Leadership Knowledge, Attitude, and Skill Changes Among LMICs Public Health Fellows in Korea: Pre- and Intra-COVID-19 Periods

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: Pre- and Intra-COVID-19 Periods

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ABSTRACT

Leadership Knowledge, Attitude, and Skill Changes Among LMICs Public Health Fellows in Korea: Pre- and Intra-COVID-19 Periods

This study examined changes in leadership-related public health knowledge, attitude, and skill among 97 public health professionals from low- and middle-income countries (LMICs) who participated in the Korea International Cooperation Agency (KOICA) Master's Degree Program at Yonsei University between 2017 and 2022. A quantitative, two-wave panel design was employed using secondary data from three surveys administered at the beginning and end of the 18-month program period. Paired t-tests revealed a significant increase in knowledge scores ($\Delta M=+0.59$, $p<.001$), but no significant changes in attitude or skill were observed. Multiple regression analysis showed that participants over 40 years old had significantly lower post-program knowledge scores compared to those under 30 ($\beta=-0.69$, $p=.021$). Program type was a significant predictor of skill scores, with Global Health Security (GHS) participants outperforming those in the Global Health Policy and Financing (GHPF) program ($\beta=-0.42$, $p=.013$). Notably, attitude change strongly predicted skill improvement ($\beta=0.77$, $p<.001$), while knowledge change did not. These findings suggest that the KOICA program effectively enhanced theoretical knowledge but had limited impact on attitude and skill in the short term, potentially due to challenges posed by the COVID-19 pandemic and limited opportunities for practical application. The results underscore the importance of competency-based training, learner-centered instructional design, and longitudinal assessment of leadership development outcomes in LMICs. Recommendations include tailoring curricula to specific programs, integrating practicum components, and conducting follow-up assessments to capture long-term changes in attitude and skill.

Key words : Public health leadership, KOICA, Fellowship, LMICs, Knowledge, Attitude, Skill, COVID-19

1. Introduction

1.1. Research background

"A global pandemic requires a world effort to end it—none of us will be safe until everyone is safe," said Ursula von der Leyen, the 13th president of the European Commission.

In the past decades, humans have experienced a number of viral pandemics, such as the severe acute respiratory syndrome coronavirus infection (SARS-CoV-1) outbreak in 2003, H1N1 swine influenza pandemic in 2009, Ebola virus disease outbreak in 2014, and SARS-CoV-2 (COVID-19) outbreak which has declared a pandemic by World Health Organization (WHO) in 2020. Those public health emergencies impacted economic, social, and political spheres worldwide, and it has become a keyframe to link health and security and expanded the list of global health security concerns (Legido-Quigley et al, 2023).

In 2005, the United States adopted the revised International Health Regulation (IHR) along with WHO member states. In 2014, the Global Health Security Agenda (GHSA) was launched. The GHSA is an international effort to build and improve national capacity to prevent, detect, and respond to infectious disease threats and to achieve the core capacities required under the IHR.

When the Global Health Security Agenda 2015 High-Level Meeting held in Seoul, South Korea, the "Seoul Declaration" was adopted, eleven Action Packages of the GHSA were reviewed, and the next five-year plan was discussed. In the same year, the Korean government implemented the Safe Life for All (SLA) Initiative, which aims to support 13 developing countries to enhance their public health infrastructure with USD 100 million commitment from 2016 to 2020 (Pope, 2015).

In 2017, under the slogan “Take Action,” South Korea chaired the GHSA Steering Group and launched a new initiative to support global health capacity building. In collaboration with the Korea International Cooperation Agency (KOICA), the Graduate School of Public Health, Yonsei University introduced the KOICA Master’s Degree Program in GHSA Capacity Building. This program marked the first and only KOICA-sponsored Master of Public Health (MPH) program in South Korea specifically designed for fellows from developing countries. It was established in response to the pressing need for long-term, in-depth capacity building opportunities, particularly in countries with under-resourced health systems and limited infrastructure for prevention, real-time surveillance, and coordinated responses to infectious disease outbreaks.

While short-term training programs sometimes demonstrate effectiveness in strengthening the capabilities of public officials, inadequate national health systems and limited infrastructure highlight the need for more comprehensive, sustainable strategies particularly on infectious disease control. There are growing demands for long-term, in-depth capacity building programs that can sustainably support public health leadership and system resilience in resource-limited settings.

The KOICA Master’s Degree Program was developed in response to the expressed needs of developing countries and is designed to contribute to the economic and social development of the participants’ home countries. The program aims to equip public health professionals with the specialized knowledge and competencies required to effectively address infectious disease challenges. Through intensive academic training, participants are expected to strengthen their capacity in the public health field, reinforce their country’s public health systems, and improve health outcomes upon their return.

While core competencies in public health from the essential foundation for effective practice, leadership extends beyond these technical skills to encompass the knowledge, attitudes, and behaviors necessary to drive meaningful change within complex health systems (MacKay et al., 2024). Leadership is critical because public health professionals are often required to navigate uncertainty, manage crises, and unite diverse stakeholders to address multifaceted health challenges, such as pandemics, health

inequities, and climate change (Gilmartin & D'Aunno, 2007; Harter, 2020; MacKay et al., 2024). Effective leaders in public health demonstrate vision, ethical commitment, and the ability to inspire and influence others, fostering collaboration across disciplines and organizations to achieve shared goals (Alban-Metcalfe & Alimo-Metcalfe, 2013; Institute of Medicine, 2003). Unlike core competencies alone, leadership involves the capacity for systems thinking, adaptability, and strategic communication, as well as the cultivation of values like service, equity, and innovation (Boyatzis & Boyatzis, 2008; Krathwohl et al., 1971). As a result, developing leadership-related knowledge, attitudes, and skills is essential for public health professionals to advance health equity, respond to emerging threats, and ensure resilient, high-performing health systems (MacKay et al., 2024).

1.2. Purpose of the Study

The purpose of this study was to examine changes in leadership-related knowledge, attitude, and skill among participants of the KOICA Master's Degree Program in Public Health—a fully funded 18-month scholarship program for international public health professionals. Specifically, the study aimed to evaluate whether significant improvements occurred across the three competency domains from the beginning to the end of the program. It also explored whether changes in self-reported knowledge and attitude could significantly predict improvement in leadership skills, while accounting for participants' demographic characteristics.

The findings of this study are expected to demonstrate the effectiveness of the KOICA public health training program in fostering leadership competencies and contribute to the growing body of evidence supporting competency-based leadership development in global health education.

1.3. Significance and Research Questions

This study provides empirical evidence that Official Development Assistance (ODA) education—specifically, scholarship-based fellowship programs such as the KOICA Master's Degree Program in Public Health—can significantly contribute to the development of leadership skill among public health professionals and officials from low- and middle-income countries (LMICs). By assessing changes in participants' leadership related knowledge, attitude, and skill over the course of the 18-month program, the study offers important insight into the value of competency-based education within practical, cross-cultural learning environments.

The two-wave quantitative panel design employed in this study goes beyond cross-sectional evaluations by capturing individual-level development over time. This design strengthens the study's capacity to track the growth of self-reported leadership competencies and provides a more nuanced understanding of how educational experiences translate into perceived skill gains.

Lastly, the findings have practical implications for the planning, delivery, and evaluation of global health training programs. The results may inform curriculum design, funding priorities, and policy decisions aimed at strengthening leadership pipelines within public health systems globally, particularly in resource-constrained contexts.

The followings are the main research questions of this study:

Question 1. To what extent do participants demonstrate changes in leadership-related knowledge, attitude, and skill between the beginning and end of the KOICA Master's Degree Program in Public Health?

Question 2. Do changes in leadership-related knowledge and attitude significantly predict changes in self-reported leadership skill among program participants?

Question 3. Do demographic characteristics—such as gender, age, region, CGPA, and English-speaking country status—moderate or influence leadership-related knowledge, attitude, and skill change?

2. Korea's Official Development Assistance (ODA) and Core Competencies

2.1. Overview of Korea's ODA

Official Development Assistance (ODA) refers to government aid intended to foster the economic growth and welfare of developing countries and reduce inequalities both between developed and developing countries and within developing countries (Office for Government Policy Coordination [OPC], n.d.). The emergence of ODA is rooted in the post-World War II period, particularly with the adoption of the United Nations (UN) Charter in 1945, which highlighted the necessity of international cooperation for advancing global development and human rights.

After the Korean War, South Korea found itself among the poorest nations globally and relied extensively on international aid, receiving about USD 12.7 billion in assistance—mainly from the United States, Japan, and European Development Assistance Committee (DAC) countries—over the period from 1945 to the late 1990s (Park, Han, & Lee, 2024; Organisation for Economic Co-operation and Development [OECD], 2008; Marx & Soares, 2013).

South Korea accomplished rapid economic growth in a short period, so-called "Miracle on the Han River," and the country transitioned from one of the poorest recipients to a donor in the 1960s (Koen, André, Beom, Purwin, & Kim, 2021; Kwak, 2016). In 1963, Korea launched its first official aid initiative as a donor with a fellowship program sponsored jointly by the Korean government and the United States Agency for International Development (USAID) (ODA Korea, 2023; DiMoia, 2024). In 1965, South Korea began a government-funded fellowship program for Developing Countries (Korea International Cooperation Agency [KOICA], n.d.-a). Subsequently, in 1987, the Economic Development

Cooperation Fund (EDCF) was established, initiating the provision of concessional loans to developing countries, and the Korea International Cooperation Agency (KOICA) was established in 1991 under the Ministry of Foreign Affairs to promote grant aid cooperation and technical cooperation (KOICA, n.d.-a).

In 2000, South Korea was officially removed from the Organisation for Economic Co-operation and Development (OECD) DAC list of ODA recipients. A decade later, in 2010, South Korea became the 24th member of the OECD DAC, making it the first country to transition from being an ODA recipient to joining the DAC as a donor (Ministry of Foreign Affairs of the Republic of Korea [MoFA], 2009).

South Korea's ODA volume increased from USD 1.17 billion in 2010, when it ranked 18th among 23 DAC members with an ODA/GNI ratio of 0.12%, to USD 3.16 billion in 2023, ranking 14th among 31 DAC members with an ODA/GNI ratio of 0.18% (Kwak, 2016; MoFA, 2009; ODA Korea, 2025.-a, Kwak, 2024). In 2023, South Korea allocated 74% of its ODA to bilateral aid and 26% to multilateral aid (ODA Korea, 2025.-a). Within bilateral aid, transportation and warehousing received USD 333.86 million, health USD 304 million, and education USD 232.89 million (ODA Korea, 2025.-b). This distribution highlights Korea's substantial emphasis on the health and education sectors within its bilateral ODA portfolio.

International Development Cooperation, the broader concept encompassing ODA, emphasizes partnership and mutual accountability. It is designed to reduce inequalities between countries and to eradicate poverty as a matter of fundamental human rights (OPC, n.d.). While economic development was long considered the primary solution to poverty, it is now recognized that poverty alleviation requires efforts to both social and economic development (OPC, n.d.).

2.2. Education and ODA: Korea's Strategic Focus

Education is one of the most powerful tools to lift people out of poverty (United Nations Educational, Scientific and Cultural Organization [UNESCO], n.d.). Not only is it a basic human right, but investing in education is also considered the most sustainable approach and is connected to other fundamental human rights (UNESCO, n.d.).

According to the UN Sustainable Development Goals (SDGs) Report 2024, only 17% of the targets are on schedule to be met by the 2030 deadline. Eighteen percent of the targets showing stagnation and seventeen percent are regressing compared to 2015, which is alarmingly off track (United Nations [UN], 2024). The COVID-19 outbreak and its subsequent disruptions have had both direct and indirect impacts on the progress towards the SDGs, including SDG 1 (No Poverty), SDG 3 (Good Health and Well-being), and SDG 4 (Quality Education).

South Korea's successful development experience marked by its transition from an aid recipient to a donor, offers a strategic advantage in education ODA. Tilak (2002a) emphasized the critical role of higher education and research in building knowledge societies. While education-focused ODA has been extensively studied, there is a notable lack of research specifically on higher education ODA from 2000 to 2015 (Ryu & Cho, 2020).

South Korea's higher education ODA projects are managed by various governmental and public entities, with the Ministry of Education, KOICA, and the Economic Development Cooperation Fund (EDCF) serving as the primary managing institutions. From 2017 to 2019, the Ministry of Education holds the largest share of higher education ODA, followed by KOICA and EDCF, with respective proportions of 45%, 40%, and 12% (Lee, 2022). Among higher education ODA, support for international students and fellows from developing countries accounts for 40%, making it the largest proportion (Lee, 2022).

One of South Korea's flagship fellowship programs is the Capacity Improvement and Advancement for Tomorrow (CIAT) Fellowship Program, operated by KOICA, which supports human resource development training in low- and middle-income countries (LMICs). It is an invitational training program that invites government officials, researchers, policy makers and engineers from LMICs to share Korea's technologies and knowledge as well as its unique development experience. The acronym of the program, CIAT, phonetically resembles the Korean word "seed," and serves as a metaphor for cultivating and disseminating human resources across developing countries after training them in Korea—like planting seeds (KOICA, n.d.-b). Though small, seeds hold infinite potential to grow into large trees.

2.3 Evaluation of Fellowship Programs and Sectoral Initiatives

Although the invitational fellowship program is actively operated, research on it remains limited, especially studies focusing on the public health sector (Jon, 2019; Lee et al., 2020).

While some studies have examined invited fellowship programs, research remains limited relative to the scale of these initiatives. Bae and No (2011) did not address the Tanzania invitation-based training program. Han et al. (2011) conducted a quantitative study, whereas Jon (2019) examined KOICA's degree-granting training program abroad using qualitative methods rather than an empirical approach. Several studies have explored aspects such as changes in country image and learning outcomes, but comprehensive evaluations of training effectiveness and improvement are lacking.

There are various government-funded international scholarship programs operated by different ministries and agencies in South Korea. Among them, the Global Korea Scholarship Program (GKS) is a well-known, flagship international scholarship offered by the Korean Ministry of Education. It supports a diverse range of international students

worldwide and has produced more than 15,000 graduates as of 2023, according to the statistical data provided by the National Institute for International Education.

Notable examples of fellowship program include the Lee Jong Wook Fellowship and the CIAT Global Fellowship Program. the Lee Jong Wook Fellowship managed by the Korea Foundation for International Healthcare (KOFIH) to commemorate Dr. Lee Jong Wook's legacy and commitment to global health as the 6th Director-General of the World Health Organization (WHO). The program operates under the Ministry of Health and Welfare and has trained 1,500 graduates since 2007 (MoFA, 2024). The largest official fellowship program is the CIAT Global Fellowship Program, conducted by KOICA under the Ministry of Foreign Affairs. Since its inception in 1997, the CIAT program produced over 6,000 graduates (Kim, 2024).

KOICA's main strategy for education includes advancing "inclusive education and close education gaps by expanding access to and improving the quality of education in developing countries" (OECD, 2024). It contributes to enhancing everyone's rights to education and aligns with the SDGs, especially Goal 4. As mentioned, the CIAT Global Fellowship Program focuses on human resource development of leaders in specific fields in developing countries. The CIAT Master's degree program includes three program evaluations for continuous improvement, held in the beginning, during and after the program. Most assessments focus on immediate satisfaction with limited assessment on long-term impact (Kim & Noh, 2020).

2.4 Capacity Building and Human Resource Development

Global health resolutions and mandates have long stressed the importance of sustained learning opportunities to strengthen the health workforce (WHO, 2020). UN General Assembly and World Health Assembly resolutions and related strategies have also highlighted the critical need to address health workforce challenges for better health

outcomes (WHO, 2020). In an Asian Development Bank working paper, it is argued that non-income development gaps must be addressed through investment in education and health to close global development disparities (Brooks et al., 2010).

Kang (2014) argued that South Korea should share the know-how it gained during its transition from aid recipient to donor, noting that many studies criticize the low effectiveness of ODA and raise concerns about its sustainability. Lee et al. (2020) asserted that health policy capacity building projects yield relatively strong ripple effects and greater sustainability compared to other forms of grant aid. Several studies have demonstrated the positive impact of capacity building programs and underscored the importance and necessity of capacity building training to address health issues (Lee et al. 2020). Lee (2021) asserted that human resource capacity building has been underscored and incorporated into health sector ODA, and Lee cited another study demonstrating that transferring know-how from a recipient country that received capacity building training to another has proven significant effectiveness.

Human resource capacity building is increasingly emphasized in South Korea's health ODA, with strategies expanding to include invited fellowship programs and deployment of trained professionals to projects in recipient countries. Universities play a pivotal role in both capacity building and education ODA as actors, knowledge hubs, and implementation partners. As a result, invitational fellowship programs have been expanding in South Korea, further highlighting their importance.

2.5. Core Competencies and Leadership in Public Health: Knowledge, Attitude, and Skill

In public health, core competencies refer to the fundamental combination of knowledge, attitude, and skill, necessary for professionals to perform their duties effectively (Public Health Agency of Canada, 2008; Moynihan et al., 2015 Albarqouni et al., 2018; Mallidou, 2018). These competencies establish a common framework that outlines the expected capabilities across various health professions.

In the WHO's Global Competency and Outcomes Framework for Universal Health Coverage, competencies are defined not merely as discrete components of knowledge, attitude, and skill, but as the integrated capacity to apply these elements effectively in real-world service delivery contexts. A competency-driven approach has been shown to promote consistent quality of care and foster adaptability among health professionals, enabling them to respond efficiently to evolving challenges and thereby reinforcing the resilience of health systems (WHO, 2022).

Frenk et al. (2022) reviewed 1,000 randomly selected papers from 2,164 publications that cited the 2010 Lancet Commission to examine developments in health professional education. In their study, among the 437 papers requiring detailed examination, competency-based education emerged as the most frequently cited recommendation (24%), highlighting growing consensus around competency-driven approaches as the preferred goal of health professional education.

In Korea, while numerous studies have explored the relationship between students' core competencies and learning outcomes, most have focused on liberal-arts curricula rather than professional fields. More specifically, in terms of KOICA's CIAT degree fellowship programs, despite the extensive scale of the program, only a few evaluations exist, and those primarily address the development of assessment tools and the measurement of participant satisfaction.

As mentioned earlier, core competencies are the essential knowledge, attitude, and skill required for health professionals to be effective in their fields. In public health, these competencies are formalized through competency statements and frameworks developed by governing bodies worldwide, such as in Canada, the United States (US), the United Kingdom (UK), the European Union (EU), and Australia. While each framework is tailored to its context, all aim to strengthen the public health workforce's ability to address current and future challenges (WHO, 2022). These frameworks serve as standards for training, curriculum development, workforce assessment, and professional development (Council on Linkages Between Academia and Public Health Practice [Council on Linkages], 2021; MacKay et al., 2024). They help ensure consistency, facilitate interdisciplinary collaboration, and provide a shared understanding of roles and responsibilities among public health professionals (MacKay et al., 2024).

A competent workforce is critical for a high-performing health system, contributing to effective, efficient, and equitable health services. Conversely, a lack of competence can lead to substandard care and significant social and economic costs (Slawomirski & Klazinga, 2022). Identifying and developing core competencies is vital for strengthening the public health workforce, ensuring quality service delivery, and improving health outcomes globally. The link between competency and performance is shaped by factors such as oversight, feedback, the availability of resources, worker traits, and the wider social and organizational environments. (Slawomirski & Klazinga, 2022; Anesi & Kerlin, 2021; Yáñez-Araque et al., 2021; Weallans et al., 2021; Bhandari, 2020).

The performance of health workers, in turn, impacts both organizational effectiveness and overall health system outcomes, ultimately influencing the health of populations (Rowe et al., 2005; Fabiano et al., 2024). Research from other disciplines suggests that factors such as sex, experience, education level, and prior training can influence competency levels (Liu et al., 2019; Czajkowska et al., 2021; Alshammari & Alenezi, 2023). These studies found that greater experience, higher education, and prior training are associated with better competency.

However, the influence of these demographic variables on competency among

public health professionals in low-resource settings remains largely unexplored Nonetheless, the impact of these demographic factors on the skills of public health professionals in resource-limited environments remains largely unexamined (Bhandari, 2020). Developing core competencies is especially vital in LMICs, where resource constraints hinder workforce effectiveness (MacKay et al., 2024, Bhandari, 2020).

Globally, the majority of initiatives aimed at developing essential skills for public health professionals have been primarily focused on high-income nations and areas, emphasizing the clinical health workforce and educational programs (Bhandari, 2020; Alonge et al., 2019; Calhoun et al., 2002, 2008, 2012).

Conversely, there is a clear and growing imperative to extend these competency-building activities to low- and middle-income countries (LMICs), where tailored approaches could close critical workforce gaps, strengthen local training institutions, and enhance the ability of under-resourced health systems to prevent and respond to emergent threats. By adapting proven models and collaborating with regional partners, competency development in LMICs can support more equitable health outcomes, foster sustainable workforce capacity, and address the unique social, economic, and infrastructural challenges these settings face.

Leadership is a critical competency for public health professionals, essential for an effective response to complex health challenges. While some studies regard leadership as an innate trait, Channing (2020) argues that it can be developed through structured education, mentorship, and leadership experiences.

Several international reports, including those from the WHO and the OECD, have highlighted the importance of a high-performing public health workforce. Leaders play a pivotal role in fostering high performance, continuous learning, and adaptability, directly impacting organizational and system effectiveness, and ultimately, population health outcomes (Rowe et al., 2005). Research found that high job performance can be achieved when even the most dissatisfied employees demonstrate both strong leadership and firm commitment (Yáñez-Araque et al., 2021).

Despite its importance, systematic leadership training and competency assessment have historically been lacking in public health education, especially in LMICs. The COVID-19 pandemic has further underscored the necessity of core competencies and leadership, particularly in resource-limited settings where training and investment are often inadequate (MacKay et al., 2024).

As public health continues to face unprecedented and multifaceted threats, the cultivation of strong, competent leaders is more important than ever to ensure resilient and responsive health systems.

3. Methodology

3.1. Research Design

A quantitative, two-wave panel design was employed based on the secondary data analysis. The study is to assess changes in leadership-related competencies—specifically knowledge, attitude, and skill—among public health professionals enrolled in the KOICA scholarship program. The retrospective nature allows for the analyses of existing data, making it feasible to examine the outcomes of interest over a defined period. Two wave panel design enabled the assessment of the identification of key predictors of skill improvement as well as the overall change of leadership competency.

3.2. Population

The study population consisted of graduates from the KOICA Master's Degree Program in Public Health who attended the Graduate School of Public Health at Yonsei University in Seoul, Republic of Korea, between 2017 and 2022.

Inclusion criteria comprised individuals who successfully completed the full 18-month program and were awarded a master's degree during the specified time frame. Participants were required to have completed both the baseline and endline surveys.

The study population consisted of international students who were enrolled in and successfully completed the KOICA Master's Degree Program at the Graduate School of Public Health, Yonsei University, between 2017 and 2022. This program targets public health professionals and government officials from low- and middle-income countries

(LMICs), providing intensive training in public health theory and practice over an 18-month academic period. A total of 97 students who participated in the program during this period were included in the analysis. These individuals completed three separate surveys on leadership-related public health knowledge, attitude, and skill.

3.3. Data Source and Tools of Measurement

Data has been retrieved from the university's academic records, alumni databases, and three separate but related surveys administered to the same participant population (N = 97). Sociodemographic data, including age group, gender, and regional affiliation, were included in the original survey dataset.

Each participant's responses across the surveys were matched using unique identification numbers, allowing the creation of one combined dataset that included both pre- and post-program data for all 97 participants.

The three surveys used in this study originate from established, reputable sources in public health and leadership development. The first survey, Core Public Health Competency Survey, is based on the Core Competencies for Public Health Professionals, developed by the Council on Linkages Between Academia and Public Health Practice and adapted by the Public Health Foundation (Council on Linkages, 2021). The second survey, Leadership and Management Development Survey was created by the Centre for Learning and Development, Newfoundland and Labrador Public Service, as part of their Leadership and Management Development Strategy, and is used to assess key behavioral and professional competencies for public sector leaders and managers in Canada (Centre for Learning and Development, 2007). The third survey, Leadership Development Competency Survey is derived from Purdue University's Leadership Development Certificate Program, which emphasizes practical leadership skills, attitude, and behaviors across multiple domains and is grounded in both academic research and applied leadership

training. Each instrument is rooted in validated frameworks and has been adapted for use in diverse public health and leadership contexts (Purdue University, n.d.).

In this study, surveys were categorized into three domains: knowledge, attitude, and skill. Knowledge and attitude were assessed using 4-point Likert scales, while skill was evaluated using a 3-point Likert scale. All measures were administered at two time points—baseline (T1, at the beginning of the enrollment) and endline (T2, following program completion). All three surveys were previously developed by external organizations and administered as part of a structured training or evaluation process. As this study utilized secondary data, no modifications were made to the original survey instruments or data collection procedures. Each domain consisted of multiple items under several categories.

3.4. Missing Data Handling and Data Cleaning

All individual survey responses were manually entered from separate Excel files into a single master sheet.

Once the dataset was fully compiled and cleaned Little's MCAR test was conducted using R(v4.5.0) to assess the nature of the missingness. This test helped determine whether the data was missing completely at random (MCAR) or if the missingness was likely due to other factors, such as Missing at Random (MAR). Given the results of this test, missing values were addressed using the multiple imputation procedure.

Little's MCAR (missing completely at random) test was conducted to examine the pattern of missing data. The results indicated that the data were missing completely at random, as the significance level (p-value) was 1.000, leading to a failure to reject the null hypothesis. Based on this finding, the multiple imputation approach was employed to handle the missing values. The multiple imputation method was used because it retains all

available data and preserves the small sample size, unlike Listwise deletion. Additionally, it helps reduce bias that can arise from artificially filling in missing values.

Missing data were handled using the multiple imputation by chained equations (MICE) method in R using the mice package. The imputation model employed the polyr method, because it preserves the ordinal structure of Likert-scale data by modeling the ordered categories rather than treating them as continuous or nominal variables. Five imputations were generated using a seed of 123 for reproducibility. In building the predictor matrix, we applied a minimum proportion of usable cases (minpuc) set to 0.1 and a minimum correlation threshold (mincor) of 0.4, ensuring only relevant predictors were included. This criterion ensured adequate information overlaps while avoiding sparsely observed predictors. The imputation process used five iterations and generated five multiply imputed datasets (m = 5), applying parallel computing with 12 workers to improve computational efficiency. Imputation was conducted at the item level across all relevant variables.

After all missing data were addressed, factor analysis was conducted to validate the measurement instruments.

Polychoric correlation analysis was conducted separately for each domain to address multicollinearity and reduce item redundancy. Sampling adequacy was evaluated using the Kaiser-Meyer-Olkin (KMO) measure, with all domains exceeding the recommended threshold (KMO > 0.90). Bartlett's test of sphericity was significant for each matrix ($p < .001$), indicating sufficient correlation among items to justify factor analysis. Items with extremely high pairwise correlations (0.90 or above) were considered redundant and were removed. Because the Likert scale structures differed across domains (third survey items used a 3-point scale, while first and second used 4-point scales), the analysis was conducted individually for each domain to ensure appropriate handling of ordinal measurement levels.

Exploratory factor analysis (EFA) was conducted on the pooled polychoric matrices using R to account for ordinal data. The number of factors to retain was

determined by parallel analysis, which the strength of patterns in the actual data to those obtained from simulated random data. For all three surveys, parallel analysis indicated a single-factor solution.

This study utilized secondary data derived from three separate surveys originally designed to assess different competency domains: knowledge, attitude, and skill. While each survey was intended to correspond to a specific domain, a detailed item-level review revealed inconsistencies in the assignment of questions. For example, several items categorized under the "attitude" survey were more appropriately aligned with knowledge or skill domains.

To ensure construct validity, all items were re-categorized based on the framing of the question wording. For example, items that involved factual recall or understanding of concepts were categorized under knowledge, while items assessing personal confidence or behavior-related perceptions were assigned to attitude, and questions focused on abilities or actions were aligned with skill. Items that did not align with the intended domain definitions were excluded. For instance, knowledge-framed questions that were originally embedded within the attitude domain survey were removed. The final cleaned dataset consisted only of those items that clearly measured the constructs of knowledge, attitude, or skill, as defined by the theoretical framework of this study. The remaining items were compiled into three domain-specific datasets for analysis.

The table below summarizes the original number of items by domain and category, as well as the final number of items retained after the cleaning process.

Table 1. Survey Domain Categories and Number of Items

Domain	Category	No. of Original Items	No. of Cleaned Items
Knowledge	Analytical / Assessment Related Knowledge	12	10

	Policy Development/Program Planning Related Knowledge	10	4
	Communication Skills & Knowledge	6	1
	Cultural Competency Skills & Knowledge	6	2
	Community Dimension of Practice Skills & Knowledge	10	4
	Public Health Science Knowledge & Skills	9	1
	Financial Planning and Management Knowledge & Skills	13	4
	Leadership and System Thinking Knowledge & Skills	8	5
Total (Knowledge)		74	31
Attitude	Communication	7	1
	Decision making	5	1
	Relationship building	8	2
	Ethics and professionalism	4	2
	Strategic focus	4	0
	Creativity and innovation	4	1
	Service delivery	5	0
	Self management	7	3
	Performance management	8	5
	Financial management	3	0
	Information Technology	3	0
	Information Management	4	0
	Project Management	3	0
	Change Management	4	1
Total (Attitude)		69	17
Skill	Understands Leadership	6	3
	Is Self Aware	5	3
	Practices Ethical Behavior	5	2
	Sustains Leadership	4	3
	Values Diversity	4	0
	Enhances Communication Skills	12	9
	Manages Conflict	4	3
	Develops Teams	7	2
	Leads Change	5	5
	Manages Projects	8	3
	Practice Citizenship	4	1
	Understands Community	9	2

	Commits to Serving Others	7	4
Total (Skill)		80	40

3.5. Statistical Analysis

All data analyses were conducted using R (version 4.5.0). The statistical analysis for this study was carefully designed to align with the nature of the data collected, which primarily consisted of responses on Likert-type scales. In this research, knowledge and attitude were measured using 4-point Likert scales, while skill was assessed with a 3-point Likert scale.

While Likert items are inherently ordinal there is ongoing debate regarding the appropriateness of parametric versus non-parametric statistical methods for their analysis (Sullivan & Artino, 2013). Recent empirical research has demonstrated that parametric analyses, such as t-tests, are robust to violations of normality and can be applied to Likert scale data, particularly when sample sizes are sufficiently large (>15–30 per group) (Mircioiu & Atkinson, 2017). In such cases, parametric and non-parametric analyses tend to yield similar conclusions, but parametric methods may offer greater statistical power and discrimination (Sullivan & Artino, 2013; Mircioiu & Atkinson, 2017). This pragmatic approach is supported by evidence showing that parametric tests remain reliable for Likert-type data when group sizes are adequate and distributions are not severely skewed (Sullivan & Artino, 2013; Mircioiu & Atkinson, 2017).

For inferential analysis, non-parametric tests were also used for the 3-point skill scale, while parametric tests were applied to the 4-point knowledge and attitude scales, provided that sample size and distributional assumptions were reasonably met.

Descriptive statistics were employed to summarize the participants' demographic characteristics, paired t-tests, Wilcoxon signed-rank tests, and linear regression models to assess changes among participants.

Paired sample t-tests were performed to examine changes in three domains, knowledge, attitude, and skill over time (T1 and T2).

Multiple linear regression models were conducted to examine if changes in knowledge and attitude can be predictors of skill change. To go further, control variables, some demographic variables, were included in the analysis to check the stability of primary effects. For all analyses, a p-value of .05 or less is considered statistically significant.

3.6. Ethical Considerations

The research protocol was reviewed and approved by the Research Ethics Committee of Severance Hospital on Oct. 22, 2024. All data used in this study is anonymized secondary data collected by the university from 2017 to 2022.

To ensure participant confidentiality and adhere to ethical standards, the university administrator anonymized all responses by assigning unique identification numbers to each participant. Sensitive personal information—such as date of birth and nationality—was not provided. Instead, only grouped demographic data (e.g., age ranges and regional nationality categories) were provided to maintain participant anonymity.

4. Results

4.1. Descriptive Statistics

The participant population included 97 individuals. Of these, 71.1% (n = 69) were male and 28.9% (n = 28) were female. The average age at baseline was 32.60 years (SD = 4.95), with a range consistent with early- to mid-career professionals. In terms of academic programs, the majority of participants were enrolled in Global Health Security (GHS) (59.8%, n = 58), while the remaining participants were in the Global Health Policy and Financing (GHPF) program (40.2%, n = 39). The GHS program operated from 2017 to 2020, and the GHPF program operated from 2020 to 2023; however, only fellows whose academic stay concluded by 2022 were included in this analysis, as the 2023 cohort participated in a different survey and their data were therefore not available for inclusion. The average CGPA was 3.82 (SD = 0.16) on a 4.3 scale, indicating high academic performance across the cohort.

Regarding linguistic background, approximately one-third of participants (34.0%, n = 33) were from English-speaking countries, while the remaining two-thirds (66.0%, n = 64) were from non-English-speaking countries. Regionally, participants were primarily from Africa (53.6%, n = 52) and Asia (43.3%, n = 42), with a small minority from other world regions (3.1%, n = 3).

Table 2 Participant Characteristics (N=97)

Variable	**N (%) or Mean (SD)**
Gender - Male - Female	 69 (71.1%) 28 (28.9%)
Age (at admission)	32.60 (4.95)
Program - Global Health Security (GHS) - Global Health Policy and Financing (GHPF)	 58 (59.8%) 39 (40.2%)
CGPA (Maximum=4.3)	3.82 (.162)
English-Speaking Country Yes - No	 33 (34.0%) 64 (66.0%)
Region - Asia - Africa - Other (South America & Oceania)	 42 (43.3%) 52 (53.6%) 3 (3.1%)

Descriptive analysis revealed a noticeable increase in knowledge scores from pre- to post-intervention (Mean = 2.54 to 3.13), indicating an overall gain in factual understanding among participants. Attitude scores remained relatively stable, with a slight decrease from 3.04 to 3.00. Skill scores showed a modest decline on average, from 2.32 to 2.23, suggesting that participants may have become more self-critical or realistic in evaluating their applied leadership abilities after program completion. These trends provide initial insight into how different dimensions of learning were impacted by the intervention and support the subsequent analysis of change dynamics and predictors.

Table 3 Pre–Post Means and Standard Deviations for Knowledge, Attitude, and Skill

Variable	T1 Mean (SD)	T2 Mean (SD)
Knowledge	2.54 (0.73)	3.13 (0.79)
Attitude	3.04 (0.79)	3.00 (0.94)
Skills	2.32 (0.56)	2.23 (0.78)

Descriptive statistics were computed to examine the magnitude and direction of individual change in knowledge, attitude, and skill from pre- to post-intervention. The average knowledge score increased by 0.59 points, with a median change of 0.61, suggesting a general improvement. Change scores ranged from -1.42 to +2.39, indicating variability in learning outcomes across individuals. In contrast, the average change in attitude scores showed around no change (Mean = -0.04, Median = 0.00), and similarly for skill (Mean = -0.09, Median = 0.00). While some participants reported positive shifts in attitude and leadership skill, others experienced decreases. These patterns suggest that while the program was effective in improving knowledge, its effects on attitude and skill were more heterogeneous and potentially influenced by contextual or individual factors.

Table 4 Score Change (Post – Pre) for Knowledge, Attitude, and Skill

Variable	Minimum	1st Quartile (Q1)	Median	Mean	3rd Quartile (Q3)	Maximum
Knowledge	-1.42	0.00	0.61	0.59	1.32	2.39
Attitude	-2.06	-0.19	0.00	-0.04	0.31	2.19
Skill	-1.90	-0.25	0.00	-0.09	0.40	1.93

4.2. Changes in Leadership Related Core Competency

To assess the effect of the program on knowledge, attitude, and skill, paired sample t-tests were conducted comparing T1 and T2 intervention scores. There was a statistically significant increase in knowledge scores, $t(96) = -6.80$, $p < .001$, with a mean difference of -0.59 (95% CI: -0.77 to -0.42). However, no significant changes were found in attitude scores, $t(96) = 0.40$, $p = .687$.

Table 5 Paired Comparison of Scores for Knowledge and Attitude

Variable	Mean Difference	Std. Error	95% CI	t	df	p-value
Knowledge	-0.593	0.087	-0.77 to -0.42	-6.80	96	< .001 ***
Attitude	0.036	0.089	-0.14 to 0.21	0.40	96	.687

Note. Mean difference calculated as T2 – T1. *** p < .001.

A Wilcoxon Signed-Rank Test was additionally performed for skill scores to account for potential non-normality. The test revealed no statistically significant difference between T1 and T2 scores, $V = 1420.5$, $p = .702$. The median score changed slightly, but the difference was not statistically significant.

Table 6 Wilcoxon Signed-Rank Test for Skill

Variable	Median (T1)	Median (T2)	Wilcoxon V	p-value
Skills (S)	2.4	2.6	1420.5	.702

V = Wilcoxon rank sum statistic.

4.3. Identifying Predictors by Domain

A multiple linear regression analysis was performed to identify predictors of post-intervention knowledge scores among participants (N = 97). The model included program group, geographic region, English-speaking status, sex, age group, and CGPA as independent variables. The overall model was not statistically significant, $F(9, 87) = 1.112$, $p = .363$, explaining 10.3% of the variance in knowledge scores (Adjusted $R^2 = 0.010$). Among the predictors, age group 40+ years showed a statistically significant negative association with post-knowledge scores ($B = -0.694$, $p = .021$), indicating that older participants tended to report lower post-program knowledge compared to those under 30. Other predictors—including program group, regional origin, English proficiency, gender, and CGPA—did not show significant associations with knowledge scores. These findings suggest that age may play a role in knowledge acquisition or perception of learning outcomes during the program, and that instructional design may need to consider age-related learning needs.

Table 7 Predictors of Knowledge Scores

Predictor	B Estimate	Std. Error	t	p-value
Intercept	3.2665	2.0557	1.589	.116
Program (GHPF vs GHS)	0.0855	0.1750	0.489	.626
Region (Africa vs Asia)	-0.0988	0.2190	-0.451	.653
Region (Other vs Asia)	-0.1202	0.4867	-0.247	.806
English-speaking (No vs Yes)	-0.1511	0.2051	-0.737	.463
Sex (Female vs Male)	0.1714	0.1919	0.893	.374
Age group (30–34 vs <30)	0.1178	0.2153	0.547	.586
Age group (35–39 vs <30)	0.0358	0.2462	0.145	.885
Age group (40+ vs <30)	-0.6942	0.2945	-2.357	.021 *
CGPA	-0.0112	0.5378	-0.021	.984

Model fit: $R^2 = 0.103$, Adjusted $R^2 = 0.010$

$F(9, 87) = 1.112$, $p = .363$

A multi linear regression for the predictors of post-intervention attitude scores did not show statistical significance, $F(9, 87) = 1.387$, $p = .206$, and accounted for 12.6% of the variance in attitude scores (Adjusted $R^2 = 0.035$). However, CGPA showed a positive association with attitude scores and approached significance ($B = 1.210$, $p = .059$).

Table 8. Predictors of Attitude Scores

Predictor	B Estimate	Std. Error	t	p-value
Intercept	-1.2949	2.4162	-0.536	.593
Program (GHPF vs GHS)	-0.1783	0.2057	-0.867	.388
Region (Africa vs Asia)	0.0705	0.2575	0.274	.785
Region (Other vs Asia)	-0.2595	0.5721	-0.454	.651
English-speaking (No vs Yes)	-0.2942	0.2410	-1.221	.226
Sex (Female vs Male)	0.1396	0.2256	0.619	.538
Age group (30–34 vs <30)	-0.2036	0.2531	-0.804	.423
Age group (35–39 vs <30)	-0.0362	0.2894	-0.125	.901
Age group (40+ vs <30)	-0.4859	0.3462	-1.404	.164
CGPA	1.2101	0.6322	1.914	.059

Model fit: $R^2 = 0.126$, Adjusted $R^2 = 0.035$

$F(9, 87) = 1.387$, $p = .206$

A multiple linear regression analysis for skill scores was performed. The overall model did not reach statistical significance, $F(9, 87) = 1.835$, $p = .073$, accounting for 16.0% of the variance in post-program skill scores (Adjusted $R^2 = 0.073$). However, within the model, program type emerged as a statistically significant predictor. Participants in the GHPF program had significantly lower skill scores than those in the GHS program ($B = -0.420$, $p = .013$).

Table 9. Predictors of Skill Scores

Predictor	B Estimate	Std. Error	t	p-value
Intercept	1.6312	1.9483	0.837	.405
Program (GHPF vs GHS)	-0.4198	0.1659	-2.531	.013 *
Region (Africa vs Asia)	0.2406	0.2076	1.159	.250
Region (Other vs Asia)	-0.3135	0.4613	-0.680	.499
English-speaking (No vs Yes)	-0.1471	0.1944	-0.757	.451
Sex (Female vs Male)	0.2022	0.1819	1.112	.269
Age group (30–34 vs <30)	0.2310	0.2041	1.132	.261
Age group (35–39 vs <30)	-0.0310	0.2333	-0.133	.895
Age group (40+ vs <30)	-0.1575	0.2791	-0.564	.574
CGPA	0.1649	0.5097	0.324	.747

Model fit: $R^2 = 0.160$, Adjusted $R^2 = 0.073$

$F(9, 87) = 1.835$, $p = .073$

4.4. Predicting Skill Change

A linear regression model was employed to assess whether changes in knowledge and attitude predict changes in skill along with CGPA. The overall model was statistically significant, $F(3, 93) = 47.96$, $p < .001$, explaining 60.7% of the variance in skill change (Adjusted $R^2 = 0.595$). Among the predictors, attitude change demonstrated a strong, statistically significant positive association with skill development ($B = 0.771$, $SE = 0.071$, $t = 10.88$, $p < .001$). For every one-unit increase in attitude scores, leadership skill improved by 0.771 units, holding other variables constant. In contrast, neither knowledge change ($B = -0.064$, $p = .378$) nor CGPA ($B = 0.257$, $p = .457$) showed significant associations with skill change.

Table 10. Skill Change Predictor by Knowledge, Attitude and CGPA

Predictor	B Estimate	Std. Error	t	p-value
Intercept	-1.0012	1.3139	-0.762	.448
Knowledge Change	-0.0640	0.0722	-0.886	.378
Attitude Change	0.7714	0.0709	10.875	< .001 ***
CGPA	0.2565	0.3433	0.747	.457

Model fit: $R^2 = 0.607$, Adjusted $R^2 = 0.595$

$F(3, 93) = 47.96$, $p < .001$

5. Discussion and Conclusion

5.1. Discussion

The study demonstrates that the KOICA's Master's Degree program at Yonsei University was highly effective in enhancing participants' theoretical knowledge, as evidenced by a significant improvement in knowledge scores ($\Delta M = +0.59$, $p < .001$).

However, the absence of significant change in attitude ($\Delta M = -0.04$, $p = .653$) and the lack of a statistically significant change in skill performance ($V = 1420.5$, $p = .702$) require careful consideration. One plausible explanation for these findings is the unique context in program environment, facing the COIVD-19 Pandemic. The pandemic necessitated a rapid shift to remote or hybrid learning modalities, which may have limited opportunities for peer interaction, hands-on practice, and real time feedback, negatively impacting skill acquisition and the development of positive attitude toward training content (Kim & Park, 2021).

Beyond the pandemic-induced limitations, the program structure itself may have provided limited practical application opportunities that contribute to skill development. The lack of change in skill scores may also be explained by participants' increased self-awareness and the adoption of higher personal standards following exposure to new knowledge and skill sets.

Moreover, the attitude scores were already high at baseline ($M = 3.04$) and remained essentially unchanged post-intervention ($M = 3.00$), suggesting a ceiling effect that left little room for measurable improvement. This finding may be attributed to the university's rigorous selection process, which likely identified candidates already possessing strong professional leadership attitude toward public health.

Kang et al. (2014) observed a decrease in attitude scores following a capacity building program for nurses in Vietnam, but attributed this decline to an increased level of critical self-reflection among participants. The study noted that as nurses became more

aware of their own limitations and areas for growth, their self-appraisals grew more discerning. This pattern has also been reported in previous research, even when substantial gains in knowledge were observed. Kang et al. concluded that, although intensive core nursing skills training may lead to more critical self-assessment in attitude, it ultimately empowers nurses to advance in their professional development.

Previous research in leadership and professional development has documented similar trends, where immediate post-training assessments sometimes reveal lower self-ratings as participants gain a more nuanced understanding of the competencies required in their field (Walker, 2001; Kezar & Moriarty, 2000).

This effect, often referred to as the “conscious incompetence” stage in adult learning theory, suggests that as individuals learn more, they become more aware of their own limitations and areas for growth (Krathwohl et al., 1971; Tubbs & Schulz, 2006). Although a slight decrease in self-assessed skill was observed, this change was not statistically significant and may reflect normal variation or random fluctuation rather than a real decline in actual ability. It is also possible that any minor change observed reflects greater critical self-evaluation and a more realistic appraisal of professional competencies, rather than a substantive decrease in skill level.

Analysis of demographic variables revealed that age is a significant predictor of knowledge retention. Participants over 40 years old showed notable challenges in retaining new information ($\beta = -0.69$, $p = .021$), whereas younger participants (<30 years) consistently outperformed the older participants across all domains. This may be attributed to differences in cognitive flexibility, learning styles, or previous exposure to similar content (Jones & Lee, 2021).

Additionally, the type of program attended emerged as a significant factor influencing skill outcomes. Participants in the GHS program demonstrated superior skill development compared to those in the GHPF program ($\beta = -0.42$, $p = .013$), suggesting that certain curricular or educational components in GHS may be more effective for skill development. The GHS program may emphasize competency-based training in outbreak

response and practical skill, such as infection control, which are directly tied to measurable outcomes. In contrast, GHPF's focus on policy and financing may prioritize theoretical frameworks over practical skills training. Another plausible explanation for these differential outcomes is the timing of program implementation. As mentioned earlier, the GHPF program fellows' data included in this analysis was collected from 2020 to 2022 during the COVID-19 pandemic, which may have compromised the program's effectiveness in developing practical skill through the remote or hybrid learning modalities that were necessitated during this period.

Although the overall regression model for attitude scores was not statistically significant, CGPA showed a positive association with approached statistical significance ($p = .059$). Despite falling short of the $p < .05$ threshold, the effect size of CGPA ($B = 1.21$) is notable. A 1-point increase in CGPA was associated with a 1.21-unit increase in attitude scores. This magnitude of the effect suggests a potentially meaningful connection between academic performance and attitude improvement and worthy of further research.

A noteworthy finding is the strong predictive relationship between attitude change and skill improvement ($\beta = 0.77$, $p < .001$). This suggests that fostering positive attitude may be a critical driver for enhancing practical competencies. Surprisingly, gains in theoretical knowledge did not translate into improved skill ($\beta = -0.06$, $p = .378$), highlighting a disconnect that has been noted in previous literature (Brown et al., 2020). It implies that knowledge alone is insufficient for skill mastery, but attitude may play a more pivotal role in facilitating behavioral change and practical application.

5.2. Limitations

One notable limitation of this study is the reliance on secondary data, as the surveys had already been collected, modification or refining of the measurement instruments was not possible. The only adjustments that could be made involved the exclusion of variables

that were not relevant or did not align with the study aims. This constraint may have limited the scope and depth of the analysis, as well as the ability to comprehensively explore certain constructs or relationships. Furthermore, since the survey instruments were originally selected prior to the launch of the GHS program—and specifically designed to align with its curriculum—they may not be fully aligned with the content or emphasis of the subsequently introduced GHPF program.

Some survey items were re-categorized and excluded based on the framing of their wording, which was used to reclassify them into knowledge, attitude, or skill domains. However, this re-categorization was conducted without direct input from the original developers and distinguishing between skill and attitude domains of the surveys based solely on the linguistic framing of survey items proved to be particularly difficult and often ambiguous due to inherent conceptual overlaps between these constructs. As a result, there is a potential limitation regarding the accuracy of item classification, since the true intent or theoretical alignment of each item—as initially designed—may not have been fully captured.

Another limitation concerns data handling. Because the original survey responses were stored in separate Excel files for each domain, manual integration was required to create a master dataset. Although this process was conducted with care, there remains a possibility of data entry errors or mismatches, which could affect the accuracy and consistency of the final dataset.

Another limitation of this study is the absence of a third time point (T3) to assess longer-term changes in attitude and skill development. While knowledge can often be acquired and measured soon after an intervention, meaningful changes in attitude and skill typically require more time to manifest and are best captured through longitudinal follow-up assessments (Bird & Binford, 2017). Research has shown that skill and attitude develop gradually and may only become evident months or even years after initial training (The Peak Performance Center, 2020). Without a T3 measurement, this study may have underestimated the extent of attitude and skill change, as short-term assessments are less sensitive to these slower, ongoing developmental processes (Hansen & Birol, 2014; Wong et al., 2006).

A key limitation of this study is the reliance on self-administered survey data. Self-administered questionnaires, while cost-effective and efficient, are susceptible to several sources of bias and error. Respondents may misunderstand questions or provide incomplete or inaccurate answers, as there is no opportunity for clarification. It should be considered when interpreting the results of this study.

5.3. Recommendation

Future studies and program evaluations should consider developing or adapting survey instruments to reflect the unique content and competencies of each program. Creating program-specific measurement tools will enhance the relevance and validity of the data and facilitate more accurate evaluation of fellows' skill development. Another consideration for improving skill scores is that the program should be reinforced by integrating more robust practicum components—such as extended field placements and hands-on project work—that give participants ample opportunity to apply concepts, receive real-time feedback, and consolidate their emerging skill.

Given the observed changes in knowledge, attitude, and skill from the pre-program (T1) to post-program (T2) assessments, where knowledge showed the greatest immediate increase, it is recommended to implement a follow-up survey at a later stage, such as one year after graduation (T3), to assess the long-term development of these competencies.

By allowing former students to retake the survey after a significant period post-graduation, we may observe further improvements, particularly in the skill and attitude domain. The time gap after graduation could provide an opportunity to assess whether skill is enhanced further through real-world application and professional development, beyond what was achieved immediately after the completion of the program.

If significant positive changes in the attitude and skill domain are observed at T3, this suggests that while knowledge tends to increase immediately at T2, attitude and skill may continue to develop more gradually over time, after the formal training period ends.

This long-term self-assessment could help illuminate how sustained training impacts the development of key competencies, especially for leadership and management in the public health field, which may evolve gradually after the formal education or training period ends.

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Appendices

Appendix 1 : Knowledge Survey with Re-categorized Categories

No	Item(Question)	Category
K1_AA1	Identify the health status of populations and their related determinants of health and illness	Knowledge
K1_AA2	Describe the characteristics of a population-based health problem	Knowledge
K1_AA3	Use variables that measure public health conditions	Skill
K1_AA4	Use methods and instruments for collecting valid and reliable quantitative and qualitative data	Skill
K1_AA5	Identify sources of public health data and information	Knowledge
K1_AA6	Recognize the integrity and comparability of data	Knowledge
K1_AA7	Identify gaps in data sources	Knowledge
K1_AA8	Adhere to ethical principles in the collection, maintenance, use, and dissemination of data and information	Attitude
K1_AA9	Describe the public health applications of quantitative and qualitative data	Knowledge
K1_AA10	Collect quantitative and qualitative community data	Skill
K1_AA11	Use information technology to collect, store, and retrieve data	Skill
K1_AA12	Describe how data are used to address scientific, political, ethical, and social public health issues	Knowledge
K2_PP1	Gather information relevant to specific public health policy issues	Skill
K2_PP2	Describe how policy options can influence public health programs	Knowledge
K2_PP3	Explain the expected outcomes of policy options	Knowledge
K2_PP4	Gather information that will inform policy decisions	Skill
K2_PP5	Describe the public health laws and regulations governing public health programs	Knowledge
K2_PP6	Participate in program planning processes	Skill
K2_PP7	Incorporate policies and procedures into program plans and structures	Skill
K2_PP8	Identify mechanisms to monitor and evaluate programs for their effectiveness and quality	Knowledge

K2_PP9	Demonstrate the use of public health informatics practices and procedures	Skill
K2_PP10	Apply strategies for continuous quality improvement	Skill
K3_CSK1	Identify the health literacy of populations served	Knowledge
K3_CSK2	Communicate in writing and orally, in person, and through electronic means, with linguistic and cultural proficiency	Skill
K3_CSK3	Solicit community-based input from individuals and organizations	Skill
K3_CSK4	Convey public health information using a variety of approaches	Skill
K3_CSK5	Participate in the development of demographic, statistical, programmatic and scientific presentations	Skill
K3_CSK6	Apply communication and group dynamic strategies in interactions with individuals and groups	Skill
K4_CCK1	Incorporate strategies for interacting with persons from diverse backgrounds	Skill
K4_CCK2	Recognize the role of cultural, social, and behavioral factors in the accessibility, availability, acceptability, and delivery of public health services	Knowledge
K4_CCK3	Respond to diverse needs that are the result of cultural differences	Skill
K4_CCK4	Describe the dynamic forces that contribute to cultural diversity	Knowledge
K4_CCK5	Describe the need for a diverse public health workforce	Knowledge
K4_CCK6	Participate in the assessment of the cultural competence of the public health organization	Skill
K5_CDK1	Recognize community linkages and relationships among multiple factors affecting health	Knowledge
K5_CDK2	Demonstrate the capacity to work in community-based participatory research efforts	Skill
K5_CDK3	Identify stakeholders	Knowledge
K5_CDK4	Collaborate with community partners to promote the health of the population	Skill
K5_CDK5	Maintain partnerships with key stakeholders	Skill
K5_CDK6	Use group processes to advance community involvement	Skill
K5_CDK7	Describe the role of governmental and non-governmental organizations in the delivery of community health services	Knowledge
K5_CDK8	Identify community assets and resources	Knowledge

K5_CDK9	Gather input from the community to inform the development of public health policy and programs	Skill
K5_CDK10	Inform the public about policies, programs, and resources	Skill
K6_PS1	Describe the scientific foundation of the field of public health	Knowledge
K6_PS2	Identify prominent events in the history of the public health profession	Knowledge
K6_PS3	Relate public health science skills to the Core Public Health Functions and Ten Essential Services of Public Health	Knowledge
K6_PS4	Identify the basic public health sciences	Knowledge
K6_PS5	Describe the scientific evidence related to a public health issue, concern, or intervention	Knowledge
K6_PS6	Retrieve scientific evidence from a variety of text and electronic sources	Skill
K6_PS7	Discuss the limitations of research findings	Skill
K6_PS8	Describe the laws, regulations, policies, and procedures for the ethical conduct of research	Knowledge
K6_PS9	Partner with other public health professionals in building the scientific base of public health	Skill
K7_FS1	Describe the local, state, and federal public health and health care systems	Knowledge
K7_FS2	Describe the organizational structures, functions, and authorities of public health agencies	Knowledge
K7_FS3	Adhere to the organization?™s policies and procedures	Attitude
K7_FS4	Participate in the development of a programmatic budget	Skill
K7_FS5	Operate programs within current and forecasted budget constraints	Skill
K7_FS6	Identify strategies for determining budget priorities	Knowledge
K7_FS7	Report program performance	Skill
K7_FS8	Translate evaluation report information into program performance improvement action steps	Skill
K7_FS9	Contribute to the preparation of proposals for funding from external sources	Skill
K7_FS10	Apply basic human relations skills to internal collaborations, motivation of colleagues, and resolution of conflicts	Skill
K7_FS11	Demonstrate public health informatics skills to improve program and business operations	Skill

K7_FS12	Participate in the development of contracts and other agreements for the provision of services	Skill
K7_FS13	Describe how cost-effectiveness, cost-benefit, and cost-utility analyses affect programmatic prioritization and decision making	Knowledge
K8_LS1	Incorporate ethical standards of practice as the basis of all interactions	Attitude
K8_LS2	Describe how public health operates within a larger system	Knowledge
K8_LS3	Participate with stakeholders in identifying key public health values and a shared public health vision	Skill
K8_LS4	Identify internal and external problems that may affect the delivery of Essential Public Health Services	Knowledge
K8_LS5	Use individual, team, and organizational learning opportunities for personal and professional development	Skill
K8_LS6	Knowledge of mentoring and coaching frameworks, benefits, and program design	Skill
K8_LS7	Knowledge of performance management systems, continuous improvement, and reporting	Skill
K8_LS8	Knowledge of systems thinking, environmental scanning, and impact of external changes	Knowledge

Appendix 2 : Attitude Survey with Re-categorized Categories

No.	Item(Question)	Category
A1_C1	Ensures information is shared to all relevant people in a prompt and efficient manner	Skill
A1_C2	Communicates in a respectful manner	Attitude
A1_C3	Adapts communication methods for the intended audience	Skill
A1_C4	Writes in a clear and concise manner	Skill
A1_C5	Actively listens to others to ensure a full understanding of what they are saying	Skill
A1_C6	Demonstrates an effective presentation style for lectures, presentations, focus groups or organized talks	Skill
A1_C7	Adheres to Government's policy regarding formal communications	Knowledge
A2_D1	Actively seeks and analyzes relevant information to help resolve problems	Skill
A2_D2	Makes decisions that are consistent with organizational goals and values	Skill
A2_D3	Applies analytical skills throughout the decision making process	Skill
A2_D4	Accepts responsibility for decisions made	Attitude
A2_D5	Implements and evaluates decisions	Skill
A3_R1	Maintains working relationships to achieve objectives	Skill
A3_R2	Works collaboratively with others to achieve goals and objectives	Skill
A3_R3	Encourages employees to work collaboratively	Attitude
A3_R4	Respects and acknowledges the contribution of others	Attitude
A3_R5	Provides recognition of team achievements	Attitude
A3_R6	Assesses the value of entering into and remaining in partnerships	Skill
A3_R7	Deals with difficult situations quickly and effectively	Skill
A3_R8	Uses effective negotiation skills	Skill
A4_E1	Acts in a respectful manner to others regardless of gender, age, race, ability, sexual orientation, culture or religious beliefs	Attitude
A4_E2	Maintains professional standards of ethics and integrity	Attitude

A4_E3	Respects privacy and confidentiality of others	Attitude
A4_E4	Leads by example to demonstrate respectful behaviour for the workplace	Attitude
A5_S1	Considers the “big picture” when making decisions about the strategic directions and goals	Skill
A5_S2	Ensures alignment of the divisional goals with the organization’s goals	Skill
A5_S3	Implements policies in accordance with established purposes	Skill
A5_S4	Understands environmental influences (both internal and external to Government) and ensures plans to incorporate these influences	Knowledge
A6_CI1	Demonstrates creativity when dealing with problems and identifying solutions	Skill
A6_CI2	Encourages new approaches and perspectives	Attitude
A6_CI3	Takes calculated risks to optimize resources and improve delivery of services	Attitude
A6_CI4	Displays adaptability and flexibility	Attitude
A7_SD1	Identifies internal and external clients	Knowledge
A7_SD2	Seeks to understand clients??current and future needs	Skill
A7_SD3	Accomplishes results which support government and departmental priorities	Skill
A7_SD4	Aligns policies and services with public need and the direction of government	Skill
A7_SD5	Utilizes evidence-informed best practices in decision-making	Knowledge
A8_SM1	Prioritizes work and respects timelines when completing tasks	Skill
A8_SM2	Recognizes barriers to work productivity and takes action to minimize these barriers	Skill
A8_SM3	Manages competing demands from multiple sources	Skill
A8_SM4	Recognizes need for assistance and requests help	Attitude
A8_SM5	Learns from mistakes and successes	Attitude
A8_SM6	Practices stress management techniques to maintain effectiveness	Attitude
A8_SM7	Pursues learning and development opportunities	Attitude
A9_PM1	Empowers others through delegation of responsibility and authority	Attitude

A9_PM2	Provides ongoing positive and corrective feedback	Attitude
A9_PM3	Ensures employees have a clear understanding of their individual goals	Skill
A9_PM4	Addresses performance problems in a prompt and constructive manner	Attitude
A9_PM5	Demonstrates conflict resolution strategies	Attitude
A9_PM6	Leads by example	Attitude
A9_PM7	Recognizes individual's work	Attitude
A9_RM8	Fosters continuous learning	Attitude
A10_FM1	Demonstrates an understanding of the budgeting process	Knowledge
A10_FM2	Manages finances in accordance with approved budgets	Skill
A10_FM3	Meets organizational financial reporting requirements	Skill
A11_IT1	Manages assigned IT assets and resources (hardware and software) in a responsible manner according to Government guidelines	Skill
A11_IT2	Uses office productivity software (such as word processing, spreadsheets, presentations and email systems software) appropriately	Skill
A11_IT3	Uses government systems (such as TRIM, FMS, Travel Claims Management System) effectively	Skill
A12_IM1	Manages information in all formats, consistent with policies and legislation, in a secure and efficient manner	Skill
A12_IM2	Practices established Government policies and procedures for the protection of information	Knowledge
A12_IM3	Identifies areas of process and procedure compliance in information management and protection	Skill
A12_IM4	Acts upon internal and external risks for information management and information protection	Skill
A13_PM1	Develops realistic project plans that clearly outline project scope, objectives, deliverables and resources	Skill
A13_PM2	Monitors progress against plan on a regular basis	Skill
A13_PM3	Anticipates potential road blocks and develops contingency plans in advance	Skill
A14_CM1	Demonstrates knowledge of the change process and how it affects self and others	Knowledge
A14_CM2	Communicates change as an opportunity for innovation and growth	Attitude

A14_CM3	Obtains and provides resources to implement change initiatives	Skill
A14_CM4	Manages resistance to change	Skill

Appendix 3 : Skill Survey with Re-categorized Categories

No.	Item(Question)	Category
S1_UL1	I am aware of my leadership strengths and weaknesses.	Attitude
S1_UL2	I take initiative on projects.	Skill
S1_UL3	I build relationships with others in order to reach a mutual goal.	Skill
S1_UL4	I understand the underlying concepts of leadership.	Knowledge
S1_UL5	I adapt my leadership style to different situations.	Skill
S1_UL6	I have a personal philosophy of leadership.	Attitude
S2_IS1	I am aware of my attitudes, values, biases, and prejudices.	Attitude
S2_IS2	I engage in activities that build or improve my leadership abilities.	Skill
S2_IS3	I pay attention to how my language and behavior may be perceived by others.	Skill
S2_IS4	I am able to exert self-discipline and control over my behavior.	Skill
S2_IS5	I know my personal power to make a difference in my life and others.	Attitude
S3_PE1	I understand the ethical responsibilities that come with leadership.	Knowledge
S3_PE2	I follow through on commitments I make.	Skill
S3_PE3	I am trustworthy.	Attitude
S3_PE4	I act in accordance with my words, e.g., “walk the talk. "	Skill
S3_PE5	I lead by setting a positive example for others.	Skill
S4_SL1	I am a life-long learner.	Attitude
S4_SL2	I reflect on situations and learn from them.	Skill
S4_SL3	I am resilient. When things don’t work out, I learn from it and bounce back.	Skill
S4_SL4	I provide opportunities for others to be leaders.	Skill
S5_VD1	I value that each person is different.	Attitude
S5_VD2	I treat each person with respect.	Skill
S5_VD3	I work effectively with others who are different from me.	Skill

S5_VD4	I reach out to include other people.	Skill
S6_EC1	I listen carefully to understand what another person is saying.	Skill
S6_EC2	To avoid misunderstanding, I ask questions to clarify what the other person is saying.	Skill
S6_EC3	I say what I mean and mean what I say.	Skill
S6_EC4	When I speak, my message is clear.	Skill
S6_EC5	I can express a view that differs from that of others in effective ways.	Skill
S6_EC6	To get different perspectives, I ask for input from a wide range of people.	Skill
S6_EC7	I establish rapport with people.	Skill
S6_EC8	I influence others through what I say and how I say it.	Skill
S6_EC9	I seek feedback from others, even if it might be negative.	Skill
S6_EC10	If my work affects others, I keep them informed about what I'm doing.	Skill
S6_EC11	I work at building a network of resource people.	Skill
S6_EC12	I initiate relationships with others.	Skill
S7_MC1	I work to solve problems, not blame others, when we hit a stone wall.	Skill
S7_MC2	I am able to give constructive negative feedback to others when needed.	Skill
S7_MC3	I initiate successful resolution of conflict with others.	Skill
S7_MC4	I can manage conflict to create positive change.	Skill
S8_DT1	I value the contribution each person makes to a team.	Attitude
S8_DT2	I help a group identify a common goal.	Skill
S8_DT3	When working in a team situation, I help the group keep its focus.	Skill
S8_DT4	I help ensure that everyone is kept informed and information is shared freely.	Skill
S8_DT5	When I'm responsible for a task or project, I follow through in a timely way.	Skill
S8_DT6	I work well with others on a team.	Skill

S8_DT7	I help the team determine how it will work together as a team.	Skill
S9_LC1	I take on new challenges in a group or organization.	Skill
S9_LC2	I initiate new projects with a group/organization.	Skill
S9_LC3	I see opportunities in challenges faced by a group/organization and help them move forward.	Skill
S9_LC4	I help groups/organization develop a vision for its future.	Skill
S9_LC5	I initiate strategic planning processes with groups/organizations.	Skill
S10_MP1	I understand the difference between the functions of leadership and management.	Knowledge
S10_MP2	I understand the dynamics of groups and adjust my leadership style accordingly.	Knowledge/Skill
S10_MP3	I help groups make decisions through consensus.	Skill
S10_MP4	I match the various skills and interests of people to the tasks.	Skill
S10_MP5	I help groups set priorities and develop a plan of action.	Skill
S10_MP6	I help groups find resources to implement their plan of action.	Skill
S10_MP7	I ensure that everyone is kept informed and involved in group projects.	Skill
S10_MP8	I recognize individuals for their contributions.	Skill
S11_PC1	I vote in elections.	Skill
S11_PC2	I stay current with issues at the local, state, national, and world level.	Knowledge
S11_PC3	I get involved in my community because I know that in a democracy I must do my part.	Attitude
S11_PC4	I respect that others will have views and values different from mine.	Attitude
S12_UC1	I understand the diversity and complexity of communities.	Knowledge
S12_UC2	I try to make a difference in my community.	Skill
S12_UC3	I understand the role of government and public policy making.	Knowledge
S12_UC4	I understand the role of non-profit organizations.	Knowledge
S12_UC5	I understand who decision makers are in the community and how public decisions are made.	Knowledge

S12_UC6	I understand the important role played by the news media in a democracy.	Knowledge
S12_UC7	I participate in public meetings when important issues are being discussed.	Skill
S12_UC8	I understand the importance of building partnerships in a community to get things done.	Knowledge
S12_UC9	I understand social injustice, prejudices and biases in our society and work to eliminate them.	Attitude/Skill
S13_CS1	I try to make a difference for causes that are greater than my own needs.	Attitude
S13_CS2	I volunteer to serve others in the community.	Skill
S13_CS3	I engage with culturally different groups in the community.	Skill
S13_CS4	I reflect on my community service to learn more about myself.	Skill
S13_CS5	I help people in a community organize to undertake a worthwhile project.	Skill
S13_CS6	I help people who do not have a voice at the policy table develop a way to be heard.	Skill
S13_CS7	I help bring information or other resources to a community project.	Skill

Appendix 4 : Example of Data Coding Scheme

Variable	**Description**	**Timepoint**	**Type**	**Coding/Value Labels**
ID	Participant ID	-	Nominal	Unique identifier
Gender	-	-	Categorical	1=male, 2=female
Age	Age at baseline survey	-	Scale	Numeric
GPA	Cumulative Grade Point Average	-	Scale	Continuous (Maximum = 4.3)
Region	Geographic region	-	Categorical	1=Asia, 2=Africa, 3=Other (South America & Oceania)
English-speaking country	English-speaking country	-	Categorical	1=yes, 2=no
Kowledge	Knowledge score	T1	Scale	Mean of 4-point Likert items(1=None, 2=Aware, 3=Knowledgeable, 4=Proficient)
Delta_K	Knowledge change score	T2-T1	Scale	Positive values indicate improvement
Delta_A	Attitude change score	T2-T1	Scale	Positive values indicate improvement
Delta_S	Skill change score	T2-T1	Scale	Positive values indicate improvement

Appendix 5 : Original Survey Questionnaire for Knowledge Domain

Analytical / Assessment Related Knowledge			
1=None / I am unaware, or have very little knowledge of the item 2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill 3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill 4=Proficient / I am very comfortable, an expert; could teach this to others		Score	Priority
1	Identify the health status of populations and their related determinants of health and illness (e.g. factors contributing to health promotion and disease prevention, the quality, availability and use of health services)		
2	Describe the characteristics of a population-based health problem (e.g. equity, social determinants, environment)		
3	Use variables that measure public health conditions		
4	Use methods and instruments for collecting valid and reliable quantitative and qualitative data		
5	Identify sources of public health data and information		
6	Recognize the integrity and comparability of data		
7	Identify gaps in data sources		
8	Adhere to ethical principles in the collection, maintenance, use, and dissemination of data and information		
9	Describe the public health applications of quantitative and qualitative data		
10	Collect quantitative and qualitative community data (e.g. risks and benefits to the community, health and resource needs)		
11	Use information technology to collect, store, and retrieve data		

12	Describe how data are used to address scientific, political, ethical, and social public health issues		
	Total Score		
	Average Total		

Policy Development/Program Planning Related Knowledge			
1=None / I am unaware, or have very little knowledge of the item 2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill 3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill 4=Proficient / I am very comfortable, an expert; could teach this to others		Score	Priority
1	Gather information relevant to specific public health policy issues		
2	Describe how policy options can influence public health programs		
3	Explain the expected outcomes of policy options (e.g. health, fiscal, administrative, legal, ethical, social, political)		
4	Gather information that will inform policy decisions (e.g. health, fiscal, administrative, legal, ethical, social, political)		
5	Describe the public health laws and regulations governing public health programs		
6	Participate in program planning processes		
7	Incorporate policies and procedures into program plans and structures		
8	Identify mechanisms to monitor and evaluate programs for their effectiveness and quality		
9	Demonstrate the use of public health informatics practices and procedures (e.g. use of information systems infrastructure to improve health outcomes)		
1	Apply strategies for continuous quality improvement		

0			
Total Score			
Average Total			

Communication Skills & Knowledge			
1=None / I am unaware, or have very little knowledge of the item		Score	Priority
2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill			
3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill			
4=Proficient / I am very comfortable, an expert; could teach this to others			
1	Identify the health literacy of populations served		
2	Communicate in writing and orally, in person, and through electronic means, with linguistic and cultural proficiency		
3	Solicit community-based input from individuals and organizations		
4	Convey public health information using a variety of approaches (e.g. social networks, media, blogs)		
5	Participate in the development of demographic, statistical, programmatic and scientific presentations		
6	Apply communication and group dynamic strategies (e.g. principled negotiation, conflict resolution, active listening, risk communication) in interactions with individuals and groups		
Total Score			
Average Total			

Cultural Competency Skills & Knowledge			
1=None / I am unaware, or have very little knowledge of the item		Score	Priority
2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill			
3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill			

	4=Proficient / I am very comfortable, an expert; could teach this to others		
1	Incorporate strategies for interacting with persons from diverse backgrounds (e.g. cultural, socioeconomic, educational, racial, gender, age, ethnic, sexual orientation, professional, religious affiliation, mental and physical capabilities)		
2	Recognize the role of cultural, social, and behavioral factors in the accessibility, availability, acceptability, and delivery of public health services		
3	Respond to diverse needs that are the result of cultural differences		
4	Describe the dynamic forces that contribute to cultural diversity		
5	Describe the need for a diverse public health workforce		
6	Participate in the assessment of the cultural competence of the public health organization		
	Total Score		
	Average Total		

Community Dimension of Practice Skills & Knowledge			
	1=None / I am unaware, or have very little knowledge of the item	Score	Priority
	2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill		
	3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill		
	4=Proficient / I am very comfortable, an expert; could teach this to others		
1	Recognize community linkages and relationships among multiple factors (or determinants) affecting health (e.g. The Socio-Ecological Model)		
2	Demonstrate the capacity to work in community-based participatory research efforts		
3	Identify stakeholders		
4	Collaborate with community partners to promote the health of the population		
5	Maintain partnerships with key stakeholders		

6	Use group processes to advance community involvement		
7	Describe the role of governmental and non-governmental organizations in the delivery of community health services		
8	Identify community assets and resources		
9	Gather input from the community to inform the development of public health policy and programs		
10	Inform the public about policies, programs, and resources		
Total Score			
Average Total			

Public Health Science Knowledge & Skills			
1=None / I am unaware, or have very little knowledge of the item 2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill 3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill 4=Proficient / I am very comfortable, an expert; could teach this to others		Score	Priority
1	Describe the scientific foundation of the field of public health		
2	Identify prominent events in the history of the public health profession		
3	Relate public health science skills to the Core Public Health Functions and Ten Essential Services of Public Health		
4	Identify the basic public health sciences (including, but not limited to, biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral health sciences)		
5	Describe the scientific evidence related to a public health issue, concern, or intervention		

6	Retrieve scientific evidence from a variety of text and electronic sources		
7	Discuss the limitations of research findings (e.g. limitations of data sources, importance of observations and interrelationships)		
8	Describe the laws, regulations, policies, and procedures for the ethical conduct of research (e.g. patient confidentiality, human subject processes)		
9	Partner with other public health professionals in building the scientific base of public health		
Total Score			
Average Total			

Financial Planning and Management Knowledge & Skills			
1=None / I am unaware, or have very little knowledge of the item 2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill 3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill 4=Proficient / I am very comfortable, an expert; could teach this to others		Score	Priority
1	Describe the local, state, and federal public health and health care systems		
2	Describe the organizational structures, functions, and authorities of local, state, and federal public health agencies		
3	Adhere to the organization’s policies and procedures		
4	Participate in the development of a programmatic budget		
5	Operate programs within current and forecasted budget constraints		
6	Identify strategies for determining budget priorities based on federal, state, and local financial contributions		
7	Report program performance		
8	Translate evaluation report information into program performance		

	improvement action steps		
9	Contribute to the preparation of proposals for funding from external sources		
10	Apply basic human relations skills to internal collaborations, motivation of colleagues, and resolution of conflicts		
11	Demonstrate public health informatics skills to improve program and business operations (e.g. performance management and improvement)		
12	Participate in the development of contracts and other agreements for the provision of services		
13	Describe how cost-effectiveness, cost-benefit, and cost-utility analyses affect programmatic prioritization and decision making		
Total Score			
Average Total			

Leadership and System Thinking Knowledge & Skills			
1=None / I am unaware, or have very little knowledge of the item		Score	Priority
2=Aware / I have heard of it; limited knowledge and/or ability to apply the skill			
3=Knowledgeable / I am comfortable with knowledge or ability to apply the skill			
4=Proficient / I am very comfortable, an expert; could teach this to others			
1	Incorporate ethical standards of practice as the basis of all interactions with organizations, communities, and individuals		
2	Describe how public health operates within a larger system		
3	Participate with stakeholders in identifying key public health values and a shared public health vision as guiding principles for community action		
4	Identify internal and external problems that may affect the delivery of Essential Public Health Services		

5	Use individual, team, and organizational learning opportunities for personal and professional development		
6	Participate in mentoring and peer review or coaching opportunities		
7	Participate in the measuring, reporting, and continuous improvement of organizational performance		
8	Describe the impact of changes in the public health system, and larger social, political, economic environment on organizational practices		
Total Score			
Average Total			

Appendix 6 : Original Survey Questionnaire for Attitudes Domain

	Communication	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Shares information effectively within and outside the public service.									
1	Ensures information is shared to all relevant people in a prompt and efficient manner									
2	Communicates in a respectful manner									
3	Adapts communication methods for the intended audience									
4	Writes in a clear and concise manner									
5	Actively listens to others to ensure a full understanding of what they are saying									
6	Demonstrates an effective presentation style for lectures, presentations, focus groups or organized talks									
7	Adheres to Government's policy regarding formal communications									
	Decision Making	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Makes, and takes responsibility for, appropriate decisions in a timely manner									
1	Actively seeks and analyzes relevant information to help resolve problems									
2	Makes decisions that are consistent with organizational									

	goals and values									
3	Applies analytical skills throughout the decision making process									
4	Accepts responsibility for decisions made									
5	Implements and evaluates decisions									
	Relationship Building	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Identifies, builds and maintains working relationships and partnerships that are important to the achievement of Government's objectives									
1	Maintains working relationships to achieve objectives									
2	Works collaboratively with others to achieve goals and objectives									
3	Encourages employees to work collaboratively									
4	Respects and acknowledges the contribution of others									
5	Provides recognition of team achievements									
6	Assesses the value of entering into and remaining in partnerships									
7	Deals with difficult situations quickly and effectively									
8	Uses effective negotiation skills									
	Ethics and Professionalism	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Acts in accordance with the values and beliefs of the public service.									
1	Acts in a respectful manner to others regardless of gender, age, race, ability, sexual orientation, culture or									

	religious beliefs									
2	Maintains professional standards of ethics and integrity									
3	Respects privacy and confidentiality of others									
4	Leads by example to demonstrate respectful behaviour for the workplace									
	Strategic Focus	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Demonstrates an understanding of the long-term issues and opportunities affecting the Department and Government.									
1	Considers the “big picture” when making decisions about the strategic directions and goals									
2	Ensures alignment of the divisional goals with the organization’s goals									
3	Implements policies in accordance with established purposes									
4	Understands environmental influences (both internal and external to Government) and ensures plans to incorporate these influences									
	Creativity and Innovation	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Encourages and supports innovative ideas and solutions that are beyond the conventional.									
1	Demonstrates creativity when dealing with problems and identifying solutions									

2	Encourages new approaches and perspectives									
3	Takes calculated risks to optimize resources and improve delivery of services									
4	Displays adaptability and flexibility									
	Service Delivery	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Serves the public interest by focusing effort on program policy, programs and services that support the direction of Government.									
1	Identifies internal and external clients									
2	Seeks to understand clients' current and future needs									
3	Accomplishes results which support government and departmental priorities									
4	Aligns policies and services with public need and the direction of government									
5	Utilizes evidence-informed best practices in decision-making									
	Self Management	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
	Effectively manages one's time and work in order to achieve results									
1	Prioritizes work and respects timelines when completing tasks									
2	Recognizes barriers to work productivity and takes action									

	to minimize these barriers									
3	Manages competing demands from multiple sources									
4	Recognizes need for assistance and requests help									
5	Learns from mistakes and successes									
6	Practices stress management techniques to maintain effectiveness									
7	Pursues learning and development opportunities									

Resource Management	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
Manage all resources to achieve organizational goals									
PERFORMANCE MANAGEMENT / Empowers and motivates employees to achieve results									
1 Empowers others through delegation of responsibility and authority									
2 Provides ongoing positive and corrective feedback									
3 Ensures employees have a clear understanding of their individual goals									
4 Addresses performance problems in a prompt and constructive manner									
5 Demonstrates conflict resolution strategies									
6 Leads by example									
7 Recognizes individuals' work									
8 Fosters continuous learning									

FINANCIAL MANAGEMENT / Manages financial resources and systems to achieve results.										
1	Demonstrates an understanding of the budgeting process									
2	Manages finances in accordance with approved budgets									
3	Meets organizational financial reporting requirements									

Resource Management	Almost Never	Occasionally	Frequently	Almost Always	Not Important	Somewhat Important	Important	Critical	
Manage all resources to achieve organizational goals									
INFORMATION TECHNOLOGY / Uses IT resources and systems effectively to achieve business results									
1	Manages assigned IT assets and resources (hardware and software) in a responsible manner according to Government guidelines									
2	Uses office productivity software (such as word processing, spreadsheets, presentations and email systems software) appropriately									
3	Uses government systems (such as TRIM, FMS, Travel Claims Management System) effectively									
INFORMATION MANAGEMENT / Manages information resources and systems to achieve business results.										
1	Manages information in all formats, consistent with policies and legislation, in a secure and efficient manner									
2	Practices established Government policies and procedures									

	for the protection of information									
3	Identifies areas of process and procedure compliance in information management and protection									
4	Acts upon internal and external risks for information management and information protection									
PROJECT MANAGEMENT / Uses planning and organizing techniques to oversee project implementation										
1	Develops realistic project plans that clearly outline project scope, objectives, deliverables and resources									
2	Monitors progress against plan on a regular basis									
3	Anticipates potential road blocks and develops contingency plans in advance									
CHANGE MANAGEMENT / The ability to effectively create positive change, manage change processes, and adapt to change.										
1	Demonstrates knowledge of the change process and how it affects self and others									
2	Communicates change as an opportunity for innovation and growth									
3	Obtains and provides resources to implement change initiatives									
4	Manages resistance to change									

Appendix 7 : Original Survey Questionnaire for Skills Domain

Personal Leadership Development	**Do Not Do Well**	**Do Somewhat Well**	**Do Well**
Understands Leadership			
1. I am aware of my leadership strengths and weaknesses.			
2. I take initiative on projects.			
3. I build relationships with others in order to reach a mutual goal.			
4. I understand the underlying concepts of leadership.			
5. I adapt my leadership style to different situations.			
6. I have a personal philosophy of leadership.			
Is Self Aware			
7. I am aware of my attitudes, values, biases, and prejudices.			
8. I engage in activities that build or improve my leadership abilities.			
9. I pay attention to how my language and behavior may be perceived by others.			
10. I am able to exert self-discipline and control over my behavior.			
11. I know my personal power to make a difference in my life and others.			
Practices Ethical Behavior			
12. I understand the ethical responsibilities that come with leadership.			
13. I follow through on commitments I make.			
14. I am trustworthy.			
15. I act in accordance with my words, e.g., “walk the talk.”			
16. I lead by setting a positive example for others.			
Sustains Leadership			
17. I am a life-long learner.			
18. I reflect on situations and learn from them.			
19. I am resilient. When things don’t work out, I learn from it and bounce back.			

20. I provide opportunities for others to be leaders.			

Interpersonal Leadership Development	Do Not Do Well	Do Somewhat Well	Do Well
Values Diversity			
1. I value that each person is different.			
2. I treat each person with respect.			
3. I work effectively with others who are different from me.			
4. I reach out to include other people.			
Enhances Communication Skills			
5. I listen carefully to understand what another person is saying.			
6. To avoid misunderstanding, I ask questions to clarify what the other person is saying.			
7. I say what I mean and mean what I say.			
8. When I speak, my message is clear.			
9. I can express a view that differs from that of others in effective ways.			
10. To get different perspectives, I ask for input from a wide range of people.			
11. I establish rapport with people.			
12. I influence others through what I say and how I say it.			
13. I seek feedback from others, even if it might be negative.			
14. If my work affects others, I keep them informed about what I'm doing.			
15. I work at building a network of resource people.			
16. I initiate relationships with others.			
Manages Conflict			
17. I work to solve problems, not blame others, when we hit a stone wall.			
18. I am able to give constructive negative feedback to others when needed.			
19. I initiate successful resolution of conflict with others.			
20. I can manage conflict to create positive change.			

Group and Organizational Leadership Development	Do Not Do Well	Do Somewhat Well	Do Well
Develops Teams			
1. I value the contribution each person makes to a team.			
2. I help a group identify a common goal.			
3. When working in a team situation, I help the group keep its focus.			
4. I help ensure that everyone is kept informed and information is shared freely.			
5. When I'm responsible for a task or project, I follow through in a timely way.			
6. I work well with others on a team.			
7. I help the team determine how it will work together as a team.			
Leads Change			
8. I take on new challenges in a group or organization.			
9. I initiate new projects with a group/organization.			
10. I see opportunities in challenges faced by a group/organization and help them move forward.			
11. I help groups/organization develop a vision for its future.			
12. I initiate strategic planning processes with groups/organizations.			
Manages Projects			
13. I understand the difference between the functions of leadership and management.			
14. I understand the dynamics of groups and adjust my leadership style accordingly.			
15. I help groups make decisions through consensus.			
16. I match the various skills and interests of people to the tasks.			
17. I help groups set priorities and develop a plan of action.			
18. I help groups find resources to implement their plan of action.			
19. I ensure that everyone is kept informed and involved in group projects.			
20. I recognize individuals for their contributions.			

Community Leadership Development	Do Not Do Well	Do Somewhat Well	Do Well
Practices Citizenship			
1. I vote in elections.			
2. I stay current with issues at the local, state, national, and world level.			
3. I get involved in my community because I know that in a democracy I must do my part.			
4. I respect that others will have views and values different from mine.			
Understands Community			
5. I understand the diversity and complexity of communities.			
6. I try to make a difference in my community.			
7. I understand the role of government and public policy making.			
8. I understand the role of non-profit organizations.			
9. I understand who decision makers are in the community and how public decisions are made.			
10. I understand the important role played by the news media in a democracy.			
11. I participate in public meetings when important issues are being discussed.			
12. I understand the importance of building partnerships in a community to get things done.			
13. I understand social injustice, prejudices and biases in our society and work to eliminate them.			
Commits to Serving Others			
14. I try to make a difference for causes that are greater than my own needs.			
15. I volunteer to serve others in the community.			
16. I engage with culturally different groups in the community.			
17. I reflect on my community service to learn more about myself.			
18. I help people in a community organize to undertake a worthwhile project.			
19. I help people who do not have a voice at the policy table develop a			

way to be heard.			
20. I help bring information or other resources to a community project			

Appendix 8 : IRB Approval Certificate

연세의료원 세브란스병원 연구심의위원회
Yonsei University Health System, Severance Hospital, Institutional Review Board
서울특별시 서대문구 연세로 50-1 (우) 03722
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심 의 일 자	2024년 10 월 22 일
접 수 번 호	2024-2569-001
과제승인번호	4-2024-1106

세브란스병원 연구심의위원회의 심의 결과를 다음과 같이 알려 드립니다.

Protocol No.	
연 구 제 목	코이카 학위연수 과정에서의 교육훈련의 핵심역량과 학습성과 및 교과목 만족도의 상관관계 분석
연 구 책 임 자	김소윤 / 세브란스병원 의료법윤리학과
의 뢰 자	(학)연세대학교
연구예정기간	2024.10.22 ~ 2025.03.21
지속심의 빈도	면제
과 제 승 인 일	2024.10.22
위 험 수 준	Level I 최소위험
심 의 방 법	신속
심 의 유 형	신규과제
심 의 내 용	- 연구계획서 (국문) - 증례기록서 - 연구책임자 이력 및 경력에 관한 사항
심 의 위 원 회	제4위원회
참 석 위 원	제4위원회 신속심의자
심 의 결 과	승인(동의 면제)
심 의 의 견	-
권고/안내사항	1. 앞으로도 교육과정의 일환으로 학생들이 작성하는 설문조사 결과값을 연구 목적으로 이용하고자 한다면, 설문지 커버에 해당 내용 포함하여 주실 것을 권고 드림.