

## Development of the smartphone application for patients with dementia: a literature review

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### ABSTRACT

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Primary technological developments are advancing rapidly, and dementia patients and caregivers are becoming more open to online interactions for enhancing dementia care. However, most existing applications only focus on patients, and there is a need to expand their scope to include caregivers. Ideally, the application should be designed with the caregiver in mind, and considering the impact they experience while caring for dementia patients. Families are specifically targeting caregivers who are at the highest risk of experiencing caregiver burnout, such as those caring for patients. This literature review described the necessary functions and content for dementia caregivers, serving as a reference for designing, developing, and implementing smartphone solutions that meet user needs. This review utilized articles from three databases i.e. PubMed NCBI, ScienceDirect, and Tandfonline. The Boolean approach method was used to generate the exact keywords. The inclusion criteria for this study encompassed smartphone applications for dementia patients, focusing on function and content, published in English-language journals within five last years, with an emphasis on original research and free full access. In this review, six articles were obtained. From these six articles, four findings related to functions and content were identified i.e. education, interactive health promotion, interaction stakeholder, and referencing information sources. These four aspects could serve as references for developing comprehensive smartphone applications for caregivers, and facilitating integrated health care.

### ABSTRAK

Perkembangan teknologi primer yang pesat, dan pasien serta perawat demensia merasa lebih toleran terhadap interaksi daring dalam meningkatkan perawatan demensia. Namun demikian, sebagian besar aplikasi yang ada hanya menysasar pasien, sedangkan untuk pendamping pasien masih harus diperluas. Idealnya, aplikasi dirancang dengan mempertimbangkan dampak yang diterima pendamping dan dampak yang mereka alami saat merawat pasien demensia. Keluarga secara khusus menargetkan pendamping yang paling berisiko mengalami kelelahan, misalnya mereka yang merawat pasien. Kajian pustaka ini memaparkan fungsi dan konten apa saja yang dibutuhkan oleh pendamping pasien demensia untuk dijadikan acuan dalam merancang, mengembangkan, dan mengimplementasikan solusi melalui *smartphone* dengan mempertimbangkan kebutuhan pengguna. Kajian menggunakan tiga database yaitu PubMed NCBI, ScienceDirect, dan Tandfonline. Metode pendekatan Boolean digunakan untuk menghasilkan kata kunci yang akurat. Kriteria inklusi penelitian ini adalah fungsi dan konten aplikasi *smartphone* untuk pasien demensia yang dipublikasikan di jurnal berbahasa Inggris dalam waktu lima tahun terakhir, penelitian original, dan dapat diakses tanpa membayar. Ada enam artikel yang didapat dalam pencarian. Berdasarkan enam artikel tersebut, terdapat empat artikel temuan yang dijadikan fungsi dan konten yaitu edukasi, promosi kesehatan interaktif, interaksi pihak yang berkepentingan, dan referensi untuk sumber informasi. Keempat aspek tersebut dapat menjadi acuan dalam pembuatan aplikasi *smartphone* bagi pendamping pasien agar pemanfaatannya dapat menjadi pelayanan kesehatan yang terintegrasi dan komprehensif.

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## **INTRODUCTION**

Dementia is a multifactorial syndrome characterized by multiple cognitive deficits. This decline in intellectual function can interfere with activities of daily living. Sometimes, changes in behavior occur but are not caused by delirium or primary psychiatric disorders.<sup>1</sup> The problem in managing dementia therapy is the increasing morbidity and mortality of dementia patients. The Centers for Disease Control and Prevention (CDC) reported that 271,872 people died from dementia in 2019. Another problem with dementia patients is that they need companions in their daily activities and require prolonged therapy, which can cause medication problems. Caregivers consist of formal and informal companions. In Indonesia, they come from families or people having a relationship with the patient. Families provide extraordinary support for patients so that sometimes they ignore their condition in managing care. Unconsciously, according to research by caregivers, levels of anxiety and depression increase, leading to an increase in the frequency of psychological or physical violence by caregivers.<sup>2</sup>

Nowadays, it is common for people to use technology as a communication tool and various applications, including those for managing health, to record information and monitor conditions. Additionally, attention must be paid to the needs of elderly patients with low literacy and chronic diseases.<sup>3</sup> The literature indicates that dementia patients and are increasingly receptive to online interactions as a means to enhance dementia care.<sup>4</sup> The World Health Organization (WHO) recognizes that digital health technology has great potential for human and public health.<sup>5</sup> Hence, there is a need to develop a mobile health application, given that mobile devices are now widely used

for various daily activities, including patient monitoring and, in some cases, diagnosis.<sup>6</sup> A previous study revealed a significant relationship between clinical evaluation and application use. Therefore, it is necessary to pay attention when designing, developing, and implementing targeted smartphone solutions.<sup>7</sup> It aligns with research showing the positive impacts of companionship for dementia patients.<sup>8</sup> Currently, there are applications; most are designed for patients, with limited support for companions, typically focusing on just one or two companion activities. Ideally, apps should be designed with family caregivers in mind, explicitly targeting those who are most at risk of caregiver burnout, such as those caring for patients.<sup>2</sup>

This review article aimed to describe the features, functions, and materials needed by dementia caregivers in carrying out care. It will serve as a reference for creating application functions and content when designing, developing, and implementing smartphone solutions that meet user needs.

## **MATERIAL AND METHODS**

### **Sources of articles**

This study used the PubMed Central, ScienceDirect, and Tandfonline databases to conduct a descriptive review. In the three databases, this research strategy used the exact keywords (“app” AND “dementia” AND “patient care”). The literature search was limited to the last five journals from 2018 to 2023. It was in the form of original research in English with topics relevant to this research and fully accessible. Relevant research involved dementia patients, the use of health applications, and the functions and materials that must be included in the application.

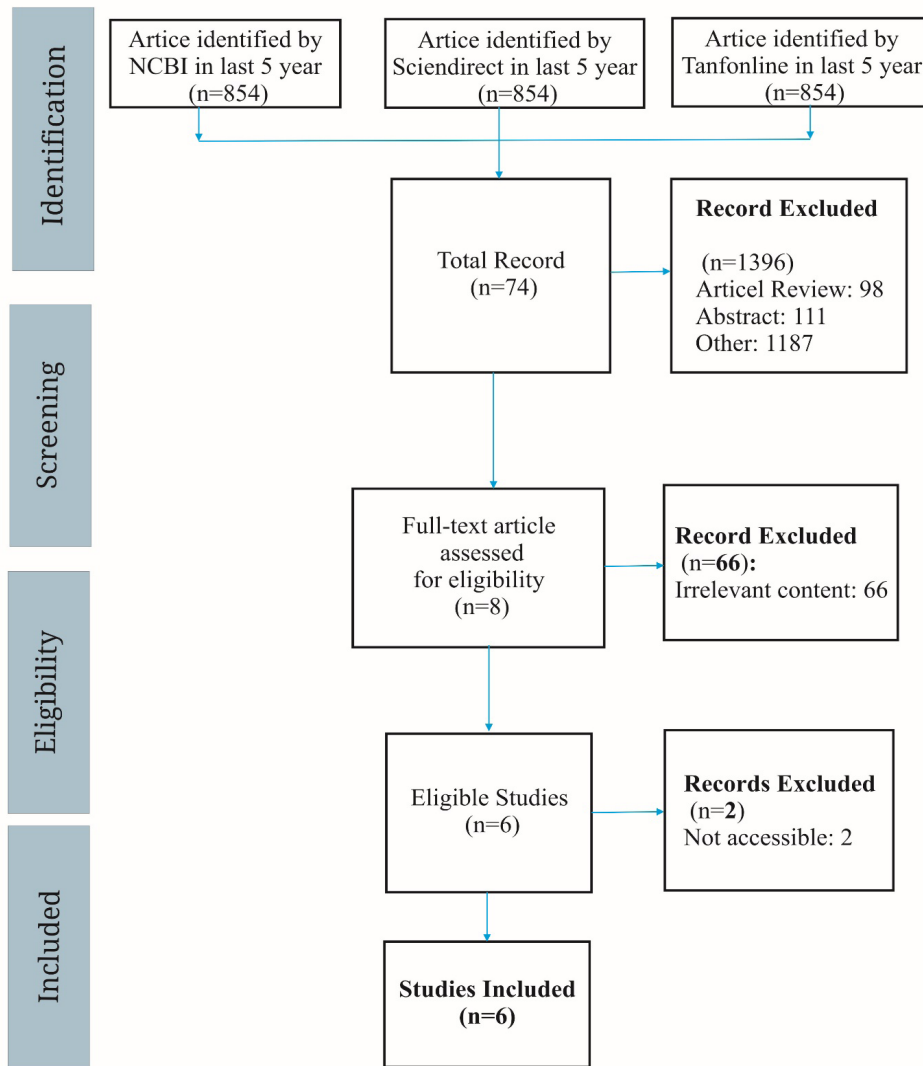


FIGURE 1. Search scheme PRISMA

### Data extraction and analysis study

The table containing the functions and content of the application used by the patient companion was utilized to extract data for each journal that met the exclusion and inclusion criteria. Each journal was identified and placed in an analytical framework based on research objectives.

### RESULTS

Six articles were obtained when searching for articles related to the purpose of this study. The six articles were examined based on this literature review's inclusion and exclusion criteria. TABLE 1 displays these articles findings.

TABLE 1. List of articles on functionality and content for smartphone apps in dementia patients

Reference	Subject	Outcome
Perry <i>et al.</i> <sup>9</sup>	Expert speakers and participants representing the fields of neurology, neuropsychology, gerontology, geropsychiatry, primary care, emergency medicine, psychology, collaborative care, social work, nursing, disease advocacy and policy groups, government agencies and providers, test issuers neuropsychologists, and insurance providers	<ol style="list-style-type: none"> <li>1. Early recognition of cognitive impairment and dementia</li> <li>2. Condition-specific information (symptoms, expected development, etc.)</li> <li>3. Chaperone resources and support (including rest and social support)</li> <li>4. Referral to existing information sources (Alzheimer’s Association)</li> <li>5. Health promotion according to evidence (exercise, social and community involvement, healthy diet, cognitively stimulating activities, etc.)</li> <li>6. Information about sleep</li> </ol>
Ahmad <sup>10</sup>	Patient and caregiver	<ol style="list-style-type: none"> <li>1. Registration (you can log in via e-mail, facebook, or phone number).</li> <li>2. Service order (to enter the address and pick-up and drop-off position).</li> <li>3. Tariff calculator (cost calculation)</li> <li>4. Escort monitoring</li> <li>5. Payment (there are several payment variants)</li> <li>6. Push alerts (essential information elements; keep customers up-to-date with trip order status, driver arrival time, driver and vehicle data, etc.)</li> </ol>
Morgan <i>et al.</i> <sup>11</sup>	Model collaboration with primary health care	<ol style="list-style-type: none"> <li>1. Team-based care (multidisciplinary team, care management, and education for patients and caregivers)</li> <li>2. Decision support tools (standard tools and guidelines)</li> <li>3. Specialist-to-provider support (access to dementia and specialists and education sessions)</li> </ol>
Gilson <i>et al.</i> , <sup>12</sup>	The development company develops digital therapy platforms to support dementia patients.	<ol style="list-style-type: none"> <li>1. Deployment of specially configured tablets to enhance user engagement routines</li> <li>2. Collaboration between care providers and informal caregivers</li> <li>3. Tools for assessing clinical outcomes</li> <li>4. Informal care partners are prompted to share meaningful content that contains <ol style="list-style-type: none"> <li>a. Formal caregiver training, listening to music and videos</li> <li>b. Education e-mail nature campaign</li> </ol> </li> </ol>
Phongtankuel <i>et al.</i> <sup>13</sup>	Caregiver	<ol style="list-style-type: none"> <li>1. Communication: video chat, text messages, pictures/ videos)</li> <li>2. Access to patient care information: drug information, symptoms, hospital contact.</li> <li>3. Education: information on shelf-life and information on drug replacement</li> <li>4. Updates from healthcare workers and scheduling services: scheduling features, patient updates).</li> </ol>
Thoma-Lürken <i>et al.</i> <sup>14</sup>	Community-based formal caregiver	<ol style="list-style-type: none"> <li>1. A decision support tool for district nurses and case managers could facilitate the complex process of detecting specific problems.</li> <li>2. Offer solutions related to detected problems, such as maintenance and support services, information resources, and supporting technology.</li> </ol>

## DISCUSSION

This review discusses the functions and contents needed by dementia caregivers in carrying out care. It needs to be conducted as caregivers encounter many challenges. It is in line with research revealing that to produce a technology platform that supports therapeutic results, the platform must be appropriately designed according to user needs and carefully considered.<sup>15</sup> The six articles can be divided into four main aspects as follows 1) information and education section; 2) health promotion section complies with the evidence; 3) interaction section; and 4) information resources in the reference section.

### Information and education section

All selected articles reported that information and education are mandatory features in the application. The education is needed regarding early recognition of cognitive disorders and dementia, such as delirium, which is often the cause of cognitive disorders,<sup>16</sup> symptoms of dementia related to sleep disturbances, social support, activities that stimulate cognitive function, nutrition and drugs, information, and medication changes. This educational content could improve the function of knowledge and parenting, so it must use standard guidelines and reliable evidence.

### Health promotion section complies with the evidence

Perry *et al.*<sup>9</sup> reported that health promotion has been shown to improve activities such as exercise, social and community involvement, healthy diet, and activities that stimulate cognitive function. Phongtankuel *et al.*<sup>13</sup> found the used technology to enhance care delivery, including features that provide access to health information and promote patient care. Thoma-Lürken *et al.*<sup>14</sup> also reported that simple games and videos can be part

of the solution to improve care delivery. Three out of six articles demonstrated that features, functions, and content are complemented by visual communication, such as images and videos, and interactive ones, such as sports videos, cognitive stimulation activities, relaxing music, games, text messages, and videos. It aligns with Aidemark's study that video conferencing improves service quality.<sup>17</sup>

### Interaction section

Perry *et al.*<sup>9</sup> also demonstrated that it is important to clarify how and by whom cognition is assessed, how assessment fits into the health care model, how medical and electronic health records can facilitate assessment, and how assessment may differ depending on situations such as emergencies. Whereas Morgan *et al.*<sup>11</sup> reported that the involvement of a collaborative team with commitment and working together in team interactions by identifying difficulties that occur because of this collaboration is beneficial for the patients.<sup>11</sup> Two out of the six articles written required a multidisciplinary team in medicine. In line with Bonnechere and Sahakian's study which reported that the researchers, clinicians, and app developers must collaborate to develop innovative and effective solutions adapted for neurological and psychiatric patients whose cognition, quality of life, functionality, and well-being are impaired.<sup>18</sup>

### Information resources in the reference section

Phongtankuel *et al.*<sup>13</sup> demonstrated that 6% of participants expressed a desire for a feature that included contact information for their hospital providers and allowed them to directly contact them through the application. Furthermore, Perry *et al.*<sup>9</sup> suggests that referral to information sources such as the Alzheimer's Association will also be useful. Thoma-Lürken *et al.*<sup>14</sup> reported



that the offered solutions are related to addressing identified problems, such as maintenance and support services, information resources, and supporting technology. Three out of six articles required access to treatment information, including information resources and hospital contacts. In addition to gaining access to specialist doctors, there is expected to be patient scheduling information and update features so that patients receive real-time information.

These four aspects can be used as a reference in creating smartphone applications for caregivers so that their use can be integrated and comprehensive. However, one of the concerns regarding the app is the potential leakage of sensitive personal data. Therefore, legal protection, especially for personal information, is needed.<sup>5</sup> Data revealed that using apps has more positive than harmful effects in improving patient care. Thus, concerns about mixing personal data with clinical care apps can be put aside.<sup>19</sup> This study supported that caregivers can accept the use of the mHealth application.<sup>13</sup> It is expected that in the future, in addition to the functions and content created, it is necessary to test their effectiveness and consider various possibilities to ensure regular updates.

## CONCLUSION

This study reveals the functions and content needed by caregivers in smartphone applications for patients with dementia, including education, interactive health promotion, interaction with stakeholders, and references to information sources.

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