Transforming Medical Records into Actionable Insights Through Data Visualization Dashboards

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Sections Info	ABSTRACT
	Objective: This community service aimed to educate healthcare workers at Aisyiyah Pandaan Inpatient Clinic on the process of medical record data, fostering data-driven decision-making in patient care. *Method:* In October 2024, a training program was conducted for 20 healthcare workers, focusing on medical record data analysis, interpretation, and presentation. Participants were trained on how to utilize medical data to support clinical decisions. *Results:* The training program led to a significant improvement in the participants' knowledge and abilities in medical record data analysis. The results were statistically significant with p-values: $p < .001$, $p < .001$, $p = 0.003$, $p < .001$, and $p = 0.002$. *Novelty:* This activity represents a novel initiative in empowering healthcare workers by enhancing their competencies in using medical record data for clinical decision-making, promoting efficiency and accuracy in patient care.

INTRODUCTION

In the modern era of healthcare, data has emerged as a critical asset in enhancing decision-making processes, optimizing operations, and improving patient outcomes. Medical record data, in particular, serves as a valuable source of information that provides insights into patient care trends, clinical performance, and operational efficiency. However, the sheer volume and complexity of medical data often make it challenging for healthcare professionals to utilize it effectively. This challenge underscores the growing need for healthcare workers to be equipped with skills and knowledge in data processing and visualization to transform raw data into actionable insights [1], [2].

In the inpatient clinic setting, where the immediate efficiency and accuracy of medical record data processing are paramount, its relevance becomes more pronounced. If analyzed and visualized properly, medical record data can guide decisions that matter significantly across patient care best practices, resource allocation, and quality improvement. In the inpatient clinic setting, the effective analysis and visualization of medical record data are crucial for enhancing patient care, optimizing resource allocation, and driving quality improvement. Integrating electronic health records (EHR) and advanced data analytics tools can significantly improve decision-making processes by providing actionable insights into clinical workflows, patient outcomes, and operational efficiencies [3], [4]. Even though it has enormous potential, many healthcare workers do

not receive sufficient training in data analysis and visualization, resulting in the underuse of this asset. This competency gap emphasizes the need for capacity-building initiatives to provide healthcare professionals with the necessary technical and analytical skills [5], [6].

This training program was tailored to fill these gaps in the knowledge and skills of healthcare workers who process and visualize medical record data. Essential elements of the program included concepts used in data analytics, exploration of analytical methods and tools available for transforming data, and learnings on how to interpret and visualize findings—from dashboards to reports. They become indispensable in training healthcare professionals to properly manage data, elaborate insight, and communicate results in convincing and uncluttered ways to enable data-based decision-making in the clinic.

This training intends to close the ever-widening chasm between the potential of medical record data and its clinical use. The program focuses on enabling healthcare workers to analyze, interpret, visualize, and understand data, enforcing a culture of data-driven decision-making in the clinic. This endeavor empowers the healthcare workforce with enhanced operational capabilities and aligns with the overall objective of augmenting patient care by facilitating data-driven and evidence-based decision-making. As global attention increasingly shifts toward the role of data in healthcare, such training programs provide a vital cornerstone for the future of health workers as they prepare for an ever-changing and data-driven healthcare environment.

RESEARCH METHOD

This community service activity was held in October 2024 and focused on educating healthcare workers in the medical record data process at the Inpatient Clinic. Training participants as many as 20 health workers in the clinic of Aisyiyah Pandaan. The training initiative aimed to ensure that participants could process raw data into useful information that can be interpreted quickly using dashboards, supporting decision-making based on data. The methodology was a proposed work of structured activities from preparation through action and to evaluation, using a combination of active and experiential learning.

The one-day training was well-structured to avoid wasting time on things that have no practical use and mainly focused on the understanding and implementation of data processing and visualization of medical records for healthcare workers. In the first half of the day, we learned about the importance of data-driven decision-making and some basic analytical concepts. We took an overview of user-friendly tools for data analysis, covering the fundamentals. In addition to being a great networking opportunity, the midday session provided a hands-on workshop allowing attendees to use dashboard tools to organize, analyze, and visualize medical record data — providing a practical foundation for taking raw data and turning it into actionable insights. The second half of the agenda revolved around understanding the visualization data and its possible inferences, and participants showcased their dashboards to peers and trainers for

feedback. What followed was a recap of essential learning elements, evaluations of trainees after the program, and seeking feedback, thus ensuring all attendees left the workshop armed with advanced techniques and practical knowledge that they could implement in their professional capacities within the industry.

RESULTS AND DISCUSSION

The primary purpose of this study was to evaluate the effect of a training program on improving the knowledge and skills of health professionals working in inpatient clinics. Using dashboard visualization tools, the training curriculum was designed for these professionals to turn raw medical record data into meaningful information. Both knowledge (such as concepts related to data usage in decision-making, data analysis, and data analysis tools) and skills (in particular, data analysis, analytics tools proficiency, interpretation of data, and inference from data analysis) were assessed.

Comparative analysis to determine the effectiveness of training at the Aisyiyah Pandaan inpatient clinic using the SPSS test. A data normality test was conducted to assess the accuracy of the test. Based on the Shapiro-Wilk test obtained as in the following table.

Table 1. Data normality test.

	Tests of Normality					
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
diff_1	.320	20	<.001	.763	20	<.001
diff_2	.251	20	.002	.800	20	<.001
diff_3	.248	20	.002	.834	20	.003
diff_4	.350	20	<.001	.736	20	<.001
diff_5	.215	20	.016	.829	20	.002

a. Lilliefors Significance Correction

Based on the data in Table 1, it is found that the data is normally distributed (p<0.05), so the following analysis is to use the paired t-test.

Table 2. Paired samples T-test.

	Paired Differences		95% Confidence Interval of the Difference				Significance	
	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
pre_knowledge	.57297	.12812	-.74316	-.20684	-3.707	19	<.001	.001
post_ knowledge	.38389	.08584	-.77966	-.42034	-6.990	19	<.001	<.001

pre_data analystcapability	.53558	.11976	-.70066	-.19934	-3.758	19	<.001	.001
post_ data analystcapability	.57124	.12773	-.56735	-.03265	-2.349	19	.015	.030
pre_Utilized the tools' capabilities.	.55251	.12354	-.65858	-.14142	-3.238	19	.002	.004

Results of a paired samples test [t = 6.0, n = 50, p < 0.01, CI 95% = (3.56, 5.84)] showed a significant positive effect of the training intervention on the knowledge and skills of healthcare workers regarding the conversion of medical record data into intelligible and understandable dashboards in inpatient clinics. The training intervention's impact on healthcare workers' ability to convert medical record data into intelligible dashboards in inpatient clinics is multifaceted. The effectiveness of such interventions can be assessed by examining improvements in knowledge and skills related to data management and analytics. Several studies have explored the impact of training on healthcare workers' knowledge and skills, albeit in different contexts [7], [8], [9], [10]. The independent variable of interest, awareness of utilizing data for decision-making, showed a mean difference of -0.475 (p = 0.001) with a 95% confidence interval of [-0.743, -0.207]. This represents a substantial knowledge increase from participants' pre-training knowledge, which indicates that the training did a good job of increasing participants' understanding of the theory behind data-informed decision-making. The knowledge of data mining, on the other hand, showed a more significant improvement, with a mean difference of -0.600 (p < 0.001) and a confidence interval [-0.780, -0.420]. This represents a significant improvement in participants' understanding and usage of analytical approaches, which are essential to operate in increasingly data-driven healthcare ecosystems. Training programs have significantly enhanced participants' experience and knowledge across various domains, including data-informed decision-making. The effectiveness of these programs is often measured by comparing pre-training and post-training knowledge levels, with substantial improvements indicating successful knowledge transfer. This is evident in several studies that have employed different training methodologies to achieve similar outcomes [11], [12], [13].

In the Variable of data analysis capability, the mean difference was −0.450 (p = 0.001) with a confidence interval of [-0.701, -0.199], demonstrating that participants' fundamental ability to analyze medical data significantly improved after the training. Correspondingly, the fourth variable (knowledge and capability of utilizing analytical tools) showed a statistically significant improvement in mean difference of -0.400 (p = 0.004) and confidence interval of [-0.659, -0.141]. It indicates that people learned much more about and thrived using data analysis tools, crucial in transforming medical record data into actionable insights. The improvement in participants' ability to analyze medical data after training is well-documented across various studies, highlighting the

effectiveness of structured educational interventions in enhancing analytical skills and the capability to utilize analytical tools [8], [14], [15].

The domain of data analytic capability (steps of input, processing, output, and presentation) also showed a statistically significant improvement (mean difference of -0.300, p = 0.030, and confidence interval of [-0.567, -0.033]). The change in this variable is statistically significant, and its lower magnitude of the mean difference than other variables suggests that participants did improve. Still, the area might require further emphasis through follow-up training or practice [16].

Each variable showed marked improvements, indicating that the training program had successfully closed conceptual and practical knowledge and skills gaps in participants' understanding. The substantial improvement in knowledge concerning data analysis and data-driven decision-making indicates that participants grasped the theoretical foundations and recognized more clearly how to leverage data to gain insights that prompt evidence-based actions. These developments include improvements in analytical tools and data interpretation skills, emphasizing the practical aspect of the training, and ensuring that participants were not just information recipients but also actively applying their knowledge in real situations. In part, due to a relatively modest gain in the ability to conclude, this may require more practical exposure to data and demand in the real world. Such a result carries special importance as synthesizing insight and delivering actionable recommendations is a core element of data-informed decision-making in healthcare. The anvil will mean that in the future, the program must touch on more advanced modules that will focus more on data interpretation and conclusion drawing, which can be aided by either a mentorship or a hands-on learning practice. It could also leverage the effects of such training on the delivery of health services and clinical decision-making.

These findings underscore the effectiveness of the training program in significantly enhancing the participants' knowledge and capabilities in all measured areas. Of these, the most significant improvements corresponded to their ability to analyze and use data to inform decision-making, with enhancements in analytical tools being the second largest. Overall, the results indicated that the training program successfully filled key gaps in the competencies of healthcare workers, providing them with powerful tools for processing and visualizing medical record data. However, the apparent lack of improvement in their ability to summarize and synthesize information suggests that future training initiatives may best serve this group by dedicating more time to practical scenarios in which they are tasked with summarizing and deriving insight from what they are reading, with the ultimate objective being synthesizing information into discussion-points. By progressing data-driven decisions in healthcare places, such advancements can lead to improved patient care and operational efficiencies.

CONCLUSION

Fundamental Finding : The training program successfully enhanced healthcare workers' abilities to process and visualize medical record data, significantly improving their knowledge of data analysis and decision-making. The results showed a substantial increase in understanding of data analysis concepts and proficiency in using analytical tools, which is essential for transforming raw data into actionable insights for improving patient care and operational efficiency. These improvements highlight the importance of equipping healthcare workers with the necessary skills to effectively utilize medical data in their daily work. **Implication :** The training's success in improving data analysis skills emphasizes the need for similar initiatives across healthcare settings. By empowering healthcare workers with data-driven decision-making capabilities, these programs can contribute to better patient outcomes, optimized resource allocation, and enhanced operational efficiency. The integration of data analytics into healthcare practices can lead to more informed, evidence-based decisions, which is crucial for improving the quality of care and addressing current healthcare challenges. **Limitation :** While the training program showed significant improvements in participants' knowledge and skills, its effectiveness may be limited by the relatively brief duration of the workshop. The inability to achieve a substantial improvement in data synthesis and conclusion drawing suggests that further practice and extended training sessions may be required to address this gap. Additionally, the results may not be generalizable to other healthcare settings without considering contextual factors. **Future Research :** Future research could explore the long-term impact of such training programs on healthcare workers' ability to consistently apply their data analysis skills in real-world scenarios. Additionally, studies could focus on refining training methods, particularly in the areas of data synthesis and decision-making, by integrating more hands-on practice and mentorship. Investigating the broader effects of data-driven decision-making on patient care and clinical outcomes would also provide valuable insights.

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