based services, and 4) the requirements for the activation of ICT based services.

Based on the focus group interview, 1) the current status of co-operative management of the older adults between institutions, 2) the current status and further improvement in the use of comprehensive geriatric assessments, and 3) comments on the ICT-based interdisciplinary service model for older adults were

evaluated online and offline by structured questionnaire survey. The medical staff (physicians/nurses) and the patients/guardians/caregivers were surveyed using different questions and the data were analyzed separately.

Following these steps described above, we developed Health-RESPECT, which included evidence-based 1) comprehensive geriatric assessment (CGA) and establishment of a customized management strategy 2) chronic disease management service including a decision support system 3) potentially inappropriate medication management service 4) rehabilitation service and 5) consultation and videoconference service.

The study protocol was reviewed and approved by the Seoul National University Bundang Hospital Institutional Review Board (IRB No. B–1904/534–104).

Results

Qualitative literature review

To identify recent technology trend, platform development cases, usability and effect of ICT-based chronic disease management in older adults, a total of 60 articles (23 on hypertension, 18 on diabetes, and 19 on heart failure) were reviewed through Pubmed. The research based on chronic disease management with ICT has rapidly grown after 2009 and this is thought to be due to the development of technology. The technology of the consultation system mainly uses web or mobile-based online platform or single application technology. In most studies, both patients and medical staff participated. For hypertension and diabetes, ICT-based chronic disease management led to significant reduction in blood pressure or blood sugar levels. (Supplementary material) In the case of heart failure, communication was quicker between the patients and medical staff, which improved patients' satisfaction. However, little research has been conducted on a consultation service model between the medical staff of different institutions. (Supplementary material)

Focus group interview

From June 4, to 28, 2018, focus group interviews were conducted with six medical staff (two acute care hospital physicians, two long-term care hospital physicians, one acute care hospital nurse, and one long-term care hospital nurse), one patient, two guardians, and a hired caregiver. Currently, inter-institutional consultations are not well established; however, due to complex multi-morbidities among the older adults, the necessity of coordinated management between the institutions was high. Moreover, standardized common tools, such as a comprehensive geriatric assessment (CGA), are highly needed for efficient information sharing about the current state of older patients. In addition, an online consultation system was expected to be helpful in the management of duplicate drugs and chronic diseases. To activate the ICT-based, inter-professional consultation system, physicians' opinions indicated that the invisible

resource input provided by personnel should be reimbursed. From the patient or guardian's standpoint, if ICT-based consultation system could be used to regularize outpatient care at a NH or LTCH without having to visit a university hospital or a big center, they were willing to pay for it. They were hoping that the sharing of medical information between the institutions would be more convenient with the ICT-based system.

Structured survey

Through qualitative literature review and focus group interview, we could confiemd the positive aspects of the ICT-based consultation service. To collect and request more specific opinions and component on the ICT-based management and consultation service system, a structured survey was conducted online and offline from August 16 to September 30, 2018. A total of 114 medical staff and 50 patients/guardians/caregivers were surveyed.

Among the 114 medical staff (53% male) who participated in the structured survey, , 80% were physicians and 20% were nurses, and 45% belonged to tertiary hospitals and the others belonged to LTCH and NH. The majority of medical staff (94%) had over one year experience in managing older adults. The most difficult things to manage or care for in the elderly patients were complex multi-morbidity (4.1/5 points), absence of assessment tool and reimbursement system for older patients (4.04/5), duplicate medication management (3.96/5), lack of information about previous medical records (3.93/5) and lack of information about patients pre-morbid function (3.90/5). The most common information transferred at the time of referral to other institutions were the medical certificate, and the medication list and medical records; laboratory results or imaging files were relatively lower in necessity. The respondents indicated using paper (86.8%) as a method of transfer of medical information most frequently but reported being dissatisfied (2.6/5) with the amount, quality, method and management of medical information currently being shared. Among the services expected to be provided by the ICT-based management service, medication and chronic disease management were indicated. Among the chronic diseases, the demand for management services was high in the order of diabetes, hypertension, and heart failure. In addition, as a management method, consultation on acute exacerbation, provision of the latest guidelines, and cumulative inquiry of results were preferred. However, there were also concerns about the lack of an adequate reimbursement system (4.33/5), and the leakage of private or medical information (3.61/5). The type of rehabilitation services that needed to be provided in the ICT-based service were in the order as follows: swallowing, physical, and cognitive rehabilitation.

Among the 50 respondents of the structured survey with the patients/guardians/care givers, 76% were guardians, 18% were hired caregivers and 6% were patients. Patients visited an average of 1.55 hospitals and met 2.66 physicians, with 42% having a history of transfer. The average travel time for outpatient/emergency visits was 1.72 hours, and the average cost was 41.22$ per person. Depending on the patient's place of care, the greatest cost and time was required for the transfer of the elderly living in nursing homes or long term care hospitals (Figure 1). Regarding the sharing of medical records through

the ICT-based service, there was a positive response that it would be helpful for treatment (4.16/5), prevention of duplicate prescription or drug abuse (4.26/5), increasing the convenience of delivering medical information (4.14/5) and save money and time (3.92/5). Similar to the medical staff survey results, there were also concerns about the leakage of private or medical information (3.42/5). On willingness to pay for the ICT-based management and consultation system, above average positive answer (3.5/5) was given by patients, guardians, and caregivers.

Development of Health-RESPECT

The ICT-based management and consultation service model for older patients dwelling in nursing homes or long-term care hospitals was developed through literature review, focus group interviews and a structured survey (Figure 1).

Since the health-care workers in LTCH in Korea assess the general function, comorbidity status, and cognitive status, on a monthly basis to claim specified daily fees for care service, we developed CGA based on this data. CGA encompassing the six domains of comorbidity, physical function, swallowing function, cognitive function, activities of living, and medication was developed to be administered on patients when they are initially included in the Health-RESPECT service model. Physical function was evaluated by activities of daily living (ADLs), instrumental ADLs (IADLs) with modified Barthel Index and Lawton and Brody Index.[6,7] Cognitive, swallowing and physical function were evaluated by the Korean version of the Mini-Mental State Examination (K-MMSE), the Standardized Swallowing Assessment (SSA), and the Functional Ambulatory Category (FAC), respectively.[8-10] We used a validated self-report frailty questionnaire, based on the Korean version of the FRAIL scale (K-FRAIL, an acronym for fatigue, resistance, ambulation, illnesses, and loss of weight).[10] Based on Beers criteria and guidelines for chronic diseases, a drug list of inappropriate drugs for older adults was selected in consideration of clinical significance, frequency of clinical use of NH and LTCH.[12-15]

Based on the result of the CGA, an individualized problem list and treatment target was provided that included chronic disease management (hypertension, diabetes and heart failure), drug management, and rehabilitation (cognitive, swallowing, physical). The drug management service was developed by screening the medication currently being prescribed and providing the number and specified drugs corresponding to the absolute or potentially inappropriate drug list each month.

The treatment targets for chronic diseases were set differently according to the frailty status of patients (Table 1). A chronic disease management service was developed to provide information about recommended or non-recommended combinations of medications, screening, and what to do when adverse events occur during treatment (orthostatic hypotension, hypoglycemia), drug adjustment according to renal function, co-morbidity screening and management (diabetes-dyslipidemia), guidance for acute decompensated condition, and lifestyle modification based on recent guidelines. [13-15]

Table 1. Treatment target in hypertension and diabetes according to frailty status.

	Robust	Pre-frail	Frail
Blood pressure (mmHg)	140/90	140/90	150/90
HbA1c (%)	<7.5	<8.0	<8.5
Random glucose level (mg/dL)	≤190	≤210	≤230

Frailty status was evaluated with K-RAIL. Scores of 3 and more, 1 to 2, and 0 were classified as frail, pre-frail, and robust, respectively.

In the rehabilitation service, video clips of exercise and swallowing rehabilitation of various levels were provided once a week according to patients' physical and swallowing function evaluated by FAC or SSA. For example, patients who are non-functional ambulatory or ambulatory dependent on physical assistance (FAC 0-1) were provided videos of pressure sore prevention or sitting exercise through correct posture. On the other hand, patients who could ambulate independently were provided videos of more intensive exercise. The cognitive rehabilitation program was developed for increasingly difficult orientation, attention, memory and problem-solving training in which patients with a MMSE score of 10 or more and 21 or less participated three times a week.

In the health-RESPECT service, a written consultation service between institutions was developed for when there were abnormal vital or laboratory findings above the limits or if the medical staff wished to do. In addition, with the development of the video conference tool, patients living in LTCH or NH and participating in the Health-RESPECT service model could be managed regularly with the acute care hospital. (Figure 2)

Discussion

In this study, the current status of management or care for older patients in Korea was identified through focus group interviews and a structured survey. In addition, the necessity of introducing a platform using ICT for the exchange of medical information between institutions and the treatment and care for older patients could be confirmed. The qualitative literature review identified that chronic disease management using ICT was also effective and efficient in older adults, leading to the development of the Health-RESPECT system with items and contents suitable for the older patients in Korea.

The Health-RESPECT system was invented to provide tools for CGA and individualized treatment strategies according to frailty in the most common and difficult chronic diseases, hypertension, diabetes, and heart failure. It includes a function for screening adverse events by patients' vital signs and laboratory findings collected from the LTCH and NH and generating warning alarms by message or consultation to the attending physician and acute care hospital. Health-RESPECT contains cognitive, physical, and swallowing rehabilitation services tailored to each patients' level of function, at a frequency that can be performed by assisted nursing or care personnel in the LTCH and NH. Additionally, tools for written consultation or videoconference have been developed to allow for the management of acute exacerbation, aggravation, and transfer of the patient.

In Japan and Europe, where the aging of society has progressed much further, the government supported policies and services for the active use of ICT as a solution to manage the older population in advance. With the use of ICT, many service models and tools with the aims of supporting independent living, health care management through disease monitoring, fall detection and emergency communication have been developed. For example, Inclusion Society (Norway, 2012-2015) was developed to provide a health solution for senior citizens at home and in institutions through a management portal with an overview of service users' condition and with data collected by medical and "smart home" sensors. The solution consists of four components of: 1) The homePad – a user-friendly, intuitive touch-screen tablet; 2) The friends and family portal – facilitating easy communication & remote care between service users and their families; And 3) the nursePad – designed with high usability and the electronic medical records (EMR) function for nurses visiting senior citizens at home or in institutions. The Care Management System provides an updated overview of patients and alarm warnings in emergency situations.[16)]

Conclusion

This study is meaningful for developing a system to manage older patients living in LTCH and NH using ICT technology. However, as with most newly developed service models, the Health-RESPECT system will need to be validated through well-organized studies to create evidence for its clinical effectiveness, utility, cost-effectiveness, safety and the willingness of service users to pay.

Declarations

Acknowledgements: Nothing to declare

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Consent for publication: Not applicable

Competing interests: None declared

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References

1. 2018 Older People Statistics [reports on the internet]. Statistics Korea [Cited 27 Sep 2018]. Available from: http://kostat.go.kr/portal/korea/kor_nw/1/1/index.board?bmode=read&a Seq=370779
2. Nihtila E.K, Martikainen, P.T, Koskinen, S.V, Reunanen, A.R, Noro, A.M, Hakkinen, U.T. Chronic conditions and the risk of long-term institutionalization among older people. Eur J Public Health 2008;18(1):77-84.
3. Park JM. Health status and health services utilization in elderly Koreans. Int J Equity Health 2014;13:73.
4. Akiyama N, Shiroiwa T, Fukuda T, Murashima S, Hayashida K. Healthcare costs for the elderly in Japan: Analysis of medical care and long-term care claim records. PLoS One 2018;13(5):e0190392
5. European Commission: INclusive INtroduction of INtegrated CAre. [Last update 25 April 2017]. Available from: https://cordis.europa.eu/project/rcn/191770/factsheet/en
6. Mahoney FI, Barthel DW. Functional Evaluation: The Barthel Index. Md State Med J. 1965;14:61-5.
7. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist. 1969;9(3):179-86.
8. Kang YW, Na DL, Hahn SH. A validity study on the korean mini-mental state examination (K-MMSE) in dementia patients. J Korean Neurol Assoc. 1997; 15(2): 300-308.
9. Perry L. Screening swallowing function of patients with acute stroke. Part two: Detailedevaluation of the tool used by nurses. J Clin Nurs. 2001;10 (4):474-81
10. Mehrholz J, Wagner K, Rutte K, Meissener D, Pohl M. Predictive validity and responsiveness of the functional ambulationcategory in hemiparetic patients after stroke. Arch Phys Med Rehabil. 2007;88 (10):1314-9
11. Jung HY. Yoo HJ, Park SY, Kim SW, Choi JY, Yoon SJ et al. The Korean version of the FRAIL scale: clinical feasibility and validity ofassessing the frailty status of Korean elderly. Korean J Intern

Med,2016:31(3); 594-600.

12. By the 2019 American Geriatrics Society Beers Criteria® Update Expert Panel. American Geriatrics Society 2019 Updated AGS Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults.J Am Geriatr Soc. 2019 Apr;67(4):674-694.
13. American Diabetes Association. Standards of Medical Care in Diabetes-2018. Diabetes Care. 2018:41; .S1
14. American College of Cardiology/American Heart Association Task Force. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Executive Summary. Hypertension. 2018:71;1269-1324.
15. Kim MS, Lee JH, Kim EJ, Park DG, Park SJ, Park JJ et al. Korean Guidelines for Diagnosis and Management of Chronic Heart Failure. Korean Circ J. 2017;47(5):555-643.
16. Ageing Well in the Digital World. InclusionSociety: Available from: http://www.aal-europe.eu/projects/inclusion-society/

Figures

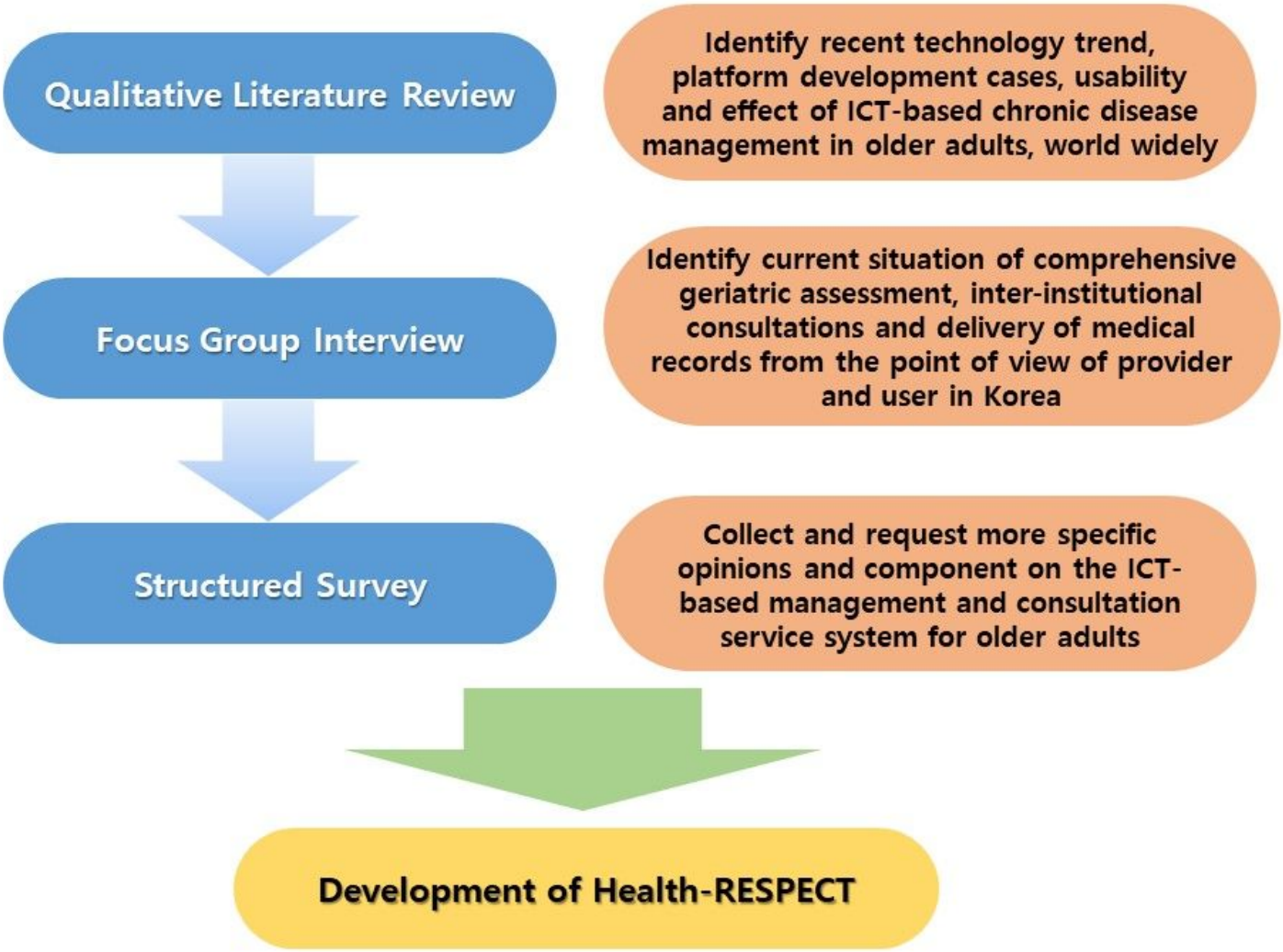

Figure 1

Flow chart of the results from the literature search After abstract review and exclude duplicates and written languages other than English, total 60 literatures were reviewed.

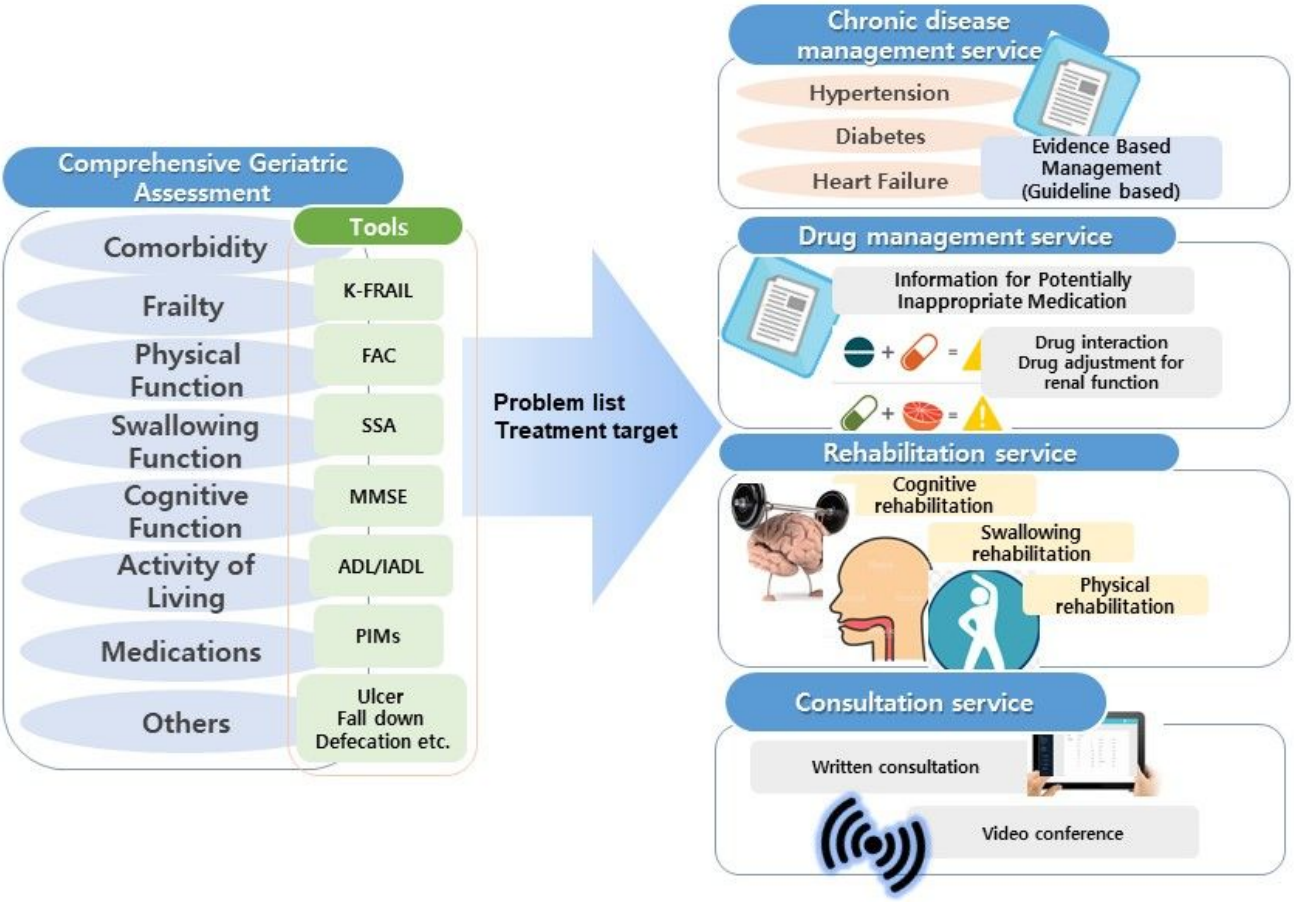

Figure 2

List of article on qualitative literature review Details of journals reviewed are presented.

Supplementary Files

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