Proceeding Book of ***The 6th ICMEM 2021****, 11-13 August 2021, Bandung, Indonesia*
ISBN*: 978-623-92201-2-9*

Healthcare Ecosystem Mapping in Secondary Health Facility for Hypertension Case

Tiara Fadila* and Mursyid Hasan Basri

School of Business and Management, Institut Teknologi Bandung, Indonesia

Email: tiara-fadila@sbm-itb.ac.id

Abstract - **Healthcare management research is currently broader its focuses beyond hospitals operations management and involves entities included in the healthcare ecosystem to improve overall quality. However, healthcare is a complex system with multiple issues and consisting of many entities and interactions involved. This study aims to describe the healthcare ecosystem interaction of hypertension cases. This case becomes the focus of attention because, based on Indonesia's basic health research results, the prevalence of hypertension increased to 34.1% in 2018. This research uses a qualitative approach, and the hypertension management process is described based on data collected and interview results. BPMN uses to describe the healthcare ecosystem services flow and identify entities' interaction involved. In elaborating the interactions between entities, several things were identified that caused poor management of hypertension, such as lack of patient compliance and social support, unintegrated health data, poor coordination among stakeholders, limited staff and technology used, and many services procedures. This study provides an overview of the entity's relationship in providing services to hypertensive patients through the healthcare ecosystem mapping that grouped entities into delivery, financing, policymaking, and innovation. Moreover, implementing an electronic-based health system is suggested to help manage hypertension cases more effectively and support data-driven decisions.**

Keywords - **BPMN, electronic health system, healthcare ecosystem mapping, hospital, hypertension management**

I. INTRODUCTION

In providing good quality services, the health industry still has several challenges in achieving effective and efficient operation management. Some of the problems that exist in the healthcare industry are about managing operations management and the interactions between the entities involved. Meanwhile, the different roles and interactions between these entities make the healthcare industry a more complex system. Therefore, healthcare organizations should become flexible, adaptable, and knowledgeable to increase efficiency and quality to meet demands to decrease costs and errors [1].

Healthcare managers use operations management to improve the quality of healthcare services and adjust it to the organization's needs to reduce service costs [2]. It focuses on improving a single health organization's operations, referred to as Healthcare Operations Management (HOM) 1.0. The application of industrial technology 4.0 facilitates the transition from hospital-based to patient-centered that will benefit patients. It can integrate different departments, roles, and responsibilities to provide optimum patient health outcomes [3]. The more advanced step to improve quality is beyond operations management, which is to see how the interactions and relationships between entities providing health services are referred to as HOM 2.0. In HOM 2.0, multiple player's behaviors in their incentive and policy environments were centrally incorporated [4]. These entities engaged in providing health services then form a healthcare ecosystem.

In Indonesia, several health issues are still a challenge in building effective healthcare operations management. It requires good coordination between the stakeholders involved, considering that Indonesia has a large population. Badan Penyelenggaraan Jaminan Sosial or BPJS, as of December 31, 2019, the national health insurance program already had 224,149,019 members, 83.86% of the total population of Indonesia [5]. Furthermore, the increase in Covid-19 cases will increase demand for the health system, and it is essential to have effective procedures to protect the medical staff [6]. It requires Indonesia to have better management of its health system.

In the 2030 Sustainable Development Goals (SDGs), non-communicable diseases (NCDs) are one of the targets that must be achieved [7]. It indicates that NCD must become a national priority that requires cross-sectoral management. Based on Indonesia's basic health research 2018, the prevalence of hypertension for people aged 18 years has increased from 25.8% in 2013 to 34.1% in 2018 [8]. Moreover, hypertension has the highest number of participants in the return referral program, with a total of 445.883 participants [5]. However, Indonesia still faces several obstacles in dealing with this problem, such as inadequate political support for preventing and controlling non-communicable diseases programs, service capacity for NCDs is not optimal, and a lack of data availability for quality programs management [7]. The increase in the prevalence of hypertension is a challenge for healthcare stakeholders. Uncontrolled conditions of hypertension can lead to more severe disease complications. Coordination between several sectors and stakeholders and clear roles are needed to ensure target groups receive complete health services at the regional and national levels to increase multi-sectoral engagement.

The research objectives are to map and analyze the interaction process of hypertension care service programs and identify the key stakeholders in the hypertension

ISBN*: 978-623-92201-2-9*

healthcare ecosystem at the secondary health facility through a business process model. The healthcare ecosystem interactions process describes based on the hypertension management programs. Therefore, this research will suggest improving the hypertension management care processes and providing a comprehensive map of the entity's relationship in the hypertension healthcare ecosystem.

II. METHODOLOGY

The research methodology used is the qualitative approach. The flow of the research methodology is shown in Fig. 1. First, the authors conducted a preliminary study on hypertension management care and its healthcare ecosystem. Data collection was obtained from the interview with the secondary health facility management and hypertension expertise. In this study, the secondary data was obtained based on previous related research, guidelines and regulations issued by the Ministry of Health, BPJS report, and the Indonesian government's healthcare regulations. The collected data are then used to analyze the business issue in hypertension management care programs.

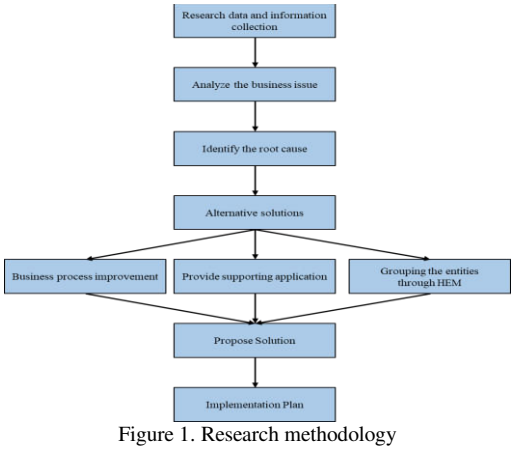

Figure 1. Research methodology

The ecosystem interactions of the hypertension care management program are described using the Business Process Model and Notation (BPMN). BPMN is a multi-vendor standard widely adopted by modelers and tool vendors alike [8]. The BPMN flow provides a detailed process description by identifying the stakeholders involved and the tasks in the processes. After analyzing the business issue, then need to conduct a root cause analysis. After that, provide alternative solutions using business process improvement, supporting app, and grouping the identified entities and their interactions into ecosystem mapping.

III. RESULTS

Promotive and Preventive Program

Based on the regulation of the ministry of health of the Republic of Indonesia number 44 the year 2018 concerning hospital health promotion, hospitals must carry out health promotion. Hospitals should also carry out preventive programs to support the prevention of hypertension. The flow of promotive and preventive programs is shown in Fig. 2.

The ministry of health is responsible in establishes regulations related to the health sector. This ministry has a Directorate General of Disease Prevention and Control that helps manage non-communicable diseases.

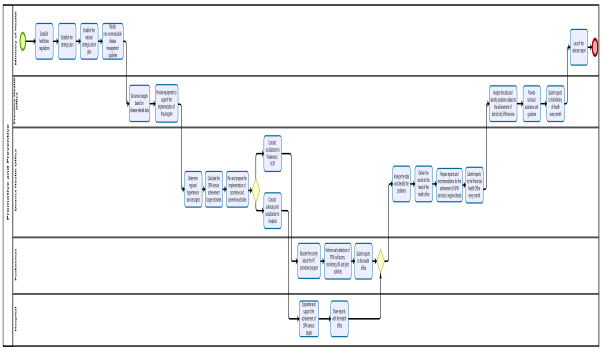
Figure 2. Promotive and preventive program flow

The ministry of health is assisted by the provincial and district/city health offices in implementing these programs. The district/city health office conducts socialization and advocacy to primary health facilities and hospitals. The health facilities must submit a report to the district or city health office. The district/city health office will then analyze the data and identify any existing problems. The results will be reported to the provincial health and then forwarded to the health ministry.

Curative Program

Based on law No. 36 of 2009, curative health service is an activity and/or a series of therapeutic activities to heal a disease, reduce suffering due to illness, control disease, or control disability to make sufferers' quality maintained optimally. The curative process is divided into admission, outpatient care, and discharge in the secondary health facility. The outpatient admission process describes in Fig. 3. In the admission process, patients must take the queue number and register at the registration counter. The admission staff then will check patient data and their insurance eligibility. They will also prepare the physical medical records. Then, the patient will go to the intended polyclinic. In outpatient care at the polyclinic, the nurses will perform the basic examination, and then the doctor will provide further investigation and consultation. Then, the patient will go to the discharge process to get the prescription medicine and complete the payment. The pharmacists have to assess the prescription and make sure that the patient receives the medicines needed.

ISBN*: 978-623-92201-2-9*

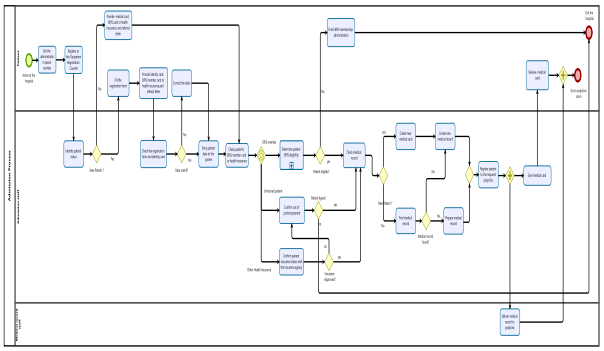

Figure 3. Admission flow

Based on the flow in Fig. 3, the patient has to follow many procedures and spend a long time queueing before receiving the medical treatment. Then, the proposed improvement for the admission process is shown in Fig. 4. Based on the analysis, the admission flow in the curative program can be simplified by implementing the online registration system for the patients. Moreover, to support controlling hypertension conditions, electronic blood pressure monitoring or e-BPM scheme is proposed. After receiving curative services from the hospital, the hypertensive patient can use the e-BPM. This application should be supported by using electronic medical records (EMR) and electronic health records (EHR) to integrate the overall patient's health condition.

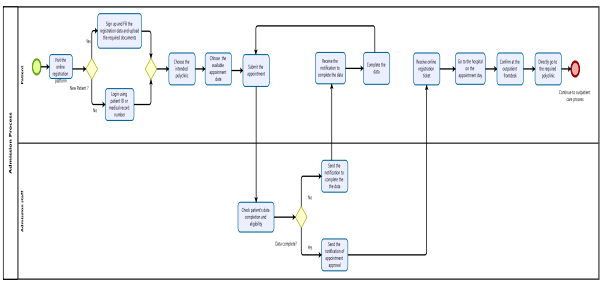

Figure 4. Simplified admission flow

As shown in Fig. 5, patients must register and fill in personal data. Then, to connect with the health facility where the patient is treated, the patient must choose the appropriate hospital on the application. The health facility will then receive a notification and check the suitability of patient data. Then, they will enter reminder data to the patient regarding the following control schedule. In addition, medical staff can enter a schedule for blood pressure checks. This blood pressure check schedule is adjusted to the degree of hypertension the patient has.

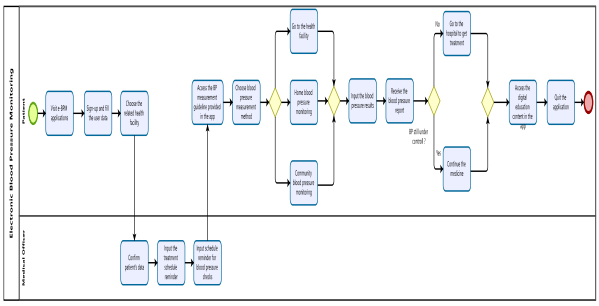

Figure 5. Electronic blood pressure monitoring process

After carrying out a blood pressure check, the results must be input into the application. Then, the application will display a report regarding the blood pressure results along with the blood pressure classification information. Apart from checking blood pressure, another prominent feature of this application is the digital educational content users can access.

Based on the healthcare ecosystem interactions, processes, and actors identified that have been described through BPMN, then the actors will be grouped into a healthcare ecosystem mapping along with their linkage with each other. The authors develop the map shown in Fig. 6 based on the hypertension care management program.

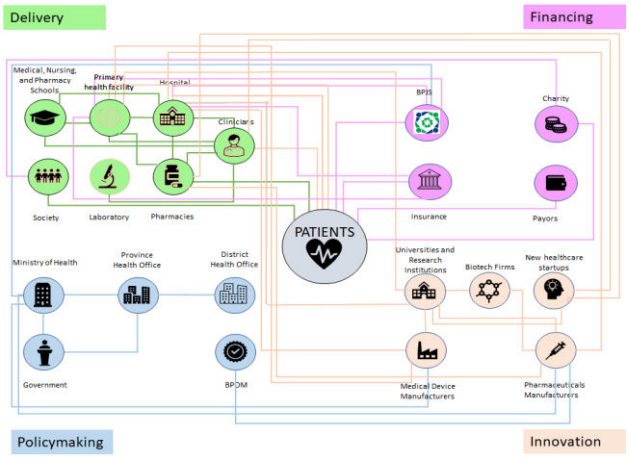

Figure 6. Healthcare ecosystem mapping for hypertension

IV. DISCUSSION

The increase in hypertension cases indicates that the hypertension care management program is still ineffective in Indonesia. The secondary health facility also has high cases of hypertension. There are also more cases when patients choose to come directly to the secondary health facility instead of visiting the primary healthcare first. It requires an improvement in hypertension management programs.

As described in Fig. 2, the promotive and preventive programs for patients involve several stakeholders. The current healthcare reporting process has problems such as unintegrated data. The NCD disease prevention and

control program department faces challenges such as a lack of data availability for quality program management because of a weak surveillance system for non-communicable diseases and their risk factors [7]. It is important to make sure that each region level submits the data based on the standardized format. Implementing a digital reporting system should have supporting infrastructure and skilled workforces to reach integrated data collection. It also requires good coordination among the stakeholders to implement the promotive and preventive program successfully.

The process of education about the disease through promotive and preventive is still not going well. Based on the interview, the patients feel like they did not receive any education from the health professionals. Hence, the public awareness of the importance of disease promotive and preventive programs is still low. Besides, the low level of patient loyalty to both treatment and control to health workers has a role in the failure to treat hypertension [12]. It is suggested to provide digital education content through animated video or posters in social media that can easily understand by society.

According to the health facility, they mentioned that the stakeholders involved in health service to patients are the doctors, nurses, pharmacists, and patient's companions. As described in Fig. 3, the patient has to go through a long procedure in the admission process. Patients spend a long time waiting in the queue at most hospitals due to many patients and limited staff. Then, the physical medical records preparation takes more time and has risks such as lost medical records, duplication, and discontinue medication records. In providing examination, the doctor mentioned that if the queue is long, they have limited time to educate the patient.

Implementation of EHR and EMR will support better service processes and facilitate patient data integration. The purpose of an electronic health information system is to support health workers in providing health care services to the patient and enabling data exchange among service providers, which can facilitate healthcare providers to control some health conditions like hypertension, cholesterol levels, diet, and obesity [13]. As the health industry has several stakeholders in providing services to patients, electronic health systems must be built to facilitate the exchange of data [14].

Simplified admission process

The simplified admission process in Fig. 4 can cover the limited staff, utilize the data integration through an electronic-based system, and provide a more straightforward admission procedure for patients. Hospitals should build an online registrations platform where patients can submit online registration. Then, patients only need to fill their data online through their respective gadgets without queueing at the outpatient front desk.

On this platform, hospitals must display important information such as available polyclinic services, medical treatment schedules, queuing quotas, and other things that patients must pay attention to when they come to the hospital. As shown in Fig. 4, the patient can choose the intended polyclinic and the desired treatment schedule. The staff will then check the incoming requests to the system. For new patients, data will be examined, including patient's insurance eligibility. If it is appropriate, the officer will send a notification that the patient registration has been approved. Then the patient can come directly to the hospital at the chosen time.

Through this system, medical personnel can connect to patient's electronic medical records. So, there is no need to look for physical files of patient medical records and take them to the polyclinic. It can make the process run faster and unravel queues. Patients no longer have to spend a long time queuing at the registration section. There is already a quota for a medical appointment schedule. So that patients can get immediate medical services which will increase patient satisfaction levels. And medical personnel can serve all patients properly at the appropriate time.

Through this electronic admission process, it helps to overcome limited staff problems because patients can register independently. In addition, this simplified admission process supported by an electronic health system also helps integrated data collection and simplifies previously complicated procedures. This integrated data will be useful by the regulators, providers, and related health facilities to improve the patient's health service quality. Moreover, it helps the improvement of the hypertension management program.

Implementation of this process needs to conduct training for medical officers and educate the hospital visitors. It also requires good time management in medical treatment schedules, patient consultation times, and proper resource allocation. While implementing a digital system, the information shown must be updated so that what is in the system and the field does not differ. This process must be supported by monitoring and evaluation. So that if there are obstacles, they can be resolved immediately. This simplified admission process also requires investment and supporting infrastructure. The success and effectiveness of the treatment plan can be supported through excellent communication between the patients, their families, and the multidisciplinary hospital team [15].

Electronic Blood Pressure Monitoring

Another factor that causes hypertension management less effective is the lack of patient compliance in undergoing disease control programs and a lack of support and control from the patient's environment, such as family and society. Public awareness about

hypertension and patient compliance is still lacking. Based on the interview, the specialistic doctor mentioned that the patient's non-compliance in treatment, lack of patient awareness, and lack of knowledge adversely affect the success of hypertension treatment. As one of the low middle-income countries, Indonesia has challenges in controlling hypertension, one of which is the low level of public awareness of hypertension [16]. The Indonesian Ministry of Health also states that patient non-compliance causes hypertension to become uncontrollable [10].

Moreover, according to reference [17], to improve treatment compliance, medical professionals should involve patients in making medical decisions, encouraging home blood pressure monitoring, maintaining relationships with patients, and providing feedback and validation of success. Also, interventions that can be done to increase drug adherence in hypertension are empowerment of the patients, accessibility of drugs, and simplification of the drug regimen [18].

As a proposed solution to help control hypertension conditions, e-BPM in Fig. 5 is suggested. Based on the discussion with the expertise, a monitoring application for hypertension specifically does not yet exist, and implementing a monitoring application may help. Therefore, this e-BPM scheme is proposed as an application that can be accessed by medical personnel and hypertensive patients to monitor blood pressure conditions. In addition, this application scheme can be used as a reminder for hypertensive patients and their families regarding hypertension treatment. This application covers several problems by providing features for improving patient adherence, education using digital content, reminders for schedule controls to health facilities, self-management with reminders for home blood pressure monitoring (HBPM), and electronic medical records for patients. So that medical decision-making becomes more accurate. The application is also equipped with a guide on how to check blood pressure independently. Thus, it will significantly help hypertension patients and accompanying families monitor their health conditions and prevent hypertension complications.

The education about hypertension can be performed through animated videos, articles, and digital posters that users can access anytime and anywhere. Implementing the e-BPM application requires investment and support from information technology experts.

Hypertension Healthcare Ecosystem Mapping

Hypertension control management programs need support from all entities involved. The management program for controlling hypertension has several processes that involve interactions between related entities. Reference [7] mentioned that the political support for the disease program at the central and regional levels is still not optimal, and cross-program and cross-sector cooperation is also not optimal. It is essential for each stakeholder to know their duties and responsibilities and how their actions can affect the services provided to patients either directly or indirectly.

Healthcare Ecosystem Mapping (HEM) is used to classify entities based on their basic functions and how they relate to one another. The map in Fig. 6 is designed with the patient as the center to support a patient-centered health model to improve overall patient quality. It refers to the HEM proposed by [4], which decomposes the healthcare system into healthcare delivery, financing, innovation, and policymaking. This healthcare ecosystem mapping shows that service quality can be improved in health facilities and related institutions in the Indonesian healthcare system. This HEM can also help describe the entities' integration to improve service delivery to hypertensive patients from various aspects. This more comprehensive framework helps health facilities, consultants, entrepreneurs, policymakers, health economists, and researchers to have a complete picture of the healthcare ecosystem in finding ways to influence the behavior of various decision-makers [4].

- Delivery

This group consists of entities that deliver care services to the patient, such as medical, nursing, pharmacy school, primary health facility, hospital, laboratory, pharmacies, society, and clinicians. Medical schools have the responsibility of educating professional health workers. Health professionals should provide appropriate health services for hypertensive patients. In the disease control management program, promotional and preventive activities for hypertension are mainly carried out by the primary health facility.

In curative services for hypertension, patients are served medically by specialist doctors and nurses in hospitals. If a supporting examination is required, the patient will be referred to a supportive examination laboratory. The pharmacy department will then serve patients in fulfilling drug needs and educate patients about drug consumption rules. The community also supports the patient's treatment process. According to WHO, healthcare organizations must harmonize services, improve medical staff's capabilities, focus on prevention, and establish information tracking systems to provide planned health care for predictable complications [19]. Hypertension can cause complications if it is not controlled. Therefore, it is crucial to offer appropriate services in managing hypertension disease control and make sure the patient gets the healthcare they need at the right time.

- Financing

The financing group consists of entities that provide

and allocate funds needed for various activities in the healthcare ecosystem. According to WHO, financing must be coordinated, and intersectoral links must be strengthened. This group consists of BPJS, insurance agencies, payors, and charities. BPJS, as the national health insurance agency, provides funds to hospitals based on INA CBGs rates. Hospital also collaborates with other private insurance agencies in serving payment for patient treatment processes. Apart from using insurance, patients can also make payments independently or by the out-of-pocket payment method. In addition, some charities are being carried out to help fund the treatment of hypertension patients.

• Policymaking

The policymaking circle consists of entities that regulate regulations regarding healthcare both at the regional and national levels. The Ministry of Health also publishes guidelines and guidelines in the implementation of health services. At the provincial level, regional health offices and governors regulate health at the regional level. Then, a district/city government is assisted by the district/city health office at the city level. Apart from these agencies, an agency regulates medicines, namely the National Agency of Drug and Food Control (BPOM). These agencies regulate the running of health regulations in Indonesia. This policymaking group can limit action healthcare organizations, limit feasible solutions for operational problems, and impede their implementation [4]. Moreover, Governments need to make informed decisions for their populations and set standards for quality and incentives in health care [19].

• Innovation

This circle consists of entities that support innovation or development in medical devices, pharmaceutical manufacturing, and the new business model. Entities belonging to this group include universities and research institutions, biotech firms, medical device manufacturers, pharmaceutical manufacturers, and new healthcare startups. Universities and research institutions help support the development of healthcare services. The medical device and pharmaceutical manufacturers are also working to provide breakthroughs to help improve healthcare services for hypertensive patients. Besides, in Indonesia, new businesses have started to emerge, such as healthcare startups that help provide services to patients through mobile applications. However, the challenge in this section is how to ensure firms and research institutions continue to develop technology and these organizations continue to innovate operations and business models [4].

This healthcare ecosystem mapping shows that it requires the stakeholders' contribution and collaboration in providing services to hypertensive patients. As discussed with the expertise, hypertension management programs require support and cross-sector coordination from the stakeholder involves. A healthcare service ecosystem perspective that involved a broad range of actors can collaborate to provide better health outcomes and better patient experience [20]. Hence, through this hypertension ecosystem mapping, the entities will consider their roles, actions, and decisions directly or indirectly impacting the services to the patient.

V. CONCLUSION

The health sector is currently shifting its focus to a broader view involving various stakeholders. However, one of the diseases that remain challenges is hypertension. In this research, the hypertension ecosystem interaction at the secondary health facility level is analyzed based on the hypertension management program through BPMN. The key stakeholders and their interactions in the hypertension management program have been described and mapped into a healthcare ecosystem mapping. The entities involved are grouped based on their basic functions in healthcare services, which are the delivery, financing, policymaking, and innovation group. The healthcare ecosystem mapping provides a comprehensive map of entities' interactions involved in the hypertension management program, and their actions can directly or indirectly impact the patient. HEM shows that improving the overall quality of healthcare in hypertension cases requires cooperation, integrity, and supportive decisions from all entities involved.

Based on the interactions among the entities involved, several factors that caused the poor management of hypertension were detected. The proposed solutions to improve the management of hypertension care are the simplified electronic admission process and e-BPM. Electronic admission aims to make the process simpler, easier, and faster for the patient. The e-BPM proposed to help the medical officer, patient, and the patient family monitor and control the hypertension condition. Implementing a technology-based system is expected to overcome the problems and improve hypertension management to be more effective.

REFERENCES

[1] R. Ramachandran, "Stakeholder Management in Health Sector," *SSRN Electron. J.*, 2020, doi: 10.2139/ssrn.3511454.

[2] R. K. J. B. S. S. P. Charan, "Healthcare operations management : a structured literature review," *DECISION*, vol. 43, no. 3, pp. 259–279, 2016, doi: 10.1007/s40622-016-0132-6.

[3] M. Alloghani, D. Al-Jumeily, A. Hussain, A. J. Aljaaf, J. Mustafina, and E. Petrov, "Healthcare Services Innovations Based on the State of the Art Technology Trend Industry 4.0," 2019, doi: 10.1109/DeSE.2018.00016.

[4] T. Dai and S. Tayur, "OM Forum—Healthcare Operations Management: A Snapshot of Emerging Research," *Manuf.*

Serv. Oper. Manag., 2020, doi: 10.1287/msom.2019.0778.

[5] BPJS Health, "Program Management and Financial Report of the JKN programme," *Bpjs*, p. 240, 2019, [Online]. Available: https://bpjs-kesehatan.go.id/bpjs/dmdocuments/5b8c446214547b3f6727a710cd62dae7.pdf.

[6] S. Setiati and M. K. Azwar, "COVID-19 and Indonesia," *Acta Med. Indones.*, 2020.

[7] Kementerian Kesehatan RI, "Rencana Aksi Nasional Penyakit Tidak Menular 2015-2019," *Kementrian Kesehatan RI*. pp. 1–166, 2017.

[8] B. Silver, *BPMN Method and Style, 2nd Edition, with BPMN Implementer's Guide: A structured approach for business process modeling and implementation using BPMN 2.0*. 2011.

[9] World Health Organisation (WHO), "WHO fact sheet on Hypertension 13," *World Heal. Organ.*, 2020.

[10] Kementerian Kesehatan RI, "Hipertensi Penyakit Paling Banyak Diidap Masyarakat," *Kementeri. Kesehat. RI. Sekr. r Jenderal. Rencana Strateg. Kementeri. Kesehat. Tahun Rencana Strateg. Kementeri. Kesehat. Tahun*, 2019.

[11] Kementrian Kesehatan RI, "Laporan Nasional Riskesdas 2018," *Laporan Nasional RIskesdas 2018*. 2018.

[12] N. Darnindro and J. Sarwono, "Prevalensi Ketidakpatuhan Kunjungan Kontrol pada Pasien Hipertensi yang Berobat di Rumah Sakit Rujukan Primer dan Faktor-Faktor yang Memengaruhi," *J. Penyakit Dalam Indones.*, 2017, doi: 10.7454/jpdi.v4i3.138.

[13] L. Shahmoradi and M. Habibi-Koolaee, "Integration of health information systems to promote health," *Iranian Journal of Public Health*, vol. 45, no. 8. 2016.

[14] World Health Organization, "Management of patient information," *Glob. Obs. eHealth Ser.*, vol. 6, p. 80, 2012.

[15] M. V. Zendrato, R. T. S. Hariyati, and E. Afifah, "Outpatient nursing care implementations in Indonesian regional public hospitals," *Enferm. Clin.*, vol. 29, 2019, doi: 10.1016/j.enfcli.2019.04.066.

[16] M. A. Hussain, A. Al Mamun, C. Reid, and R. R. Huxley, "Prevalence, awareness, treatment and control of hypertension in Indonesian adults aged ≥40 years: Findings from the Indonesia Family Life Survey (IFLS)," *PLoS ONE*, vol. 11, no. 8. 2016, doi: 10.1371/journal.pone.0160922.

[17] N. M. Kaplan and R. G. Victor, *Kaplan's clinical hypertension: Eleventh edition*. 2014.

[18] M. Burnier and B. M. Egan, "Adherence in Hypertension: A Review of Prevalence, Risk Factors, Impact, and Management," *Circ. Res.*, vol. 124, no. 7, 2019, doi: 10.1161/CIRCRESAHA.118.313220.

[19] World Health Organization, "Innovative Care for Chronic Conditions (ICCC): Building Blocks for Action," 2002.

[20] O. M. Pop, S. Leroi-Werelds, N. Roijakkers, and T. W. Andreassen, "Institutional types and institutional change in healthcare ecosystems," *J. Serv. Manag.*, vol. 29, no. 4, 2018, doi: 10.1108/JOSM-02-2017-0041.