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User-centred socio-technical requirements for telehomecare in hospital-based homecare services in Indonesia: a qualitative study

Iman Permana[1], Moch Zihad Islami[2], Winny Setyonugroho[3], Ika Puspita Sari[4], Janatarum Sri Handono[5], Sentagi Sesotya Utami[6]

[1]Department of Master of Nursing, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[2]Public Policy and Management, Faculty of Social and Political Sciences, Universitas Gadjah Mada, Yogyakarta, Indonesia
[3]Department of Information Technology, Faculty of Engineering, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[4]Department of Master of Clinical Pharmacy, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia
[5]Doctoral Program in Medical and Health Sciences, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[6]Department of Physics and Nuclear Engineering, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, Indonesia

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ABSTRACT

The increasing number of homebound and bedridden patients in Indonesia illustrates the importance of effective hospital-based telehomecare. While telehomecare can improve access and continuity of care, its implementation depends on alignment with user needs. This study aimed to identify user-centered socio-technical requirements for telehomecare in hospital-based homecare services in Indonesia. A qualitative descriptive study was conducted using in-depth interviews and a focus group discussion with 12 purposively selected stakeholders. A telemonitoring device was used as a contextual probe. Data were analyzed using inductive thematic analysis with stakeholder triangulation. Three main areas of needs were identified: i) functional needs, which include constant monitoring, settings for specific diseases, early warning alerts, organized communication, and access to long-term data; ii) technical needs, like ease of use for older people, access through mobile devices, support for location tracking, easy-to-read dashboards, and compatibility with hospital information systems; and iii) data security, privacy, and making sure everyone can use the system, which involves dealing with. These findings help shape the design and growth of fair telehomecare systems in health settings with limited resources and provide real-world evidence from a low- and middle-income country.

Corresponding Author:

Winny Setyonugroho
Department of Information Technology, Faculty of Engineering, Universitas Muhammadiyah Yogyakarta
Yogyakarta 55184, Indonesia
Email: setyonugrohowinny@gmail.com

1. INTRODUCTION

Management of elderly patients with chronic diseases remains a significant challenge in Indonesia's healthcare system. Despite the ongoing rapid population aging transition, with older adults accounting for 11.93% of the total population in 2025 and an elderly dependency ratio of 11.00 [1], life expectancy is also increasing, rising from 72.51 years in 2015 to 75.47 years by 2045 [2]. This population transition phenomenon has undoubtedly led Indonesian society to acknowledge the challenges of an aging population and the swift increase in the number of homebound or bedridden elderly suffering from chronic illnesses [3].

Homebound describes a condition in which an individual's mobility is restricted to their domicile, although they remain capable of moving within their home [4]. On the other hand, immobility is a condition in which an individual has suffered considerable physical debilitation and is unable to move freely, resulting in being confined to their bed [5]. These two statuses are generally attributable to the patient's comorbidities and frequently necessitate comprehensive care and support from caregivers [6]-[8]. Integrated healthcare services are crucial for these individuals, and home healthcare services have consistently demonstrated effectiveness in improving patient outcomes. These services are especially valuable for assessing patients' living conditions and have demonstrated effectiveness in reducing hospitalizations and improving overall quality of life among older adults [9].

Telemedicine has emerged as a promising solution to address the disparity in healthcare access for homebound or immobile patients [10]. Telehomecare is a branch of telehealth. It entails providing patients with healthcare services at home via telecommunications technologies that allow voice, video, and health-related data to interact [11]. Telehealth broadly encompasses health or social services delivered remotely via synchronous or asynchronous videoconferencing, digital applications, or telephone to enhance health outcomes [12]. Telemedicine uses technology to deliver healthcare services directly to patients in their homes, making it easier for them to manage their own health [13]. In this study, telehomecare is the primary term, while telemedicine and telehealth are used only in broader contexts.

In homecare settings, telehomecare is increasingly adopted to enhance time efficiency in healthcare delivery, expand access to medical services, and support preventive strategies to avert costly emergencies [14]. Research shows that telehomecare helps patients take care of themselves and manage their own health, which could lead to lower costs, better access, and better health outcomes (15). Although its effect on the frequency of follow-up visits may be limited, telehomecare has been associated with reduced mortality, fewer emergency visits, and improved quality of life [15]. Research on gestational diabetes showed that telehomecare reduced in-person visits by 56% and lowered costs by 16% [16]. Telehomecare technologies for in-home care deliver more accessible and efficient healthcare services [13]. As a result, patients can receive consultations and health monitoring without facility visits, expanding access to supporting autonomy in self-care and disease management [17], [18].

Despite these advantages, the success of telehomecare implementation in homecare settings is strongly influenced by contextual and human factors. Previous studies have highlighted that perceived needs, ease of access, and the flexibility of technology are important for telehomecare adoption [19]. Healthcare providers' attitudes toward technology, their perceived usefulness of telehealth-enabled services, and their professional competence in using digital systems significantly affect implementation outcomes [20], [21].

In Indonesia, telemedicine is regulated under the Ministry of Health Regulation No. 20 of 2019 [22], and national digital health development is guided by the Blueprint for Digital Health Transformation 2024 [23]. However, these frameworks primarily address technical standards and inter-facility clinical consultations. Given that the success of telehomecare implementation depends on understanding the perspectives and needs of multiple stakeholders [24], there remains a need for in-depth qualitative inquiry into how telehomecare is experienced and negotiated in real-world homecare settings. Therefore, this study aims to identify user-centered system requirements emerging from the adoption and use of telehomecare within hospital-based homecare services in Indonesia.

2. METHOD

This study employed a qualitative descriptive design, which is appropriate for systematically describing experiences, practices, and user needs in applied health service contexts without imposing heavy theoretical interpretation [25], [26]. The study was conducted at Home Care Jatayu, the Academic Hospital (RSA) of Universitas Gadjah Mada, Yogyakarta, Indonesia. This setting was selected because Jatayu Home Care operates as a hospital-based homecare unit delivering daily home-visit services across diverse clinical conditions, functioning as a "hospital without walls". The Special Region of Yogyakarta was chosen because it has the highest proportion of older adults in Indonesia, accounting for 17.78% of the population [1].

To support contextual exploration of telehomecare practices, the CovWatch homecare device, developed by PT CovWatch Karya Nusantara, was deployed among 15 homecare patients. The device enables remote monitoring of vital signs via an IoT-based dashboard and was used solely as a contextual probe to facilitate participant reflection and discussion during data collection, rather than as an intervention or technology effectiveness evaluation. Although the use of CovWatch may have shaped participants' responses toward device-related features, the interview guides emphasized broader telehomecare experiences, needs, workflows, and concerns beyond the device's specific functionalities. Participants were also encouraged to articulate the desired features and challenges that the system does not currently address.

A total of 12 participants were included (Table 1), comprising one physician, one head of homecare services, one head of hospital information systems and IT, five homecare healthcare professionals (nurses/physiotherapists), and four homecare patients. Sample size adequacy was determined using the concept of information power, which requires fewer participants when the study aim is a narrow, highly specific sample with rich data [27]. Information power was supported by a focused study of user-centred telehomecare requirements, high sample specificity involving key clinical, managerial, technological, and patient stakeholders, and strong dialogue quality informed by participants' direct experience with homecare services. Data collection was concluded when sufficient thematic depth and redundancy were achieved across participant groups. Participants were recruited using purposive sampling with inclusion criteria: i) involvement in homecare services for at least six months (for staff) or current enrollment as a homecare patient with prior exposure to telehomecare devices; ii) age ≥18 years; and iii) ability to provide information required, especially for the homecare patients.

Table 1. The characteristics of respondents

Characteristics	Description	Frequency	%
Age	<30 years	4	33.3
	30–50 years	5	41.7
	>50 years	3	25.0
	Mean ± SD	45.7±14.7	
	Range	28–75	
Gender	Female	5	41.7
	Male	7	58.3
Role/Position	Physician	1	8.3
	Head of Hospital Information	1	8.3
	Head of Homecare	1	8.3
	Homecare Health Professional	5	41.7
	Homecare Patient	4	33.3
Education level	High School	2	16.7
	Bachelor	6	50.0
	Master	3	25.0
	Doctoral	1	8.3

Data were collected through semi-structured in-depth interviews and one focus group discussion (FGD). Individual interviews were conducted with physicians, IT personnel, homecare managers, and patients to capture personal experiences, decision-making processes, and individual perspectives related to telehomecare use and needs. The FGD, involving homecare healthcare professionals, was designed to elicit shared operational practices, collective challenges, and team-based coordination experiences in delivering hospital-based homecare services. Data collection took place between June and September 2023 at RSA UGM and participants' homes. Interviews and the FGD lasted 45 to 60 minutes, were audio-recorded with participants' permission, and transcribed verbatim. Ethical clearance was obtained before the research.

Data were analyzed using inductive thematic analysis, following the phases: familiarizing yourself with your data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report [28]. Coding focused on identifying patterns related to functional requirements, technical requirements, and data security considerations. The analysis was led by the second author (MZI), who has prior experience in qualitative health and technology research. Analytic rigor was enhanced through iterative team discussions across clinical and technological perspectives, consensus-building on theme interpretation, and the maintenance of an audit trail. Trustworthiness was further strengthened through data and method triangulation and peer debriefing.

3. RESULTS

Three overarching themes emerged from the analysis: functional requirements, technical requirements, and data security, privacy, and digital inclusion. Table 2 provides a concise synthesis of user-centered telehomecare requirements across these interrelated domains.

3.1. Functional requirements

Participants identified continuous remote monitoring as a core requirement to support early detection of clinical changes. Access to real-time vital signs was perceived as enabling clinical responsiveness even in the absence of physical visits. As one nurse explained,

> *"[...] If the patient suddenly has high blood pressure, we can monitor the condition remotely, even from the hospital."* (P5)

Participants further stressed the need to develop disease-specific system configurations. Rather than applying uniform monitoring parameters, telehomecare systems were expected to adapt to patients' underlying conditions. As one participant noted,

> *"There needs to be a specialised system based on each patient's condition, such as diabetes or nerve issues."* (P12)

An early warning system (EWS) was seen as an important tool that helps doctors make decisions by automatically alerting them when clinical values are abnormal, enabling quicker responses in line with standard operating procedures. One healthcare professional stated,

> *"[...] If parameters exceed the normal limits according to the SOP, the medical team can take action more quickly."* (P2)

In addition to real-time monitoring, participants emphasized the value of longitudinal access to patient data. History-based health information was considered essential for evaluating trends and supporting long-term care planning. As a physician explained,

> *"The system should include illness history, examination results, diagnoses, and other relevant data for ongoing evaluation."* (P1)

Communication and coordination were also identified as key functional requirements. Notification systems were considered essential for facilitating timely information exchange among patients, families, and healthcare providers. As one nurse remarked,

> *"Notifications are important so families are aware of the patient's condition and the medical team can respond quickly."* (P8)

However, participants acknowledged operational constraints and emphasized that communication should follow hospital workflows. As noted by a manager,

> *"The chat system should operate during hospital working hours, not continuously."* (P3)

Telehomecare was further viewed as a medium for health education and family engagement. Participants highlighted that effective homecare relies on collaboration between patients, families, and healthcare providers. One participant stated,

> *"This is not only education for the patient, but also for the whole household"* (P12), while a nurse emphasized, *"Family cooperation is essential, especially in reporting symptoms or vital signs that need follow-up"* (P4).

Finally, patients emphasized the importance of transparency and access to health information. Being informed about their health status was perceived as empowering and reassuring. As one patient expressed,

> *"We want to know when our condition is getting worse"* (P9), while another added, *"Patients need to see the data so they understand whether they are in good condition"* (P10).

3.2. Technical requirements

Participants described technical requirements as features that enable telehomecare functions to operate effectively within everyday clinical workflows. A key requirement concerned location accuracy and travel coordination. Accurate patient location data was considered necessary to optimize visit planning and response time. As noted,

> *"There is currently no GPS point in the patient sensor, so the location has to be adjusted to the patient's address to make tracking more accurate."* (P7)

Usability and simplicity emerged as technical concerns, particularly since most homecare patients are older adults. Participants emphasized that system adoption would depend on whether the technology reduced, rather than added to, patients' daily burden. As one patient stated,

> *"We are willing to use the system as long as it does not complicate things for the patient."* (P12)

To minimize access barriers, participants proposed simple authentication and navigation mechanisms. For example, one participant suggested,

> *"A barcode on the smartwatch could make it easier for patients to access important information quickly"* (P12).

Participants also expressed a strong preference for mobile application–based access over web-based platforms. Mobile applications were perceived as more personal, practical, and better suited to everyday use. As one participant explained,

> *"A mobile application is simpler and more personal than a website, especially since browser performance on mobile devices is not optimal"* (P2).

Interface and dashboard design were identified as technical elements supporting system usability. Participants expected dashboards to align with hospital standards while remaining accessible for elderly users. A manager said, "The dashboard should be tailored to the needs at RSA UGM, with clear menus and a display that is easy to use*"* (P3). Readability was emphasized as a practical concern:

> *"Most of our patients are elderly, so the text in the application should not be too small"* (P5).

Finally, integration with the Hospital Information System (HIS) was viewed as a fundamental technical requirement to ensure continuity of care and operational efficiency. Participants expressed apprehension that non-integrated systems would lead to redundant documentation and an increased administrative burden. As a physician stated,

> *"Problems arise when homecare data are not integrated with medical records, because it creates double work that should be avoided"* (P1).

3.3. Data security, privacy, and digital inclusion

Participants identified limited internet connectivity as a major barrier to effective telehomecare use, particularly in households without stable Wi-Fi or sufficient mobile data. These limitations constrained sustained monitoring and real-time data transmission, especially when family members were not consistently present at home. One participant said,

> *"Some patients don't have Wi-Fi or an internet quota, especially when their kids are often away from home" (*P4). Another noted, *"Some patients cannot use telemonitoring continuously because they do not have Wi-Fi"* (P6).

These accounts highlight digital inclusion as a prerequisite for equitable telehomecare implementation.

IT stakeholders primarily raised concerns about data security and privacy, emphasizing regulatory compliance, data minimization, and secure system architecture. One participant suggested,

> *"If the system is not registered as a PSE, data collection should be minimized, for example by scanning information through a barcode."* (P2)

Anonymization was also viewed as a key safeguard:

> *"Patient data can be* anonymized *using random identifiers such as UUID to maintain confidentiality."* (P2)

Patients framed privacy in relation to dignity and social acceptability. Wearable devices that visibly signaled illness were perceived as potentially stigmatizing and could discourage continued use:

> *"If a watch is designed specifically for people with diabetes, it may make them reluctant to wear it. It should look like a regular watch and not show someone's illness"* (P12).

This underscores that privacy concerns extend beyond data protection to include symbolic and social dimensions of technology use. Participants also emphasized transparency and data ownership as central to trust in telehomecare systems. Patients and families expected real-time access to health data generated through monitoring devices, enabling them to stay informed and actively involved in care decisions. As one patient stated,

> *"Patients and families have the right to access the data collected by the sensors in real time."* (P9)

Table 2. User-centered requirements for telehomecare

Theme	Category	Key requirements	Description
Functional requirements	Clinical monitoring	Remote monitoring	Early detection & timely response
	Condition-based care	Disease-specific configuration	Tailored to patient conditions
	Decision support	Early Warning System	SOP-based automated alerts
	Continuity of care	Longitudinal data access	Trend evaluation & care planning
	Communication	Notifications & chat	Coordinated, time-bound communication
	Education & engagement	Health education	Patient & family empowerment
	Transparency	Data access	Patient awareness of health status
Technical requirements	Operational efficiency	Location accuracy	Travel & service coordination
	Usability	Procedural simplicity	Elderly-friendly operation
	Access mechanism	Mobile app & barcode	Low-barrier system access
	Interface design	Dashboard readability	Clear, customizable display
	Interoperability	HIS integration	Avoid duplicated documentation
Data security, privacy, and digital inclusion	Access equity	Internet connectivity	Sustained system use
	Data protection	Data minimization	Regulatory compliance
	Privacy & dignity	Non-stigmatizing design	Social acceptability
	Data governance	Data ownership	Real-time patient access

4. DISCUSSION

This study provides an empirically grounded, user-centered analysis of telehomecare requirements within hospital-based homecare services in Indonesia. While telemedicine and telehealth have demonstrated substantial potential to improve access, efficiency, and cost-effectiveness in healthcare delivery [13], [29], our findings reinforce that the effectiveness of telehomecare extends beyond technological capability alone. Telehomecare is a system that integrates social and technical elements, emphasizing patient safety, workflow compatibility, patient independence, and trust alongside technological factors.

This study highlights that sustainable telehomecare adoption depends on aligning system design with patients' and healthcare providers' perceived needs, capabilities, and everyday practices [30]. Our findings show that usability challenges can undermine trust and discourage continued use. This aligns with prior research demonstrating that complexity and poor usability are major barriers to telehealth adoption [31]. Conversely, the emphasis on simplicity, disease-specific design, and early warning systems highlights the need to reduce cognitive burden while supporting clinical decisions [32].

From a digital public health perspective, this study reframes telehomecare as a hospital-based care infrastructure rather than a standalone digital tool, emphasizing longitudinal data access, SOP-based early warning systems, structured communication, and system interoperability. These features position telehomecare as a mechanism for enhancing care continuity, preventive monitoring, and service coordination [33]. Practically, the findings offer actionable design guidance for scaling telehomecare in resource-constrained health systems facing population ageing and chronic disease burdens.

The study's findings also align closely with the World Health Organization's Global Strategy on Digital Health 2020–2025, particularly its emphasis on people-centered design, interoperability, data governance, and equity [34]. Similarly, participants' expectations for transparent data access, non-stigmatizing design, and patient involvement align with WHO guidance on trust, ethics, and human rights in digital health [34]. By grounding these principles in hospital-based homecare in Indonesia, this study contributes context-specific evidence from a low- and middle-income country setting.

Privacy and data security emerged as foundational requirements influencing trust and acceptance. Consistent with prior telehealth research [30], [35], participants expressed concerns regarding data misuse, unauthorized access, and regulatory compliance. Importantly, this study shows that privacy extends beyond

technical safeguards to include social and symbolic concerns. Patients' emphasis on non-stigmatizing wearable design highlights how dignity and social acceptability influence engagement with telehomecare technologies. These findings reinforce the need for "privacy by design" approaches that integrate technical safeguards with attention to users' lived experiences and cultural contexts [36].

Equity and digital inclusion constitute another key contribution of this study. Limited internet connectivity, reliance on family members for device operation, and varying levels of digital literacy among older adults highlight the risk that telehomecare implementation will reproduce existing health inequities. Digital exclusion in this context is not merely an individual constraint; it is integrated into household infrastructure, caregiving frameworks, and socioeconomic conditions. This finding extends digital public health literature by demonstrating that equitable telehomecare implementation requires system-level responses rather than assuming individual technological readiness [37], [38].

In terms of technical design, the strong preference for mobile applications, readable dashboards, and simple access mechanisms reflects well-documented usability challenges in digital health interventions for older adults [39]. Our findings support prior evidence that successful eHealth services for chronic disease management must be grounded in user-centered and iterative design processes that align with everyday routines [40]. Importantly, participants' emphasis on interoperability with hospital information systems underscores the need to match technical usability with organizational integration to ensure sustainability.

Theoretically, this study advances understanding of telehomecare by conceptualizing it as a care-oriented socio-technical system rather than a purely functional digital solution. Building on human-centred design theory in digital health [41], the results show that usability in home-based care includes clinical reassurance, the ability to understand health data, and the protection of patient dignity. Additionally, the study improves technology acceptance theories like the technology acceptance model (TAM) [42] and the Unified Theory of Acceptance and Use of Technology (UTAUT) [43] by showing that how useful people find telehomecare depends not just on how efficient or convenient it is, but also on ongoing care, shared monitoring, and trust between patients, families, and healthcare providers.

The single-site design and small sample size of this study limit its generalizability. The findings are intended to provide in-depth, context-specific insights rather than represent broader populations. Future studies should include different locations and a wider range of participants to evaluate how well user-centered telehomecare needs can be applied elsewhere and to help create fair and large-scale solutions.

5. CONCLUSION

This study demonstrates that effective implementation of telehomecare in hospital-based services depends on aligning technological functions with clinical workflows, patient autonomy, and socio-contextual realities. Telehomecare should be understood as a socio-technical care infrastructure that supports continuity of care, early clinical response, and shared monitoring between patients, families, and healthcare providers. From a health systems perspective, the findings suggest that telehomecare can strengthen hospital outreach, reduce avoidable service utilization, and support preventive care for ageing populations when integrated with existing hospital information systems. At the policy level, national digital health strategies should move beyond technical standards to include guidance on interoperability, data governance, equity, and user-centred implementation within homecare services. At the design level, telehomecare systems should prioritize disease-specific monitoring, SOP-based early warning mechanisms, elderly-friendly interfaces, non-stigmatizing wearable design, and transparent patient access to health data. Addressing digital inclusion should be treated as a core design and policy requirement rather than a peripheral issue. Future research should use multi-site and longitudinal designs to examine how user-centered requirements vary across institutional and socioeconomic contexts, and to assess how telehomecare can be sustainably integrated into national health systems for equitable, scalable care.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Iman Permana	✓	✓		✓		✓			✓	✓				✓
Moch Zihad Islami	✓	✓	✓		✓	✓		✓	✓	✓	✓		✓	
Winny Setyonugroho	✓		✓	✓			✓			✓	✓		✓	✓
Ika Puspita Sari	✓								✓			✓		
Janatarum Sri Handono						✓	✓			✓			✓	
Sentagi Sesotya Utami	✓									✓		✓		

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

INFORMED CONSENT

Written informed consent was obtained from all study participants.

ETHICAL APPROVAL

Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada (KE/FK/0444/EC/2023).

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [WS]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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BIOGRAPHIES OF AUTHORS

Iman Permana is a lecturer in the Master of Nursing program at Universitas Muhammadiyah Yogyakarta (UMY), Indonesia. His academic expertise includes health promotion and religiosity/spirituality in healthcare. In recent years, his research has expanded to focus on the development and application of digital health technologies, particularly in community-based and clinical care settings. He can be contacted at email: imanpermana@umy.ac.id.

Moch Zihad Islami is a social and multidisciplinary researcher with a background in the philosophy of science and technology. His scholarly work is situated within Science and Technology Studies (STS), with a particular focus on science and technology policy, digital governance, and the social, ethical, and humanistic dimensions of technological development. His research examines how technological systems interact with public policy, institutional arrangements, and societal values, especially in the context of digital technologies. He has published several academic articles exploring the relationships between science, technology, society, and policy. He can be contacted at email: zihadislami16@gmail.com.

Winny Setyonugroho is a researcher and academic specializing in health technology and medical informatics. With an educational background in medicine and information technology and a Ph.D. in Medical Informatics and Education, his research focuses on telehealth, hospital information systems, IoT-based biometric monitoring, psychometric analysis, and digital health education. He has published extensively on healthcare technologies, patient monitoring systems, and medical education assessment. He can be contacted at email: setyonugrohowinny@gmail.com.

Ika Puspita Sari is a professor in the Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Gadjah Mada (UGM), Indonesia. She is a full professor in pharmacology and toxicology, with expertise in antibiotics, molecular biology, and obstetrics and gynecology–related pharmacotherapy. She earned her Ph.D. from Monash University, Australia. Her research focuses on the development of anti-inflammatory and antioxidant agents. She has also served as Director of Human Resources and Academic Affairs at the Academic Hospital of Universitas Gadjah Mada (RSA UGM). She can be contacted at email: ika_tunggul@ugm.ac.id.

Janatarum Sri Handono is a medical doctor with professional experience in clinic and hospital management. He is currently a doctoral candidate at the Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada (FK-KMK UGM), Indonesia. His research focuses on the adoption of emerging technologies to improve healthcare service delivery, integrating clinical practice, healthcare management, and technology-oriented research to bridge innovation with real-world healthcare processes. He can be contacted at email: janatarumsrihandono@mail.ugm.ac.id.

Sentagi Sesotya Utami is a senior academic and researcher at Universitas Gadjah Mada (UGM), specializing in building physics and acoustics. She holds degrees from Universitas Gadjah Mada and Brigham Young University (USA), and a Ph.D. in architectural acoustics from the University of Michigan (USA). Her research interests include acoustics, building physics, smart and green building systems, and environmental monitoring. She co-founded and coordinates the Integrated Smart and Green Building (INSGREEB) research unit at UGM and is an active member of professional societies such as the Acoustical Society of America (ASA) and the Audio Engineering Society (AES). She also contributes to sustainability and SDGs initiatives at UGM, including serving as Coordinator for SDGs reporting. She can be contacted at email: sentagi@ugm.ac.id.