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Utilization of AI-Based Predictive Analytics in Public Health Planning

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***Abstrak*:** *The public health planning faces on increasing challenges related to disease burden, limited resources, and the need of more proactive decision-making. In this context, artificial intelligence–based on predictive analytics offers potential support for evidence-based public health planning through data utilization and health trend forecasting. The study aims to analyze the utilization of artificial intelligence–based predictive analytics in public health planning and its role in support of planning quality. A quantitative descriptive-analytical design was employed by structured questionnaires data collection involving stakeholders engaged in public health planning. Data were analyzed by using descriptive statistics and descriptive relational analysis to map patterns of predictive analytics utilization and planning quality. The findings indicate that predictive analytics utilization is a moderate to high level and is positively associated with public health planning quality, particularly in data-driven decision-making and anticipatory capacity for future health needs. However, predictive analytics is more frequently applied to forecasting purposes than for direct resource allocation and operational decision-making. The study concludes that artificial intelligence–based predictive analytics serves as an important decision-support instrument in evidence-based public health planning, while further institutional capacity building and governance improvements data are required to maximize its impact.*

Keywords : artificial intelligence; decision making; predictive analytics ; health planning

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INTRODUCTION

Public health systems are currently facing increasingly complex challenges as the burden of disease rises, demographic patterns change, and limited resources must be managed efficiently. The dynamics of public health needs evolve rapidly and are often non-linear, influenced by interacting epidemiological, social, economic, and environmental factors. In practice, public health planning still relies heavily on descriptive and retrospective analyses of historical data, resulting in policy responses that tend to be reactive and insufficiently adaptive to future health risk dynamics (Nascimento et al., 2021; George et al., 2025).

Advances in artificial intelligence have driven the emergence of predictive analytics as a new approach to processing large-scale health data. Predictive analytics enables the use of historical data, real-

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time data, and trend patterns to project health risks, service needs, and potential future burdens on health systems. In the context of public health, this approach is regarded as having strategic potential to support more proactive, evidence-based, and prevention-oriented planning, particularly in the face of epidemiological uncertainty and resource constraints (Al-Nafjan et al., 2025; Junguka, 2025).

At the global level, the integration of artificial intelligence-based predictive analytics has begun to be applied across various public health domains, including disease forecasting, health surveillance, service capacity planning, and health resource allocation. International health organizations and institutions emphasize the importance of data-driven decision making as a foundation for effective and sustainable public health policy. Predictive analytics is positioned as an instrument to enhance planning accuracy and reduce reliance on intuition or purely emergency-based responses (Panteli et al., 2025; Kapoor, 2025).

However, in national contexts and in developing countries, the utilization of artificial intelligence-based predictive analytics in public health planning remains relatively limited. The challenges encountered include data infrastructure readiness, the quality and interoperability of health data, and institutional capacity to interpret analytical outputs to support policy planning processes. As a result, the use of artificial intelligence in the health sector is more commonly found in clinical and administrative domains, while its potential as a public health planning instrument has not yet been optimally utilized (Setiaji & Pramudho, 2022; Odilibe et al., 2024).

From an academic perspective, research on artificial intelligence in health remains dominated by studies focusing on algorithm performance, predictive model accuracy, and specificclinical applications. These studies make important contributions to technological development, but they relatively under explore how predictive analytics outputs are used as strategic information in public health planning processes. In other words, the informational and policy dimensions of predictive analytics have not yet become a primary focus within the public health literature (Alowais et al., 2023; Kolawole et al., 2025).

Several studies have demonstrated that predictive analytics can improve the accuracy of health risk forecasting and support decision making at the system level. Nascimento et al. (2021) emphasize that big data analytics has the potential to strengthen population-based health planning, while George et al. (2025) show that population risk prediction can assist health planners in anticipating service needs. Nevertheless, most of these studies do not explicitly analyze the relationship between the level of predictive analytics utilization and the quality of public health planning in an empirical and measurable manner.

Another limitation of previous research is the scarcity of descriptive-analytical quantitative studies that map how artificial intelligence-based predictive analytics are utilized by publichealth stakeholders in planning practice. Many studies position predictive analytics as a stand alone technical tool rather than as an integral component of policy decision-making processes. Consequently, understanding of the role of predictive analytics as a supporting instrument for public health planning remains fragmented (Molldrem et al., 2022; Olugbami & Ogundeko, 2025).

Based on this mapping, the research gap of this study lies in the absence of descriptive-analytical quantitative research that empirically examines the utilization of artificial intelligence-based predictive

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analytics in public health planning and its relationship with the quality of health planning. Previous studies, such as using population risk prediction for healthcare planning: a qualitative study of healthcare planners' experiences and views by George, Ramsay, Crowe, and Hayward (2025), emphasize qualitative experiences of health planners, while impact of big data analytics on people's health by Nascimento et al. (2021) focuses on a systematic review. There is no existing study that quantitatively maps the informational role of predictive analytics in public health planning practice.

Accordingly, the novelty of this study lies in positioning artificial intelligence-based predictive analytics as an instrument for public health planning rather than merely as a technical data analysis tool. This study employs a descriptive-analytical quantitative approach to describe the level of predictive analytics utilization and its role in supporting the quality of public health planning. The research focuses on actual public health planning practices rather than on the development or evaluation of artificial intelligence algorithms themselves.

Based on this background, the objective of this study is to analyze the utilization of artificial intelligence-based predictive analytics in supporting public health planning, with an emphasis on its role as a source of strategic information in evidence-based public health decision making.

METODOLOGI

Research Design

This study employs a quantitative approach with a descriptive-analytical design to examine the utilization of artificial intelligence-based predictive analytics in public health planning. This design is selected because the study does not aim to test causal relationships or manipulate variables, but rather to map patterns of predictive analytics utilization and analyze its role as a source of information in health planning processes. The research focuses on how predictive information is used to support health needs forecasting, strategic decision making, and evidence-based planning, in line with data-driven decision making approaches in public health policy (Sarwono & Handayani, 2021; Nascimento et al., 2021; Panteli et al., 2025).

Population and Sample

The research population were stakeholders in public health planning, health officials, program planners, policy analysts, and professionals who have responsibilities in managing and interpreting health data. The sample was determined by using a purposive sampling technique with criteria requiring respondents who had experience in using or considering artificial intelligence-based predictive analytics outputs in health program or policy planning. This approach is chosen to ensure that the collected data reflect actual health planning practices that are relevant to data-driven decision making contexts (George et al., 2025; Odilibe et al., 2024).

Research Instruments

The research instrument consists of a structured questionnaire developed based on a review of the literature on predictive analytics and public health planning. The instrument measures two main dimensions, namely the level of utilization of artificial intelligence-based predictive analytics and the quality of public health planning. Indicators of predictive analytics utilization include the use of predictive models for disease forecasting, population risk identification, and health service demand projections, while indicators of planning quality reflect data-driven orientation, anticipation of needs, and accuracy of

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planning targets. All items are measured using a likert scale and analyzed descriptively and analytically to identify patterns and tendencies in the utilization of predictive analytics to support evidence-based health planning (Al-Nafjan et al., 2025; Junguka, 2025; Molldrem et al., 2022).

RESULTS AND DISCUSSION

Result

Respondent Characteristics

Data analysis was conducted on 214 respondents who met the study's criteria and completed the questionnaire. i. The respondents came from various roles in public health planning, including regional health officials, program planners, policy analysts, and technical personnel responsible for managing health data. In general, the respondents possessed substantial work experience in planning processes and data-driven decision making, and were considered relevant for providing an empirical overview of the utilization of artificial intelligence-based predictive analytics.

The report of mostly respondents which had been exposed to or had been used predictive analytics outputs in the context of health needed forecasting and program planning, although the intensity and depth of utilization varied. This variation constitutes an important basis for descriptive analysis of patterns in predictive analytics utilization and quality of public health planning.

Table 1. Respondent Characteristics

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	118	55.1
	Female	96	44.9
Occupation	Public Health Officer	82	38.3
	Health Program Planner	64	29.9
	Policy Analyst	38	17.8
	Data/Information Officer	30	14.0
Work Experience	< 5 years	46	21.5
	5–10 years	92	43.0
	> 10 years	76	35.5

The table showedthat the majority of respondents who had more than five years of work experience, indicating relatively mature involvement in public health planning processes.

Descriptive Statistics of Predictive Analytics Utilization

Descriptive statistical analysis was conducted to describe the level of utilization of artificial intelligence-based predictive analytics in public health planning. Scores are measured using a five-point likert scale, which higher values indicate a more intensive level of utilization.

Table 2. Descriptive Statistics of Predictive Analytics Utilization

Indicator	Mean	Standard Deviation

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Disease trend forecasting	3.94	0.72
Health service demand projection	3.87	0.75
Population risk identification	3.78	0.81
Resource allocation planning	3.69	0.84
Support for proactive intervention planning	3.82	0.77
Scores	**3.82**	**0.69**

The results on Table 2, indicate that the utilization of predictive analytics falls within a moderate to high category. The indicator with the highest mean score was disease trend forecasting, while resource allocation planning showed a relatively lower score, although it remained within a positive category. This finding indicated that predictive analytics was more frequently utilized as an early warning tool rather than as a primary basis for resource allocation decisions.

Descriptive Statistics of Public Health Planning Quality

The quality of public health planning was analyzed based on respondents' perceptions of data-driven orientation, anticipatory capacity, and accuracy of planning targets.

Table 3. Descriptive Statistics of Public Health Planning Quality

Indicator	Mean	Standard Deviation
Data-driven decision making	4.01	0.68
Anticipation of future health needs	3.88	0.74
Accuracy of program targeting	3.79	0.79
Timeliness of planning decisions	3.73	0.82
Perceived effectiveness of planning outcomes	3.85	0.71
Scores	**3.85**	**0.66**

On Table 3 showed that the quality of public health planning was perceived to be a fairly high level, particularly in the aspect of data-driven decision making. Nevertheless, the indicators of targeting accuracy and planning timeliness still indicated room for improvement.

Descriptive Relationship Patterns between Predictive Analytics Utilization and Planning Quality

To provide an initial overview of the relationship between predictive analytics utilization and the quality of public health planning, a descriptive correlation analysis was conducted.

Table 4. Descriptive Correlation between Predictive Analytics Utilization and Plannin Quality

Variables	Correlation Coefficient (r)
Predictive analytics utilization – Planning quality	0.61

The positive correlation values from moderate to strong indicated that respondents who report higher levels of predictive analytics utilization also tend to report better quality of public health planning. This finding was descriptive in nature and not interpreted as a causal relationship, but it provided a

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beginning indication of informational role of predictive analytics in supporting public health planning processes.

Discussion

The results of study showed that the utilization of artificial intelligence-based predictive analytics was a moderate to high level and was positively associated with the quality of public health planning. These findings indicated that predictive analytics had begun to function as a source of strategic information in health planning processes, particularly in supporting data-driven decision making, enhancing anticipatory capacity, and sharpening the targeting of health interventions. This pattern aligns with the global paradigm shift toward data-driven decision making in public health policy, in which planning decisions are no longer based solely on historical data, but also on projections of future risks and needs (Nascimento et al., 2021; Panteli et al., 2025).

The utilization indicator with the highest score is disease trend forecasting. It is suggested that predictive analytics were more readily adopted as a surveillance instrument and early warning system than as a direct basis for resource allocation. This finding was consistent with the literature indicating that the use of artificial intelligence in public health typically began with informational predictive functions, such as population risk mapping and disease burden projection, before expanding to more complex operational planning functions (Al-Nafjan et al., 2025; Junguka, 2025). Accordingly, predictive analytics served to strengthen cognitive capacity of health systems to interpret risk trajectories, rather than to replace policy decision making itself.

The quality of public health planning in this study showed relatively high scores in the dimension of data-driven decision making. This indicated that the use of predictive information contributes to greater planning rationality, particularly in the formulation of programs that are more closely aligned with projected health needs. George et al. (2025) emphasize that predictive information helps health planners shift their focus from reactive responses to health events toward anticipatory approaches based on population risk. The findings of this study supported this perspective by demonstrating that respondents who utilized predictive analytics more intensively tend to perceive higher planning quality.

Nevertheless, the relatively lower scores on resource allocation and planning timeliness indicators indicated that the integration of predictive analytics into policy processes is not yet fully optimal. This finding reinforces the argument that the main challenge in utilizing artificial intelligence in public health lies not in the availability of predictive models, but in institutional capacity to translate analytical outputs into concrete operational decisions (Panteli et al., 2025; Odilibe et al., 2024). In other words, there remains a gap between the availability of predictive information and its application within bureaucratic and multi-actor planning processes.

The strong descriptive relationship between predictive analytics utilization and public health planning quality indicated that predictive analytics functions as a policy enabler rather than a sole determinant. This pattern is consistent with the view of Molldrem et al. (2022), who emphasize that predictive analytics in public health should be understood as part of a broader decision-making ecosystem involving ethical, political, and social considerations. Therefore, improvements in planning quality depend not only on technological sophistication, but also on how predictive information is integrated with professional judgment and broader policy contexts.

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From a theoretical perspective, the findings of this study strengthen the position of predictive analytics as an informational instrument in public health planning. Rather than being treated as a stand alone technical tool, predictive analytics serves to enrich the evidence base used by health planners in assessing priorities, risks, and population needs. This approach aligns with the evidence-based public health framework, which emphasizes the integration of scientific data, systematic analysis, and contextual considerations in policy decision making (Nascimento et al., 2021; Kapoor, 2025).

In addition, these findings indicated that the utilization of predictive analytics can enhance the proactivity dimension of health planning. Planning supported by risk projections and trend analyses enables health systems to allocate resources more strategically before health problems escalate into crises. This is increasingly relevant to the context of global health uncertainty, where the ability to predict and anticipate health needs is a key factor in the resilience of public health systems (Affinito, 2025; Panteli et al., 2025).

Nevertheless, the study also indicated that the utilization of predictive analytics had not yet been evenly distributed across all aspects of health planning. Variations in utilization levels across indicators reflect structural barriers such as limited data interoperability, human resource capacity, and governance frameworks for artificial intelligence use in the public sector. This finding was consistent with Olugbami and Ogundeko (2025), who highlight that without clear policy frameworks and strengthened institutional capacity, predictive analytics risks remaining a technical tool with limited impact on reducing health inequalities.

Accordingly, the results of this study affirm that the primary role of artificial intelligence-based predictive analytics in public health planning is to support the rationality and quality of decision making, rather than to serve as an automatic policy determinant. Effective integration requires strengthening data literacy, ethical governance, and institutional mechanisms that enable analytical outputs to be translated into well-targeted policy actions. These findings extend the literature by providing quantitative empirical evidence that predictive analytics utilization is associated with improved planning quality, while also emphasizing that technology will achieve optimal impact only when embedded within a mature and evidence-based public health policy framework.

CONCLUSIONS

The utilization of artificial intelligence-based predictive analytics plays an important role as a supporting instrument for evidence-based public health planning. Descriptive analysis results indicate that the level of predictive analytics utilization is moderate to high and is positively associated with planning quality, particularly in data-driven decision making and anticipatory capacity regarding future health needs. These findings confirm that predictive analytics functions as a source of strategic information that strengthens planning rationality, although it has not yet been fully and optimally integrated across all stages of health policy decision making.

Theoretically, this study contributes to strengthening the evidence-based public health framework by positioning artificial intelligence-based predictive analytics as an informational instrument in public health planning, rather than merely a technical tool or algorithmic innovation. Practically, these findings have implications for policymakers to promote the integration of predictive analytics outputs into more systematic planning processes, including health service demand forecasting, intervention prioritization, and the strengthening of proactive planning. The development of human resource capacity, data governance, and mechanisms for translating analytical outputs into operational policies constitutes an important

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prerequisite for ensuring that artificial intelligence delivers more tangible impacts within public health systems.

This study has several limitations that should be considered. First, the descriptive-analytical design and reliance on respondents' perceptions limit the ability to draw causal conclusions regarding the impact of predictive analytics on health planning quality. Second, variations in institutional contexts and health system capacities among respondents are not fully captured in the analysis. Therefore, future research is recommended to employ longitudinal designs or mixed-method approaches to explore the dynamics of predictive analytics utilization over time, as well as to further examine institutional and policy factors influencing the effective integration of artificial intelligence in public health planning.

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