Implementation Of The Me-Smile Application At Dharmais Cancer Hospital: An Implementation Research

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Article Info	ABSTRACT
Keywords: Waste management, Me-Smile, Implementation,	Healthcare facilities must monitor waste generation data daily so it can always be tracked as reference for medical waste management. Mostly, each Fasyankes has a scale to record their medical waste generation at their facilities, but this data's only available within the Fasyankes. The medical waste generation data from Fasyankes still needs to be recapitulated for reporting so that it's available for policymakers to support the medical waste management from Fasyankes. However, human error significantly affects the data when weighing, because the waste weighing is done twice: first during the disposal and transfer of medical waste from its source to Temporary Disposal Site, and second when the medical waste is collected by the third party who has permission and MoU with the healthcare facility, with different monitoring officers present during the disposal to the TPS and during the collection by the third party. The numerous complaints regarding this matter led the Ministry of Health to collaborate with United Nations Development Programme (UNDP) to develop an application named ME-SMILE in 2023. This application utilizes Internet of Things technology with sensors, microprocessors, and modules. Type of Research: Implementation Research with Research Design: case study, which falls under descriptive analysis research, namely research that is focused on a specific case to be observed and analyzed thoroughly and meticulously.With this research, it is hoped to share experiences and knowledge for the authors, especially in addressing the issues of implementing the Me-Smile application in healthcare facilities.
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INTRODUCTION

Waste is the result of human activities in healthcare facilities that are no longer used and are repurposed. According to Law No. 17 of 2023 on Health, Article 104 states that Environmental Health Efforts aim to realize a healthy environment in physical, chemical, biological, and social aspects, enabling everyone to achieve the highest degree of health. Article 105 states that in the context of organizing environmental health, the process of managing medical waste originating from health service facilities must meet the technical requirements set by the Minister. Based on PermenLHK P-56/2015, waste categories include sharp objects, pathological waste, infectious waste, chemical waste, pharmaceutical waste, cytotoxic waste, heavy metal waste, pressurized containers, and radioactive waste.

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Thus, the question arises as to why medical waste must be managed; the reason is that if not properly managed, it can cause environmental impacts, health impacts, and non-compliance with regulations.(Peraturan Menteri Lingkungan Hidup Dan Kehutanan Nomor P.56/Menlhk/Setjen/2015 Tentang Tata Cara Persyaratan Teknis Pengelolaan Limbah Bahan Berbahaya Dan Beracun Dari Fasilitas Pelayanan Kesehatan, 2015)

According to Capoor, M.R., and Parida, A., 2021, biomedical waste from the diagnosis, isolation, and treatment of patients with the coronavirus disease 2019 (COVID-19) can become a source of new infections, posing dangers and impacts of medical waste if not managed properly, leading to human health disturbances, genetic and reproductive disorders, economic losses, and disruptions in comfort and aesthetics. And according to Gita Azizah Putri, A., 2022, clinical medical waste has a more significant and greater potential for pathogenicity and toxicity compared to other types of waste.

Every day, healthcare facilities must monitor waste generation data so that waste generation can always be tracked as a reference for the capacity needed in medical waste management. Currently, each healthcare facility generally has scales to record medical waste generation in their respective facilities, but this data is only available within the healthcare facilities. According to Kumar, S., et al., 2020, waste generated from health centers poses a serious health threat worldwide, as the disposal of unsegregated biomedical waste can become a source of serious disease transmission among managers and the community. (M, 2017)

The data on the generation of medical waste from healthcare facilities still needs to be recapitulated for reporting purposes so that it is available to policymakers in order to support the management of medical waste from healthcare facilities. However, human error has a significant impact on the waste generation data when weighing to determine the amount of waste because the waste weighing is done twice: once during the disposal and transfer of medical waste from the room to the Temporary Disposal Site (TPS), and again during the collection of medical waste by a third party who has a permit and a Memorandum of Understanding (MoU) with the healthcare facility, with different monitoring officers present during the disposal to the TPS and the collection by the third party. Additionally, Bayusunuputro, B.Z.N., et al., 2021 state that healthcare services, besides providing care, also generate waste, one of which is solid waste. It is also important for us to understand the issues related to the process and cost of managing medical solid waste, which is part of hazardous waste (B3).

Due to the numerous complaints regarding this matter, the Ministry of Health, in collaboration with UNDP (United Nations Development Programme), has developed an application called ME-SMILE. This application utilizes Internet of Things technology with sensors, microprocessors, and modules, which are the result of the collaboration between the Ministry of Health and UNDP. (United Nations Development Programme).

The development of ME-SMILE, which can be accessed via a website and installed on smartphones, transforms the system for recording medical waste generation that was initially only available at healthcare facilities (Fasyankes) to be accessible by stakeholders. Access to data on medical waste generation from Fasyankes is expected to enhance

stakeholder support for the management of medical waste from Fasyankes, thereby improving the management of medical waste from Fasyankes in the future. According to Novi, F. et al. (2018), infectious waste in its handling assessment is divided into six parameters, including hospital policies on organizational structure, the status of cleaning staff, the classification and separation process, the collection and transportation of infectious waste, the temporary storage conditions of infectious waste, and the disposal stage of infectious waste.

Dharmais Cancer Hospital is a Type A educational hospital serving as the National Cancer Center, which is the National Referral for Cancer Diseases and the pioneer of the cancer network in Indonesia. The Ministry of Health, in this case, the Directorate of Environmental Health, in collaboration with UNDP, has launched and developed the Me-Smile Application to be implemented in vertical hospitals owned by the Ministry of Health, one of which is Dharmais Cancer Hospital.

The Me-smile application development project was first conducted at Tarakan Hospital as a representative of regional government hospitals, Sarjito Hospital Yogyakarta as a representative of vertical central hospitals under the Ministry of Health, and Setia Budi Community Health Center as a representative of community health centers.(Tim Kerja PLR Direktorat Penyehatan Lingkungan, 2023)

After the project was tested, the Ministry of Health and UNDP (United Nations Development Programme) attempted to implement the application in several vertical hospitals across Indonesia, one of which is Dharmais Cancer Hospital. Then the implementation of the Me-Smile application was socialized at the Hilton Hotel Bandung for 2 days with speakers from 2 hospitals (RS Tarakan and RS. Sarjito) and 1 Puskesmas Setia Budi Jakarta in March 2023. Finally, in June 2023, the Me-Smile application began to be implemented in all Kemenkes Vertical Hospitals, including Dharmais Cancer Hospital. The application can be installed on the Play Store, either through Android or a laptop, and can connect with scales that are compatible with the application. It is also equipped with a barcode printer.

With the me-smile application, weighing only needs to be done once at the time of disposal at the TPS, and during transportation, it does not need to be weighed again because it uses a barcode, and the amount or volume of waste can be monitored on a phone or laptop. But besides the advantages, there are definitely disadvantages, including the WIFI network, behavioral factors, human error, misprinted barcode names, scale errors, etc. Based on that, the researcher chose the thesis title "Implementation of the Me-Smile Application at Dharmais Cancer Hospital: An Implementation Research."

METHODS

The type of this research is a descriptive research with case-study approach. Case-study approach contains quantitative evidence, and not only described as qualitative research. (Schwartz, H., & Jacobs, 1979) According to the WHO in Implementation research in health, 2013, implementation issues arise as a result of various real-world contextual factors that are overlooked by other research. Implementation research highlights these factors,

providing a basis for context-specific and evidence-based decision-making that is crucial for turning what is theoretically possible into practical reality.

The populations of this research are sanitarians and cleaning service officers. Primary data was collected by filling out a questionnaire and secondary data was obtained from waste generation data from Dharmais Cancer Hospital. Since implementation research is embedded in reality, people working in the real world often ask questions that serve as starting points for new thinking. One way to support collaboration between researchers and practitioners is by integrating implementation research into policy and programmed decision-making processes from the outset.(Sabri, L., & Hastono, 2014)

RESULTS AND DISCUSSION
Implementation of the Me-Smile Application at Dharmais Cancer Hospital
After the project was successfully tested, the Ministry of Health and UNDP (United Nations Development Programme) attempted to implement the application in 30 vertical hospitals across Indonesia, one of which is Dharmais Cancer Hospital. Dharmais Cancer Hospital is a Type A educational hospital serving as the National Cancer Center, a National Referral for Cancer Diseases, and a leader in the cancer network in Indonesia. The Ministry of Health, in this case, the Directorate of Environmental Health, in collaboration with UNDP, has launched and developed the Me-Smile Application to be implemented in vertical hospitals owned by the Ministry of Health, one of which is Dharmais Cancer Hospital.

Then, the implementation of the Me-Smile application was socialized at the Hilton Hotel Bandung for 2 days with speakers from 2 hospitals (RS. Tarakan and RS. Sarjito) and 1 Puskesmas Setia Budi Jakarta in March 2023. Finally, in June 2023, the Me-Smile application was implemented in all vertical hospitals of the Ministry of Health, including Dharmais Cancer Hospital. The application can be installed from the Play Store, either on Android or laptop, and can be connected to a smart scale that has been adapted to the application and is also equipped with a barcode printer. Implementation of the Me-Smile Application in Hospitals

The implementation of the Me-Smile Application began on June 5-6, 2023, in hospitals, starting with the socialization of Me-Smile and training on how to use the Me-Smile application, which was delivered by the Help Desk Team from UNDP and accompanied by the Ministry of Health team from the Directorate of Environmental Health. The implementation of the Me-Smile application was carried out in several stages, including:

1. The handover of equipment and the welcoming and reception of the Ministry of Health and UNDP teams to support the Me-Smile application, including smart scales, barcode printers, and barcode sticker paper on June 5, 2023, at the Temporary Shelter of Dharmais Cancer Hospital.
2. The smart scale, totaling 1 unit, was placed at the TPS, the barcode printer 1 unit, and 13 rolls of barcode stickers were placed in the Environmental Health and Occupational Safety and Health Installation room.
3. The welcoming and reception of the Ministry of Health and UNDP teams regarding the socialization and practical training on the use of me-smile in the training room on

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the 5th floor of the training building on June 6, 2023. The reception and welcome of the Ministry of Health team and the UNDP team were conducted by the Environmental Health Coordinator and several teams from the Environmental Health Installation. The UNDP team presented the me-smile application and its features that can be used within the application. This was followed by a socialization session on how to use the me-smile application directly at the temporary storage site for solid medical waste, guided by the UNDP help desk team. The socialization activities were conducted by several representatives from the Environmental Health Installation, Cleaning Service, Ministry of Health team, and UNDP Help Desk team.

Implementation of the Me-Smile Application in Other Hospitals

1. Harapan Kita Heart Hospital (RSHK)
   Based on the interview results with the Sanitarian at RSHK, the following results were obtained:
   a. The Me-Smile application was implemented at RSJP in early June 2023, but before Me-Smile, they had a similar application called DX RSHK. However, the previous application only recorded data internally and could not be linked to a phone or laptop; it could only be used on a computer near the TPS because it used a cable connection instead of Wi-Fi.
   b. The advantage of the Me-smile application compared to the previous application is that Me-smile can be monitored remotely, whereas the previous application could only be used at the TPS because it used a cable connection. If the computer needed to be moved further away, a longer cable had to be added.
   c. Field challenges, aside from signal issues, include unstable Wi-Fi because it is located in the basement. When getting or clicking on the phone, it records more than it should; for example, a volume of 10 kg is recorded as 100 kg. Additionally, when the admin tries to edit it, sometimes the storage period changes. For instance, if the collection date is September 30, 2024, after editing or changing, the storage period might change to September 18, 1791.

Figure 1. Data Changes In Me-Smile Application

   To address the issue, the sanitarian requested are-weighing to ensure the data aligns with the maximum limit and the timing corresponds with the weighing.
   d. For regulations related to digital implementation, there is nothing specific yet, but more towards general waste management in the form of SPO, while for me-smile activities, they are included in IK. (Instruksi kerja).
   e. The success rate of the me-smile implementation at RSHK is 90%.

f. For the unit cost of implementing me-smile, they must budget for 1 year for the procurement of thermal paper and request thermal paper every quarter.

g. For the implementation activities of me-smile, it is expected that there will be a maintenance visit schedule from the me-smile help desk to check or monitor the activity and field conditions regarding the application and implementation of the me-smile application.

h. The staff (HR) at RSHK consists of 6 people for environmental sanitation and 6 cleaning service supervisors who take turns according to shifts.

2. Harapan Kita Child and Mother Hospital

Based on interviews with Environmental Sanitation Staff regarding the implementation of the me-smile application, the following points were noted:

a. The implementation of me-smile began in June 2023.

b. Its usefulness and benefits include saving time as there is no need for re-cap, and previously, before the me-smile implementation, there were communication errors between cleaning service and sanitation staff regarding waste volume writing that was sometimes unclear. Previously, weighing was done twice, but now with me-smile, it is done only once.

c. The challenge was the limited availability of barcodes during the initial distribution.

d. The creation of a digital waste management SPO is currently in progress.

e. Barcode provision with the vendor is done annually.

f. The success rate is 100% if the Wi-Fi is stable.

g. Coordination with the IP team for network keys for operators.

h. There must be routine maintenance of weighing scales and printers to ensure continuity.

i. For human resources in environmental sanitation, there are 4 people.

b. 1 person as coordinator, 3 people as TSL staff and as me-smile supervisors

a. Weighing is done in the morning and afternoon, while for the evening, it is done in the morning and stored in the provided wheelbin.

3. Persahabatan Hospital

a. The me-smile application was used at Persahabatan Hospital around June 2023.

b. The advantages or benefits of the me-smile application are more accurate waste recap data and time efficiency, reducing the weighing process from two times to one time.

c. The challenge is the procurement of thermal stickers or barcodes because it has not been budgeted for in 2024, so it will require reimbursement.The issue with the procurement of thermal stickers or barcodes is that they have not been budgeted for in 2024, so it will be done with cost reimbursement.

d. For the guidelines, the SPO is still using the old rules because the new rules have not been made yet, as they are waiting for the standard rules related to me-smile.

e. The success rate is 99% because there are still issues related to the barcode.

f. To ensure the continuity of the mes-smile application, maintenance and periodic field supervision by UNDP are necessary.

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g. The number of human resources is 2 people (1 sanitarian and 1 high school graduate), and two additional human resources are provided to back up the cleaning service supervisors.

h. For waste weighing, it is done only twice, in the morning and afternoon, while at night it will be weighed in the morning and temporarily stored in the provided wheelbin.

Technical Instructions for Me-Smile

The use of ME-SMILE utilizes Internet of Things technology with sensors, microprocessors, and modules. Sensors are useful for obtaining data; the microprocessor processes that data, and the module sends unique data from each device to the application server. The current ME-SMILE application is equipped with a smart scale to obtain data on the location, date, and weight of medical waste and then automatically send it to the server. In addition to the smart scale, there is also a QR/quick response code printer along with its scanner (or Scan QR by phone). A QR code is used to identify the source of medical waste by attaching one QR code to one medical waste bag during weighing. The identification data of the waste source that has been stored during weighing and the initial setup of the ME-SMILE application stored on the server can be identified by scanning the QR code.

Waste generation data from smart scales and waste identification data from QR codes can be used for decision-making and policy formulation based on evidence to support medical waste management in Indonesia. In addition, this data can also serve as a reference for waste management investments, fostering partnerships between the government and the private sector in the management of medical waste from healthcare facilities.

Purpose of the Me-smile Application

As a guide for the use of ME-SMILE devices and applications for users in Fasyankes, as well as a guide for the use of the site for users in the Health Office and the Ministry of Health. This usage guide includes but is not limited to installation, maintenance, operation, and troubleshooting common issues related to thermal printer devices, smart scales, applications, and the ME-SMILE site.

Behavior of Implementing the Me-Smile Application at Dharmais Cancer Hospital

Management of medical waste at Dharmais Cancer Hospital before and after using the Me-Smile application with the 5 M can be seen in the following table:

Table 1. Management of Medical Waste's Behavior Before – After Me-Smile Application

Before the me-smile app existed	After the introduction of the me-smile app

1. Labor (HR) or Man
  a. must fill out the label on the trash bag starting from the source of the waste, the delivery date, the sender's name, and the type of waste.
  b. Weigh and record the total waste that has been weighed.
	1. Staff (HR) or Man
	  a. No need to fill out the label anymore, just mention the origin and type of waste, and it will be printed in the form of a barcode.
	  b. Weighing and recording the waste that is weighed but directly linking it to the me-smile application for the amount of waste that is weighed.

2. The method used is manual weighing and	2. The method used is weighing with a

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Before the me-smile app existed	After the introduction of the me-smile app
manual recording.	smart scale that employs sensor technology, microcontrollers, and IoT modules to obtain waste weight data, process the data, and send it to the server.

3. Machine
  a. digital scale
  b. does not use a printer or any devices.
	3. Machines
	  a. Digital scales but already equipped with sensor technology and IoT modules.
	  b. QR or quick response code printing device along with its transfer tool.

4. Money
  There is a possibility of data errors in the amount of medical waste because during the recording, the writing was not very clear, and if it was weighed twice, there might be an increase in the weight or volume of the waste.
	4. Money
	  The total amount or waste recap according to real data or actual data at the time of weighing before and after transportation.

5. Material
  a. Scale
  b. Computer
  c. Stationery
  d. Log book
	5. Material
	  a. Scale
	  b. Printer
	  c. Barcode Sticker
	  d. Wifi
	  e. Computer
	  f. Mobile Phone
	  g. Stationery
	  h. Log Book

Results of the Implementation Behavior of the Me-smile Application at Dharmais Cancer Hospital

Before the me-smile application
1. Mistakes or discrepancies in waste volume due to unclear writing.
2. Staff had to weigh twice, before and after waste collection.
3. Hospitals incurred losses due to potential errors in waste data recap caused by unclear writing or discrepancies before and after weighing.
4. Waste collection took a long time because it had to be reweighed.
5. Medical waste recaps always had discrepancies before and after weighing.
6. There was an addition of writing on the label of each plastic bag containing the source of the waste, sender's name, delivery time, and type of waste.

After the implementation of the me-smile application:
1. The actual and valid waste volume because there is no need for further writing.

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2. The staff only needs to weigh once, not twice.
3. The hospital no longer incurs losses due to discrepancies in waste volume.
4. The waste transportation time is no longer lengthy because weighing is only done once during delivery, and there is no need to weigh again during transportation.
5. There are no longer discrepancies in the medical waste data recap before and after weighing.
6. There is no need to write on the waste plastic bags anymore; just attach the previously printed barcode.

In accordance with the Decision of the Director General of Disease Prevention and Control Number: HK.02.02/C/1389/2024 Regarding Guidelines for Digital-Based Healthcare Facility Waste Management, digital-based waste management for healthcare facilities is an important step in data accuracy, real-time efficiency, security, and sustainability to enhance accountability in healthcare facility waste management. This can be utilized by policymakers and stakeholders for decision-making and evidence-based policy determination to support healthcare facility waste management in Indonesia.

In the implementation of digital-based healthcare facility waste management, there are several users in healthcare facilities who have roles, access, and functions as outlined in the following table: Additionally, based on waste volume data from January 2023 to May 2023, there is a discrepancy between the daily logbook data of waste volume generated by Dharmais Cancer Hospital and the waste manifest data recapped by the third party. This is because the weighing is done twice, namely during the initial weighing before the waste is transported by the third party and the re-weighing during the waste transportation. This could possibly result in an increase in volume weight because the medical waste containing liquid was not yet liquid during the initial weighing, but after the transportation, the medical waste containing liquid became liquid. It could also be due to unclear recording by the cleaning service in the waste logbook.

Evaluation of Behavior in the Implementation of the Me-Smile Application

Table 2. Comparison of Solid Waste Generation/Data Volume Before and After the Implementation of the Me-Smile Application January 2023 – May 2023 and January 2024 – May 2024

Month	Before Me-Smile App (Jan-Mei 2023)	After Me-smile App (Jan-Mei 2024)	Savings
Jan	12202,25	10820,5	1381,75
Feb	11346,55	9935,75	1410,8
Mar	11733,6	10236,5	1497,1
Apr	9431,89	9612,6	-180,71
Mei	11250	10980,8	269,2
Total	55964,29	51586,15	4378,14

Secondary data RSKD Year 2024

From the waste generation data recap from January 2023–May 2023 before the implementation of the me-smile application, the waste generation data was 55,964.29, and

after the implementation of the me-smile application from January 2024–May 2024, the waste generation data was 51,586.15. Compared to before and after the me-smile application, the waste generation data decreased by 4,378.14 kg. In monetary terms, we can save approximately 4,378.14 kg x rp. 4,000 = rp. 17,512,560 over 5 months.

Discussion

Based on the results of the questionnaire distributed via Google Form from the total sample population of 140 people, after calculating using the formula for the number of cleaning service and environmental health employees, the margin of error used is 10%, and the calculation results can be rounded to achieve consistency. According to the formula, the total sample size is 60 people, but after the respondents filled out the questionnaire, data was obtained showing that 83 respondents completed the questionnaire.

Knowledge

Knowledge is the occurrence of the process of knowing; people engage in activities on the objects that will be studied. (Astri 2017). Knowledge is obtained in three ways: formal education, informal education, and non-formal education. (contoh pelatihan). The level of knowledge possessed can influence the process of managing solid medical waste.

Knowledge is the result after a person perceives a certain object. Knowledge, or the cognitive domain, is a very important domain in shaping a person's actions (Notoatmodjo, 2014). In the study, it was found that among respondents with good knowledge, with an average (mean) of 4.47 about waste management, there were 50 people or 60.2%, while for respondents with less good knowledge about waste management, there were 33 people or 39.8% of the total respondents, which was 83 people. This study is in line with the research conducted by Widayati (2017), which showed a significant relationship between knowledge and attitudes towards medical waste disposal (p = 0.05). The supporting factor is the higher education of healthcare workers with diplomas and bachelor's degrees, which provides them with good knowledge in medical waste management. (Widiyawati, 2017).(Notoatmodjo, 2014)

Behavior

According to Notoatmodjo (2014), behavior is an activity or action of the organism (living being) itself. Behavior is the result of all kinds of experiences and interactions between humans and their environment. Its manifestations can be in the form of knowledge, attitudes, and actions. For respondents with good behavior, answering "yes" to 6 distributed questionnaires with an average score above 5.49 regarding the implementation of Me-smile waste management, there are 60 people, or 72.3%. Meanwhile, for respondents with less good behavior, with an average score below 5.49 in the application of the Me-smile waste management, there are 23 people, or 27.7% of the total respondents, which is 83 people.

The results of the statistical test obtained a p-value (0.050) equal to the alpha value (0.05), thus Ho = rejected and Ha = accepted. It can be concluded that there is a difference in the proportion of me-smile implementation behavior between respondents with good knowledge and those with poor knowledge. This means there is a relationship between the respondents' knowledge and the implementation behavior of me-smile.

Digital waste management

Digital interventions show impact and evidence regarding the cost-effectiveness of digital health interventions, which will generally be beneficial in terms of cost and outcomes.(Gentili et al., 2022). In several other studies, including research by Chen X et al., 2023, it was found that digital governance helps improve the domestic waste sorting rate for rural residents. Mechanistic tests show that digital governance has an impact on domestic waste sorting through the mass relationship and institutional trust.(Xi et al., 2023)

Then, according to Joon et al. (2017), the growth of electronic production and consumption has resulted in a surge in electronic waste generation. Many electronic items contain hazardous substances, including lead, mercury, and cadmium. Recycling or disposing of these items informally poses a serious threat to human health and the environment, therefore, strict enforcement of waste disposal laws is necessary with the implementation of health assessment studies to mitigate the management of electronic waste that has reached the end of its life, especially in developing countries.(Joon et al., 2017)

Hospital health experts collect the results of large-scale data analysis and integrated documentation in the hospital sector through proper healthcare waste management, presented in a software-based quantitative index to assess the performance of healthcare waste management processes. (Baghapour, M, 2018). (Baghapour et al., 2018). The appropriate processing methods in healthcare waste management pose a challenge for developing countries as a complex multi-criteria decision-making problem that requires consideration and alternative solutions (Liu, C., et al., 2013).(Hu-Chen et al., 2013) According to Liu, C., et al. (2014), ITL MULTIMOORA can solve the problem of selecting healthcare waste management technologies, and the MULTIMOORA method has also been modified based on interval 2-tuple linguistic variables (named ITL-MULTIMOORA) to evaluate and select healthcare handling technologies. Specifically, the subjective and objective importance coefficients of the criteria are considered in the developed approach to conduct a more effective analysis.(Hu-Chen et al., 2014)

Development in integrated decision-making according to the cloud model and MABAC method in evaluating and selecting the best healthcare officer treatment technology from the stakeholders' perspective. (Hua et al., 2017). Digital technology includes artificial intelligence, blockchain, the Internet of Things, sensors, data analysis, and radio frequency identification. This technology has the potential to address issues such as vehicle route planning and scheduling, resource optimization, real-time tracking, and visibility in healthcare waste management. (Sharma et al., 2024)
Digital health interventions can provide patient-centered services on a global scale and include decision support systems that have the potential to enhance the performance and quality of healthcare services. (Fragão-Marques & Ozben, 2022)

CONCLUSION

Based on the results and discussion in this research, the following conclusions can be drawn: The existence of the me-smile application is strongly supported by its

implementation from the Management (Director), Head of Environmental Health Installation, and environmental health staff and cleaning service related to the me-smile application, starting from planning, implementation, execution, and evaluation of me-smile. There are indeed challenges in the implementation of me-smile, but they are limited to unstable network or internet issues. The implementation of me-smile does not require a large amount of funding; it only involves replacing thermal stickers/barcodes when they run out, approximately 3 rolls per month. The success rate of me-smile implementation at Dharmais Cancer Hospital is between 80-100%. The implementation of the me-smile application can be sustainable if supported by regular maintenance and field surveys related to the condition of scales, printers, and the application itself. For guidelines and SOPs related to medical waste management, they already exist, but specific regulations regarding digital medical waste management need to be created. There is a new regulation on digital waste management in 2024 issued by the Director General of P2P number HK.02.02/C/1389/2024 regarding the Guidelines for Digital-Based Healthcare Facility Waste Management. (Pedoman Pengelolaan Limbah Fasilitas Pelayanan Kesehatan Berbasis Digital Bahwa Pengelolaan Limbah Fasyankes Berbasis Digital, 2024). There is a difference in the recap of medical waste volume before and after the implementation of the me-smile application. Comparing the implementation and application in 3 vertical hospitals and based on interviews with the Sanitarian of Harapan Kita Heart Hospital, Harapan Kita Child and Mother Hospital, and Persahabatan Hospital regarding the me-smile application, the following results were obtained: Implementation of the me-smile application at Harapan Kita Heart Hospital (helps monitor medical waste remotely via mobile phone, issues when changing waste volume through the application include maximum storage changes and unstable internet connection due to the TPS location in the basement, success rate 90%, for sustainability there must be maintenance from the UNDP help desk team). Implementation of the me-smile application at Harapan Kita Child and Mother Hospital (helps provide more valid and accurate waste data recap, issues with unstable internet connection due to interference with other networks, routine equipment maintenance required, success rate 100%, weighing is done in the morning and evening, for night weighing in the morning). Implementation of the me-smile application at Persahabatan Hospital (the benefits of the me-smile application include more accurate waste data recap, time efficiency from weighing twice to once, success rate 99% due to issues related to barcodes, for sustainability there must be maintenance and field supervision). Before the implementation of the me-smile application from January 2023 to May 2023, the volume of medical waste was not consistent between the daily waste volume recap and the daily recap using manifest data due to weighing being conducted twice: once before transportation and once after transportation, resulting in a volume difference of 2626.72 kg. In monetary terms, this amounts to 2626.72 X Rp.4000 = Rp.10,506,880. The waste generation data recap from January 2023 to May 2023 before the implementation of the me-smile application shows that the waste generation was 55964.29, and after the implementation of the me-smile application from January 2024 to May 2024, the waste generation was 51586.15.

Comparing the data before and after the me-smile application, the waste generation decreased by 4378.14 kg. In monetary terms, this amounts to a savings of approximately 4378.14 kg X Rp.4000 = Rp.17,512,560 over 5 months. The average age of employees with knowledge related to waste management and the Me-Smile application does not have a significant relationship. The average education level of respondents with knowledge related to waste management and the Me-Smile application does not have a significant relationship. The average work experience of respondents with knowledge related to waste management and the Me-Smile application does not have a significant relationship. There is a difference in the proportion of Me-Smile implementation behavior between respondents with good knowledge and those with less knowledge. This means there is no relationship between respondents' knowledge and Me-Smile implementation behavior. Not all the required items are yet integrated into mobile phones or computers/laptops, such as medical waste data that can be directly linked to KLHK. There is no regular schedule from the Me-Smile help desk for maintaining application support tools such as smart scales and printers. From the UNDP and the Ministry of Health, there have indeed been socialization and updates introducing Me-Smile at several government and private hospitals that do not yet have the Me-Smile application and those that already have the Me-Smile application, as well as informing them if there are new items or items that will soon be added/realized in the application. However, until now, this has not yet been realized.

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