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Development of *Aplikasi Satu Data Kesehatan* (ASDK) on key performance indicator of District Health Office of Kulon Progo using District Health Information Software 2 (DHIS2)

Guardian Yoki Sanjaya[1*], Dini Prasetyawati[1], Rio Aditya Pratama[1], Vivi Ninda Sutriana[1], Lutfan Lazuardi[1], Mohammad Yusuf Setiawan[2], Beni Mulyadi Sutaryana[3], Titi Supriati[4]

[1]Department of Health Policy and Management, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia;
[2]Sekolah Tinggi Ilmu Kesehatan Yayasan Rumah Sakit Dr. Soetomo, Surabaya, Indonesia;
[3]District Health Office of Kupang, Nusa Tenggara Timur, Indonesia;
[4]District Health Office of Kulon Progo, Yogyakarta, Indonesia.

*Corresponding author:
Guardian Yoki Sanjaya;
Department of Health Policy and Management, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia;
gysanjaya@ugm.ac.id

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ABSTRACT

Introduction: Many health applications have been developed at various levels, including primary care, hospitals, district and provincial health offices, private sectors, and the national level, resulting in the fragmentation of health data at the primary health center level. Assisted by Department of Health Policy and Management, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, *Aplikasi Satu Data Kesehatan* (ASDK) Kulon Progo, based on an open-source technology District Health Information Software 2 (DHIS2) was used to mitigate health data fragmentation in District Health Office of Kulon Progo that has been struggled since 2018 to integrate several routine health data from different programs.
Methods: The activity focused on integrating routine data from the nutrition program, maternal and child health program, and immunization to create an ASDK Kulon Progo dashboard for the 2021-2022 period based on various levels. The steps taken to continue this integration into the ASDK included analyzing needs, identifying routine program data, compiling blueprint data, preparing metadata, monitoring, importing routine program data, analyzing and vizualizing it according to the needs of each program.
Results: Several metadata have been established on ASDK Kulon Progo based on activities conducted from April to December 2022. These metadata include data elements and indicators featured in six health dashboards. Furthermore, various forms of data visualization, such as pivot tables, charts, and maps have been compiled and integrated into the health dashboards on ASDK Kulon Progo.
Conclusion: As a system developed to support monitoring and evaluation activities, six ASDK Kulon Progo dashboards have been arranged based on integrating various health data from cross-program within the District Health Office of Kulon Progo. Support and supervision are required to sustain the implementation of ASDK Kulon Progo.

Keywords: data fragmentation; health data digitalization; digital transformation; aplikasi satu data Kesehatan; asdk kulon progo.
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INTRODUCTION

Health information is part of the six building blocks of a health system, according to the World Health Organization (WHO).[1] The purpose of using information technologies in the health sector includes improving the flow of health data to support the management of health system programs.[2] In Indonesia, more than 400 health applications are being developed to support decision-makers at different levels of the health system, in national and sub-national levels, which leads to the fragmentation of health data.[3] The fragmented health information system underlies the need to develop the Satu Data initiative, as stated in the Regulation of the Minister of Health of the Republic of Indonesia Number 21 of 2021 concerning the Strategic Plan of the Ministry of Health for 2020-2024. Therefore, to overcome the problem of fragmentation of health data, it is necessary to integrate health data into a data warehouse or repository.[4] Implementing an information system such as District Health Information Software 2 (DHIS2), to manage health data and information is an option to integrate data from different sources. DHIS2 is an open-source software designed as a data warehouse and used to manage health data according to regional and central needs.[5] It was initially developed by the Health Information System Programme at the University of Oslo.

In DHIS2, features include data management, validation, analysis, visualization, and sharing of health

information. These will be very useful for stakeholders at various levels to support health program planning, monitoring, evaluation of program achievements, and integrated and sustainable decision-making.[6] In African countries such as Kenya, DHIS2 has been designed to support decentralized decision-making and management of health services. The flow allows healthcare workers to use data to analyze levels of service provision, predict service needs, and assess performance in meeting health service targets. Implementation in Kenya has enabled simple, customized data analysis thus encouraging data use for decision making right from the lowest level.[7,8] Ease of integration between data from DHIS2 is also utilized to support the antimicrobial resistance integration system supervision in Bangladesh, namely the integration of WHONET and DHIS2.[9]

The Ministry of Health, especially the Data and Information Center (Pusat Data dan Informasi/Pusdatin), continues to coordinate the development of applications in the health sector, one of which is an open-source program called the ASDK Kulon Progo, which was developed using the DHIS2 platform to be used in data collection, managing and analyze routine health data. Aplikasi Satu Data Kesehatan Kulon Progo is also a system that can perform or stream data from different systems into a single data repository, transform, calculate data to be indicators and visualize information into an integrated dashboard. *Aplikasi Satu Data Kesehatan* Kulon Progo implementation emphasizes aspects of data source integration at the sub-national and national levels.[4]

The limited expansion of ASDK Kulon Progo implementation by the Ministry of Health, especially in the Special Region of Yogyakarta, has encouraged the Department of Health Policy and Management to assist districts/cities in the Special Region of Yogyakarta region in implementing the one health data program. Special Region of Yogyakarta is a province that has widely used information systems for several health programs.[9] In 2018-2019 the Department of Health and Policy Management implemented DHIS2 for five districts and province level through community service activities, but it was limited to several health programs. District Health Office of Kulon Progo is one of the districts that is currently still being assisted in implementing DHIS2.[10]

Although it was realized that the DHIS2 has the potential to facilitate routine health data integration from some health programs, the pilot implementation of DHIS2 in 2018 was stopped due to a lack of technical support, human resource turnover, and internal policy changes. Community service activities implementing the DHIS2-based ASDK Kulon Progo system at the District Health Office of Kulon Progo have been ongoing since 2021 in collaboration with the Department of Health and Policy Management and continue to this day. District Health Office of Kulon Progo has collected routine health data in the spreadsheet form and documented it into a google drive. Google drive has been a cloud service for data sharing amongst health programs up to village-level data. However, the spreadsheet file has limited capabilities to link between data sources and limited functionality to visualize and share information. It is expected that other tools, like the DHIS2, can be used to integrate data visualized information into pivot tables, trend lines, bar charts, stacked charts, maps, and display the integrated information into a dashboard system that can be shared.

The health dashboard is a modern analytics tool to monitor healthcare key performance indicators (KPIs) dynamically and interactively. At the district level, it should be able to drill down health information up to the village level. The dashboard should also facilitate indicators that meet health program requirements, mainly to accommodate program monitoring and evaluation, which can be carried out periodically. Data analysis, visualizations, and dashboards must be easy to use, access, and understand by different levels of stakeholders. The dashboard should also accommodate the compilation of several indicators calculated from the different data sources and grouped into different executive and middle manager KPIs, such as the Main Performance Indicators of the Head of District Health Office of Kulon Progo and the Main Performance Indicators of the Public Health Division Program. It is expected that using the ASDK Kulon Progo system can integrate routine data where all relevant stakeholders can simply monitor health program achievements and assist in decision-making. This study aimed to develop ASDK Kulon Progo dashboards based on several key performance indicators and hierarchy levels to support the monitoring and evaluation of health programs in the District Health Office of Kulon Progo.

METHOD

The Community Service team of the Department of Health Policy and Management, consisting of lecturers, assistants, students, and alumni, conducted activities with the District Health Office of Kulon Progo from April to December 2022. In this study, the roles of the author's team as consultants for the development of ASDK Kulon Progo, and involved in creating key performance indicators dashboards. Ethical clearance was obtained from the Medical and Health Research Ethics Committee Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, with reference number KE/FK/0977/EC/2022. The activity was focused on routine data integration of nutrition programs, maternal and child health programs, and immunization (Figure 1). The selection of maternal and child health programs is similar to one of the case studies conducted in Sri Lanka. District Health Information Software (DHIS2) was used as a maternal and child health management information system from 2011 to 2012.[11] We identified the availability of health program data, format of data source (spreadsheet files), disaggregation level of data source by administrative level (village, primary health center) and period (monthly), and operational definition of each indicator and its calculation method. Method of data integration from different data sources and format was also identified to avoid repeated data entry. When all identified data had been successfully imported into the DHIS2, we analyzed, visualized, and arranged the health information into the ASDK dashboard.

Table 1. Development activities of the ASDK Dashboard in 2022

Implementation	Activities
April 2022	**Need analysis activities** Developed the key performance indicators dashboard in collaboration with the public health division program of the district health office of Kulon Progo
August 2022	**Developed the key performance indicator dashboard for the head of the district health office of Kulon Progo** The key performance indicator dashboard for the head of the district health office of Kulon Progo is a combination of several performance indicator achievements from the Nutrition Program, Maternal and Child Health, Health Promotion, Health Services, and Environmental Health.
December 2022	**Developed the achievement indicators of each program dashboard of the public health division program** Until December 2022, the accommodated health programs are Nutrition, Maternal and Child Health, Immunization, Health Promotion, and Environmental Health.

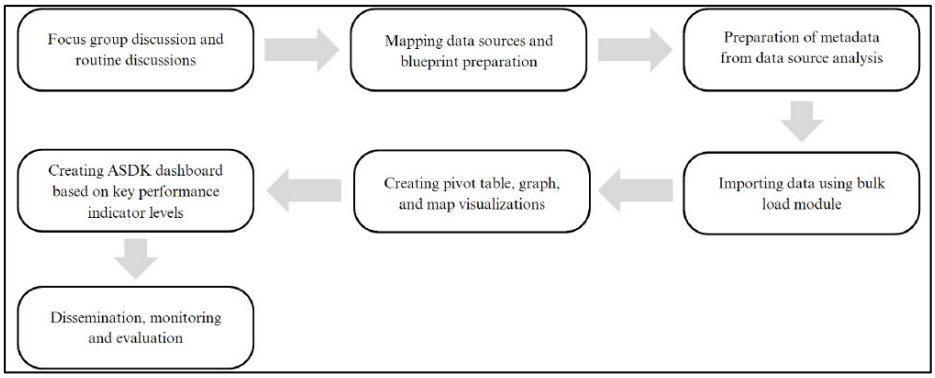


Figure 1. Summary of ASDK dashboard study steps.

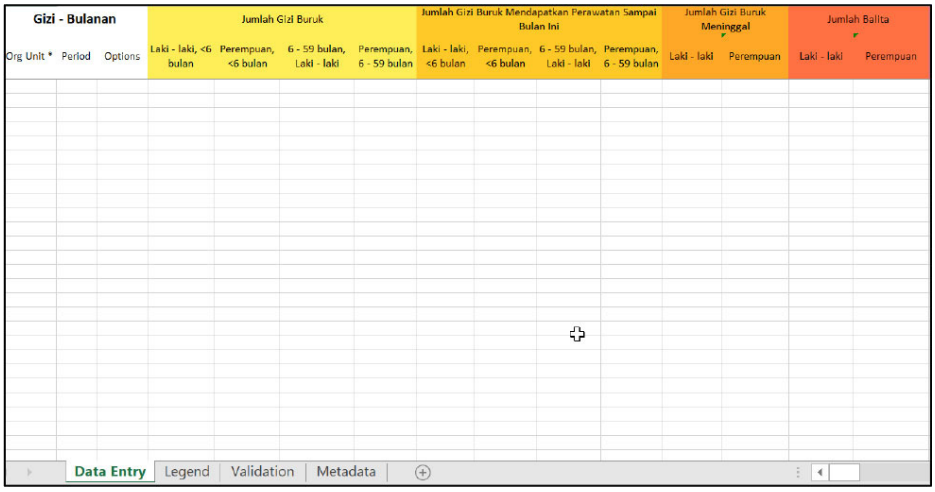


Figure 2. An example of a Nutrition Programme bulk load template for importing data.

Based on the information presented in Table 1, it can be seen that the development of the ASDK dashboard began in April 2022, initiated with a program in the public health division. Several indicators from public health, particularly the nutrition program and maternal and child health, were accommodated into the ASDK Kulon Progo dashboard, such as stunting, maternal, and neonatal mortality rates. In August, several health indicators from other programs, such as health promotion, healthcare services, and environmental health, were also integrated into the ASDK dashboard. These indicators were then organized into the dashboard to monitor the key performance indicators of the Head of the Kulon Progo District Health Office. Then by December 2022, additional indicators from the existing programs were added to be included in the ASDK Kulon Progo dashboard. However, by the end of 2022, each program had its own achievement dashboard.

The steps that had been taken to continue the integration of health data into the ASDK were: 1) need analysis, 2) identification of routine program data, 3) compilation of blueprint of routine program data, 4) preparation of metadata, 5) monitoring, 6) importing routine program data, 7) analyzed and visualized routine program data according to the needs of each program, and 8) creating ASDK dashboard for the year 2021-2022 based on the levels (Figure 1). The dashboard levels consist of a Dashboard of Key Performance Indicators for the Head of the District Health Office of Kulon Progo, and Dashboard of Key Performance Indicators for the public health sector.

For routine program data, a bulk load feature with a specialized template has been used to import routine data into the ASDK system. It was adjusted to fit the routine data reporting format, ensuring its continued use for the next several years. The data import template simplifies the process, eliminating the need for program management staff to repeatedly export templates from the system and readjust them to fit the routine reporting format. An example of a nutrition program bulk load template is presented in Figure 2.

The activity starts with conducting a focus group discussion (FGD) for needs analysis together with the relevant staff of the District Health Office of Kulon Progo. The situation of health data management in the District Health Office of Kulon Progo, the conceptual framework of Satu Data di Bidang Kesehatan, and the importance of optimizing routine health data have been discussed in this FGD. From the FGD, the condition of data management in the District Health Office of Kulon Progo has been determined, such as each program has responsibility for its data, monthly

Figure 3. Second workshop at the District Health Office of Kulon Progo on August 2023.

data monitoring, collection of fragmented data, various types and models of data collection formats, high turnover and movement of human resources responsible for the data, and pooling each routine data sources in spreadsheet format. Initially, the routine online discussion activities with the District Health Office of Kulon Progo were held once a week. After evaluation, it was decided that the Community Engagement Program team needed more time to follow up on the results of previous discussions. Therefore, the routine online discussion schedule was changed once every two weeks. Routine online discussions have been conducted to discuss the indicators to be displayed on the dashboard that will be developed, the fulfilment of data sources from each program, the types of visualization to be displayed on dashboards, and restricting access rights to the ASDK dashboard according to user levels based on the agreement with the District Health Office. The visualization to be displayed in the dashboards was adjusted according to the needs of each program, for example, trend lines and pivot table to observe the year-to-year percentage comparison of stunting cases maps to visualize the distribution of stunted toddlers in specific areas.

From the routine online discussions, it has been agreed that the Dashboard of Key Performance Indicators for the Head of the District Health Office of Kulon Progo has been structured based on cross-sectoral data encompassing the following indicators: Maternal Mortality Rate (MMR), Neonatal Mortality Rate, Stunting Rate, Active Alert Village, Active Integrated Health Service, Clean and Healthy Household Lifestyle, Complete Immunization, Village program to stop open defecation and Access to Safe Drinking Water. The sectors and programs within the Health Office that have been involved in developing this dashboard are the Public Health sector, consisting of Family Health, Nutrition, Health Promotion, and Environmental Health; the Disease and Prevention Control sector, consisting of Immunization; and Health care service sector, consist of Basic Health Service.

Meanwhile, the Dashboard of Key Performance Indicators for the Public Health sector has been structured based on cross-program data, encompassing indicators such as Underweight, Anemia in pregnancy, Low birth weight, Exclusive breastfeeding, Malnutrition, Active Alert Village Program, Clean and Healthy Household Lifestyle, Active Integrated Health Service, and Community Based Total Sanitation. The sectors programs within the Health Office that have been involved in developing the *Kesmas* sector dashboard are Nutrition, Mother and child health, Environmental Health, and Health Promotion.

Besides routine online mentoring and online discussions, another activity in this Community Engagement Program includes conducting ASDK workshops in collaboration with the District Health Office of Kulon Progo. The topic for the first workshop held on May 23, 2022 was Socialization of Implementation and Utilisation of the Aplikasi Satu Data Kesehatan (ASDK) Based on DHIS2 in Kulon Progo District, while the topic for the second workshop held on August 3, 2022 was Presentation of the Revised ASDK Dashboard in Kulon Progo District Based on the Need Assessment. Representatives from various health programs from the District Health Office of Kulon Progo attended both workshop activities.

RESULT

Based on activities carried out starting from routine discussions, data import activities, data visualization, and data dissemination at the district health level, several metadata have been formed on ASDK Kulon Progo. This metadata consists of data elements and indicators on several health dashboards, as listed in Table 2 below.

Apart from metadata, several forms of data visualization, starting from pivot tables, charts and maps, are compiled and placed on the health dashboard in ASDK Kulon Progo (Figure 4).

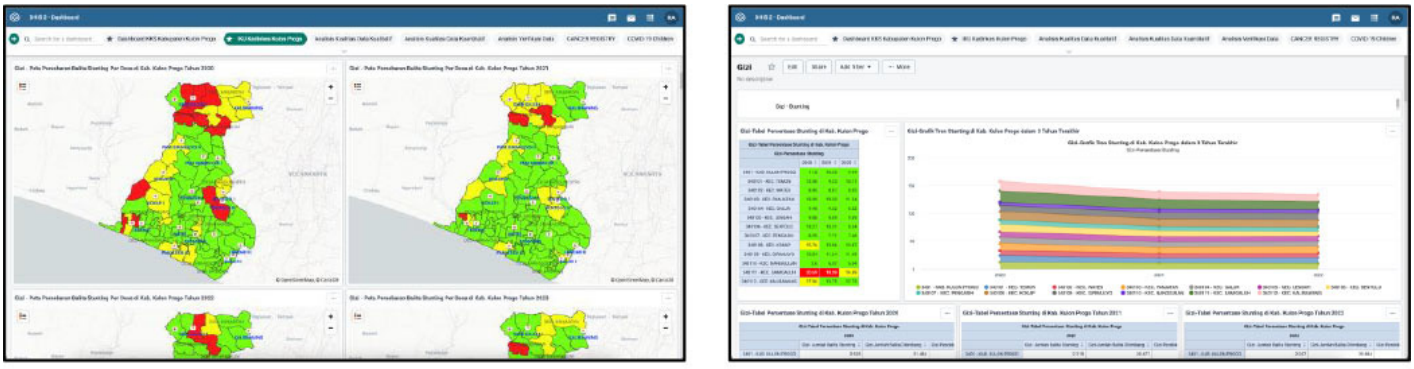
The number of visualizations from each health dashboard is presented in Table 3 below.

DISCUSSION

In low-income settings such as Indonesia, using open software like DHIS2 may be a solution, but it comes with its own challenges, such as the requirement for sufficient user training. Users who are anticipated to be able to train other users in the future must receive training. Training for Trainers of Trainers (ToT) has been used in many countries; among them is Kenya, where it was used to implement the electronic health record (EHR) system.[12] Training for Program Managers at the Kulon Progo District Health Office is then carried out by a team that has experience in using and managing the DHIS2 applications. The competency of the program management staff in using ASDK is expected to improve through technical support and hands-

Table 2. List of Data Elements and Indicators Based on the Health Dashboard

No.	Dashboard	Data Element	Indicator
1.	Key Performance Indicators for the Head of the District Health Office of Kulon Progo	32 items, such as the number of neonatal deaths and the number of live births	9 items such as Maternal Mortality Rate (MMR), Neonatal Mortality Rate, Stunting Rate, Active Alert Village, Active Integrated Health Service, PHBS RT (clean and healthy household lifestyle), Complete Immunization, Village program to stop open defecation, Access to Safe Drinking Water
2.	Key Performance Indicators for the Public Health	17 items, such as anemia in pregnant women and malnutrition	9 items such as malnutrition, anemia in pregnant women, low birth weight, Exclusive Breastfeeding, Malnutrition, Active Alert Village Program, PHBS RT (clean and healthy household lifestyle), Active Integrated Health Service, Community Based Total Sanitation
3.	Family Health	32 items, such as health services for pregnant women and health services for mothers giving birth	9 items such as toddler malnutrition, anemia in pregnant women, low birth weight, Exclusive Breastfeeding, Malnutrition, Active Alert Village Program, PHBS RT (clean and healthy household lifestyle), active posyandu program, Community Based Total Sanitation
4.	Nutrition	16 items, such as the number of stunting and wasting	5 items such as Nutrition - posyandu participation rate, Nutrition - program success rate, Nutrition - Underweight Toddlers, Nutrition - Wasting Toddlers, Nutrition - Giving Fe tablets to young women
5.	Health Promotion	6 items, such as the number of smoke-free areas and the number of active toddler posyandu	5 items such as Smoke-Free Areas, active posyandu program, The use of village funds, Active Alert Village Program, PHBS RT (clean and healthy household lifestyle)
6.	Environmental Health	17 items, such as families accessing healthy latrines and securing household waste	5 items such as Smoke-Free Areas, active posyandu program, The use of village funds, Active alert sub-district program, households with a clean and healthy lifestyle



(a) (b)

Figure 4. ASDK Kulon Progo Health Dashboard. (a) Key Performance Indicators Dashboard for the Head of the District Health Office of Kulon Progo. (b) Key Performance Indicators Dashboard for the Public Health.

on practice in data entry and analysis using actual routine data.[13] Regular and supportive supervision is also necessary to maintain the commitment of the program management staff to use ASDK for their routine data entry.[14] Lainstitutional and technical support can lead to the program's sustainability failure.[15]

During implementation, the community engagement program team regularly supports the program management staff, especially when they carry out routine data imports into the ASDK system using the bulk load feature. Feedbacks were also given to the program management staff regarding their DHIS2 data utilization. Previous studies conducted in Ethiopia revealed that reasonable supervision and feedback on health information system utilization was positively associated with the commitment level of the staff to use the data for their decision-making.[14,16]

Support activities are accompanied by

Table 3. List of Data Visualizations Based on the Health Dashboard at ASDK Kulon Progo

No.	Dashboard	Number of Visualizations		
		Pivot Tables	Charts	Maps
1.	Key Performance Indicators for the Head of the District Health Office of Kulon Progo	14	12	15
2.	Key Performance Indicators for the Public Health	0	9	9
3.	Family Health	14	17	1
4.	Nutrition	9	5	7
5.	Health Promotion	0	5	1
6.	Environmental Health	2	6	4

monitoring and evaluation throughout the routine data entry process, updating data and metadata in the system, and developing various data visualizations, and dashboards. Suppose program management staff encounter any difficulties during the routine data import process. In that case, the community engagement program team promptly investigates and coordinates with the staff until the data is successfully imported into the ASDK system. Another purpose of monitoring activities is to ensure that the incoming data and the visualizations created align with the specific needs of each program. The opinions of stakeholders directly involved in the implementation of ASDK and the management of the health program, as well as the program management staff serving as end users, are important for evaluating the effectiveness and functionality of the ASDK system. Their perceptions and viewpoints will provide valuable insight into the sustainability of the implementation of the ASDK system and whether the system is meeting the objectives and fulfilling the users' needs.[17] A modifiable system designed to meet the stakeholders' and end users' needs and conditions can help enhance the likelihood of sustainability.[18] The assessment of how the District Health Office staff have utilized the ASDK system for program monitoring and evaluation, facilitating program development, and serving as a reference for decision-making is also carried out during the monitoring and evaluation process by the Department of Health Policy and Management team.

District Health Information System 2 is utilized across various regions globally for collecting, managing, analyzing, and presenting aggregated data and indicators at the district level.[19,20] Implementing ASDK using DHIS2 can result in increased timeliness and completeness of routine reporting of data on various health facilities from district to national level. However, there needs to be ongoing support, both in terms of supervision and assistance, as well as additional system or infrastructure improvements, including internet connectivity, so that it can further improve the performance of DHIS2 as a Satu Data Kesehatan system.[21]

The various types of data, diverse characteristics, and different applications within each program pose specific challenges for the community engagement program team and the District Health Office of Kulon Progo during the implementation process.

CONCLUSION

System development carried out together with the District Health Office OF Kulon Progo to support monitoring and evaluation activities has resulted in six Kulon Progo ASDK dashboards, which are prepared based on the integration of various health data across health programs within the District Health Office OF Kulon Progo. The main factor in increasing the competency of program management staff in using ASDK and the sustainability of the implementation of ASDK Kulon Progo is by providing intense support and supervision, both in technical assistance support and direct practice in data entry and analysis using routine data.

The continued use and utilization of the system of ASDK Kulon Progo is carried out by implementing it in routine activities, starting from data collection activities through routine data reporting, monitoring and evaluation as well as program socialization, facilitating program development, and also as a reference for decision making. Apart from that, the health data collected by ASDK Kulon Progo can constantly be updated according to user needs and data availability. The assistance provided by the team from the Department of Health Policy and Management and supported by additional system or infrastructure improvements, including internet connectivity, is expected to increase the potential for sustainability of ASDK Kulon Progo and user staff from the health service can independently manage ASDK Kulon Progo as a routine activity in management and utilization of health program data at the District Health Office of Kulon Progo.

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CONFLICT OF INTERESTS

The authors declare that they have no competing interest. The article has not been previously published and is their original work.

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