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Assessing literacy on the interconnection between non-communicable diseases and climate change among youth in Nairobi, Kenya: An interventional study

Abstract

This study investigates the efficacy of mixed-method educational interventions in enhancing literacy levels among youth in Nairobi concerning the intricate relationship between climate change and non-communicable diseases (NCDs). The education methods used in this study included a continuous trainer-of-the-trainer approach, and peer learning combined with digital health interventions including the NCDs 365 App and the NCDs for Public Health Online course. Utilizing a rigorous methodology, the study engaged 70 participants at baseline and 65 at endline, with a minimal attrition rate. The study focused on key indicators, including literacy levels, positive behavioral changes, and the integration of digital health technologies.

Results indicate a commendable increase in literacy levels, with 95.4% of respondents accurately recognizing NCDs at the endline, compared to 81.4% at baseline. Positive shifts were evident in the understanding of examples and major risk factors of NCDs. Climate change awareness notably improved, with 76.9% defining it as a long-term shift in weather patterns at the endline, compared to 44.3% at baseline. The association between climate change and NCDs was acknowledged by 86.2% at endline, up from 57.1% at baseline. Attitudinal and behavioral changes were prominent, as 95.4% expressed intent to participate in NCDs and climate change activities at the endline, compared to 81.4% at baseline. Digital health technologies demonstrated substantial engagement, with 87.7% downloading the NCD365 app. Further, 93.8% enrolled in the online course, and 75.4% frequently used the NCD365 app. Encouragingly, 94.7% would recommend the app to friends. The study concludes that educational interventions significantly enhance knowledge, attitudes, and behaviors related to climate change and NCDs among youth in Nairobi.

Recommendations include expanding similar initiatives, incorporating interactive elements, and continuous monitoring for long-term impact assessment. This research contributes pivotal insights to addressing 21st-century challenges through targeted education and technological integration.

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Introduction

Background and rationale

Non-communicable diseases and climate change were termed as two of the biggest challenges of the 21st century by the United Nations.[1] This is because the rising global impact of non-communicable diseases (NCDs) and the multifaceted consequences of climate change pose intricate challenges to human health and planetary health.[2] These challenges are particularly pronounced in urban environments, where the risk factors and effects of both NCDs and climate change are heavily pronounced including access to foods high in pesticides and processed foods, air pollution from vehicles and factories, and sedentary living exacerbated by the urban built environment.[2] All of these risks affect both the development of non-communicable diseases and climate change. The interconnection between NCDs and climate change in this context is underscored by the intricate web linking environmental shifts, lifestyle factors, and health outcomes.

The Step-Up Project, implemented by Stowelink in Nairobi County, delved into this connection. Against the backdrop of increasing urbanization, the project aimed to raise the awareness and literacy of youth, aged 18-35, and dwelling in informal settlements. Through a strategic combination of in-person training sessions, an online course, and the utilization of the NCDs 365 mobile application, the project sought to empower youth with knowledge concerning the reciprocal impacts of NCDs and climate change.[3]

The project's inception was grounded in the recognition that urban areas, grappling with a surge in NCD prevalence, also face environmental vulnerabilities attributable to climate change.[4] The effects and contributors to climate change, such as altered weather patterns, poor soils as a result of heavy pesticide application, increasing temperatures, and air pollution, intertwine with lifestyle choices, influencing the incidence and progression of NCDs. For instance, urbanization-driven sedentary lifestyles, coupled with dietary shifts influenced by climate-related factors, contribute to the rising burden of NCDs among the youth population.[4]

The rationale rested on the idea that by enhancing awareness of the intricate relationship between NCDs and climate change, the youth could become catalysts for sustainable health practices and climate resilience. Moreover, the project recognized the shared risk factors, including air pollution, dietary patterns, and mental health impacts, necessitating an integrated approach for effective mitigation and adaptation.[2]

Significance of the study

The significance of the Step-Up Project lies in its innovative approach to addressing crucial knowledge gaps among youth regarding the interplay between NCDs and climate change. Nairobi, symbolic of challenges posed by fast urbanization and environmental vulnerabilities, is a fitting backdrop for this study. The project's focus on youth is crucial, recognizing them not just as a vulnerable group but as potential changemakers in promoting sustainable health practices. By explaining the interconnectedness of NCDs and climate change, the project aimed to increase literacy and understanding of the topics in the short term and enhance behavior change in the long term. The expected positive outcomes include a potential reduction in NCD risk factors and an improved ability to adapt to climate-related challenges. Furthermore, the project's findings contribute to the wider discussion on integrated interventions, emphasizing the need for collaborative efforts across the health, environment, and education sectors.

Objectives of the step-up project

The Step-Up Project set forth comprehensive objectives to address the identified gaps:

- To increase the literacy levels of youth on the complex interconnection between Non-Communicable Diseases (NCDs) and climate change through targeted educational programs.
- To investigate the project's efficacy in influencing positive behavioral changes, particularly in lifestyle choices, dietary habits, and awareness of climate-related health risks.
- To assess the effectiveness of modern communication tools, such as the NCDs 365 mobile application and online courses, in disseminating information and sustaining engagement.

Literature review

Intr.oduction to NCDs and climate change

Non-communicable diseases (NCDs) impose a substantial global health burden, contributing to increased morbidity and mortality. According to the World Health Organization (WHO), NCDs account for approximately 71% of global deaths, with cardiovascular diseases, cancers, respiratory diseases, and diabetes being the primary culprits.[5] The burden of NCDs is exacerbated by diverse risk factors, including unhealthy lifestyles, dietary patterns, and environmental exposures. At the continental scale, Africa faces unique challenges in dealing with the burden of NCDs. The African continent experiences a dual health burden, with infectious diseases coexisting with an increasing prevalence of NCDs.[6] In Kenya, NCDs account for a significant proportion of the disease burden. The Kenya Stepwise Survey for Non-Communicable Diseases Risk Factors 2015 revealed that about 27% of Kenyans aged 18-69 years had raised blood pressure, indicating a high prevalence of cardiovascular risk factors.[7] Furthermore, the rising incidence of diabetes, cancers, and respiratory diseases contributes to the multifaceted challenges in healthcare management.

Climate change, a global phenomenon, manifests through shifts in temperature, precipitation patterns, and the frequency of extreme weather events. The Intergovernmental Panel on Climate Change (IPCC) reports that global temperatures are on an upward trajectory, with projections indicating potential increases of 1–3 degrees Celsius by 2020 and 3–5 degrees Celsius by 2080, particularly in tropical and subtropical regions.[8] Kenya, like many other regions, experiences the impacts of climate change. Changes in precipitation patterns, rising temperatures, and extreme weather events contribute to environmental stressors. For instance, prolonged droughts in subtropical regions, including parts of Kenya, lead to water scarcity and agricultural challenges. These climate-induced shifts affect traditional living and dietary patterns, potentially amplifying the burden of NCDs.[9]

Climate change and various NCDs: the interconnectedness

The interconnection between climate change and NCDs, particularly cardiovascular diseases (CVD), is intricate. Climate change affects cardiovascular health through direct exposure to air pollution and extreme temperatures. Altered weather patterns and pollution concentrations contribute to increased hospitalization and mortality due to CVD.[10] Moreover, the physiological responses to increased heat exposure, such as elevated core body temperature and increased heart rate, impose stress on the cardiovascular and respiratory systems.

Climate change compromises outdoor air quality, increasing the production of tropospheric ozone and fine-particle air pollution. These pollutants escalate respiratory tract irritation, chronic pulmonary disease hospitalizations, and lung disease mortality.[11] Changes in weather patterns also intensify bushfires, contributing to greater air pollution and, consequently, an increased risk of respiratory illnesses.

Global climate change alters ambient ultraviolet radiation (UVR), influencing the risk of UV-related health outcomes, including cancers.[12] Changes in precipitation and cloud coverage may bring new pests and diseases into the agricultural system, potentially leading to increased use of herbicides and pesticides, raising the risk of cancers. Furthermore, climate-induced conditions, such as increased aflatoxin contamination due to warming and erratic weather patterns, contribute to liver cancer risks.[13]

The mental health implications of climate change are vast. Increased frequency and intensity of extreme weather events, coupled with competition for scarce resources, contribute to stress and anxiety. Direct impacts of events like hurricanes result in immediate mental health consequences, while gradual disruptions to social and economic determinants, such as drought-induced job losses, lead to long-term mental health challenges.[14]

Extreme weather events, sea-level rise, and temperature extremes associated with climate change pose direct risks of injuries. Coastal inundation and flooding increase the risk of injury, and temperature extremes affect physiological functioning, potentially increasing the risk of accidents.[2]

Co-benefits of addressing both NCDs and climate change: expanding perspectives

Efforts to combat non-communicable diseases (NCDs) and mitigate climate change can forge synergies that extend beyond the specific domains of health and environmental conservation. This dual-faceted approach not only promotes the well-being of individuals but also contributes to the broader goals of sustainable development.[2]

Well-designed strategies aimed at mitigating climate change offer a unique win-win opportunity. By reducing greenhouse gas (GHG) emissions, these strategies contribute to the global imperative of addressing climate change. Simultaneously, they yield tangible benefits by lowering NCD risk factors within local populations. This duality aligns with the broader developmental goals of countries, fostering health improvement, supporting sustainable development, and aiding in the attainment of national emission targets.[15]

Sustainable interventions targeting the reduction of air pollution, a crucial aspect of climate change mitigation, have the potential to deliver substantial health benefits. Beyond the immediate gains in air quality, these measures can alleviate the prevalence of cardiovascular and respiratory ailments, particularly in vulnerable populations.[15]

Encouraging a shift toward active transport, such as walking and cycling, emerges as a powerful intervention. This not only reduces carbon emissions associated with vehicular transport but also induces widespread cardiovascular health gains.[2] The co-benefit extends to a decreased risk of cancer, improvements in mental health, and a reduction in the incidence of various chronic conditions. This approach aligns with the principles of sustainable urban planning, promoting health-conscious transportation alternatives.[10]

Adapting to the impacts of climate change can concurrently create living conditions that mitigate NCD risks. Well-designed climate change adaptation strategies, including infrastructure development and sustainable urban planning, can inadvertently foster environments that support health and well-being. By reducing exposure to climate-related stressors, such as extreme temperatures and natural disasters, these adaptations contribute to resilience against NCDs and support overall developmental goals.[16]

The role of youth in health and environmental initiatives

Youth, as agents of change, play a pivotal role in health and environmental initiatives. Andrej Kirbiš,[17] contributes insights into environmental attitudes across diverse cultural contexts, emphasizing the need for interventions that consider the unique perspectives and behaviors of youth.[17] Understanding these attitudes is essential for tailoring interventions that resonate with the cultural and social contexts of diverse youth populations. Han,[18] expands on this by examining sustainability indicators, shedding light on the comprehensive measurements required to gauge the impact of youth-led initiatives on health and the environment.[18]

The youth, often at the forefront of innovative solutions and advocacy, can be instrumental in bridging the gap between awareness and action. Harnessing their potential involves recognizing their agency in shaping health and environmental outcomes and incorporating their perspectives into the design and implementation of interventions.

Conclusion

The reviewed literature underscores the intricate interplay between NCDs and climate change, emphasizing the urgency of tailored and nuanced interventions. Recognizing the pivotal role of youth in these initiatives is essential for fostering sustainable health practices and environmental resilience.

Methodology

Study design

The study employed interventional design.[19] Initially, a pre-intervention questionnaire was administered to assess the baseline knowledge. Subsequently, the intervention was implemented, followed by a post-intervention (endline) questionnaire to evaluate the knowledge, attitudinal/behavioral changes, and utilization of digital platforms after the intervention.

Study setting

The project engaged 100 selected participants from 10 groups, with 10 participants representing each group. These groups were situated in the Roysambu sub-county, Nairobi, Kenya. During the baseline survey, only 70 responses were received. The project spanned 16 months, commencing from August 2022 to November 2023. Implementation was carried out by the Stowelink Foundation in collaboration with the Non-Communicable Diseases Alliance of Kenya.

Sampling

Utilizing purposive sampling, 100 youths drawn from the 10 groups were eligible to take the baseline survey. The ten groups engaged were required to be formally registered and have been involved in community initiatives. At the endline, only the baseline survey participants were eligible for the study.

Inclusion and Exclusion criteria

Inclusion criteria

- Members of an implementing community-based organization
- Individuals aged 18 and above from each community-based organization
- Access to online resources and completion of the online course
- Basic English comprehension for the online questionnaire
- Participation in the evaluation by providing informed consent.

Exclusion criteria

- Members from a different implementing community-based organization
- Inability to read, write, and respond in English
- Non-participation in the project
- Individuals below 18 years
- Inability or unwillingness to provide informed consent.

The inclusion and exclusion criteria were presented as a checklist in the online questionnaire and were prerequisites for completing the rest of the questionnaire.

Data collection management and storage

KoboCollect App was utilized in data collection exercised during the in-person baseline and endline data collection sessions. The Stowelink Foundation, as the implementing partner, organized two data collection events with research assistants entering data to ensure accuracy. The Foundation managed the form, centralizing all data on a secure platform, facilitating efficient and secure data collection, as well as streamlined data management and organization.

Intervention methods

Following baseline data collection, participants underwent in-person training on the link between NCDs and climate change. This was followed by an in-depth online course titled "NCDs and Public Health," exploring the subject further. Participants were introduced to the NCDs 365 app, which serves as both an information repository and an engagement platform. Trained individuals received a "Trainer of Trainers" badge and were deployed to their communities to continue the training, emphasizing a hands-on learning approach. Finally, at the project's conclusion, trainers from each group conducted an endline survey.

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Data analysis

Before conducting the data analysis, a thorough quality check was performed to ensure the reliability of the data. Only participants who completed the entire questionnaire were included in the analysis for this study. This criterion was implemented to maintain data integrity.

Ethical considerations

Ethical considerations were of utmost importance in this research study, and measures were implemented to ensure the protection and confidentiality of the participants following the Helsinki.[20] The study began by obtaining informed consent from the participants, as outlined in the Helsinki Declaration (Principle 25) and other relevant ethical guidelines. The informed consent statement communicated the purpose of the research and provided a comprehensive explanation of the potential circumstances under which the data could be shared.[20]

This approach aimed to respect the autonomy and rights of the participants. To safeguard the privacy and confidentiality of the participants, the questionnaire deliberately avoided collecting personal identifying information such as names, emails, ID numbers, or phone numbers. This measure was in line with the Helsinki Declaration (Principle 17), which emphasizes the importance of protecting the confidentiality of participants' data.[20]

Furthermore, the research study obtained written permission from the Stowelink Foundation, the primary custodian of the data, to use the secondary data for the study. This step was taken to ensure compliance with the Helsinki Declaration's provisions on data protection (Principle 24) and the ethical handling of secondary data.[20]

By adhering to these ethical guidelines and regulations, the study ensured the ethical integrity of the research and addressed the ethical issues related to informed consent, confidentiality, and data protection. These measures were crucial in upholding the ethical principles outlined in the Helsinki Declaration and safeguarding the rights and well-being of the research participants.

Results

Analysis

In this section, we present a condensed overview of key statistics, concentrating on the socio-demographic attributes of respondents and the primary objectives of the study. The overarching aim of this research was to evaluate the literacy levels regarding the interconnection between climate change and climate action among youth in Nairobi. To accomplish this objective, primary outcomes were gauged using a questionnaire deployed on a digital data collection platform (Kobo Collect). The specific primary outcomes and corresponding indicators are succinctly outlined in Table 1 below.

Table 1

Measure	Indicators
Increase in literacy level on the interconnection between NCDs and Climate change	% of project beneficiaries whose literacy levels on the interconnection between NCDs and Climate change have increased.
Positive behavior/attitudinal change regarding NCDs and Climate change	% of project beneficiaries who embrace positive behaviors and practices critical in addressing both NCDs and climate change. Positive attitudinal change regarding NCD and climate change.
Digital health technologies (NCDs365 App) as a resource for supporting health education and sustaining engagements with young people	Retention rate: The number of project beneficiaries who have downloaded the app and are actively using it for their health benefits. NCDs for Public Health Course Completion Rate.

Socio-demographic characteristics

Social-demographic attributes of the respondents are shown in Table 2. The total number of participants at baseline and endline differed slightly (70 vs 65) as some[5] project beneficiaries dropped out of the project. They were not eligible for the endline survey. In terms of gender distribution, almost similar percentages of men (higher percentage at endline) participated in the baseline and endline survey (64.3% vs 67.7%). The percentage of female participants dropped; 35.7% at baseline and 32.3% at endline. This is the distribution of the survey respondents at baseline juxtaposed against endline; 18-25 (55.7% vs 56.9%), 26-30 (31.4% vs 36.9%), 31-35 (7.1% vs 4.6%) and above 35 (5.7% vs 1.6%). All the participants reside in Nairobi, the project location. In terms of education level, 14.3% had primary level education at baseline, dropping to 12.3% at the endline; secondary education at 50.0% during the baseline survey, increasing to 53.8% at endline; college education at 30.0% during the baseline survey, dropping slightly to 29.2% at endline, and University education at 5.7% dropping marginally to 4.6%.

Table 2

		Baseline	Endline
Total number of respondents		**70**	**65**
Gender	Male	64.3% (45)	67.7% (44)
	Female	35.7% (25)	32.3% (21)
Age	18-25	55.7% (39)	56.9% (37)
	26-30	31.4% (22)	36.9% (24)
	31-35	7.1% (5)	4.6% (3)
	Above 35	5.7% (4)	1.6%Top of Form (1)
Residence	Nairobi County	100% (70)	100% 65
Level of Education	Primary	14.3% (10)	12.3% (8)
	Secondary	50.0% (35)	53.8% (35)
	College	30.0% (21)	29.2% (19)
	University	5.7% (4)	4.6% (3)

The variation in the percentages at baseline and endline is justified by the attrition rate (participants dropping out of the project).

Key indicators

Literacy levels on the interconnection between NCDS and climate change

The study participants' knowledge of NCDs and Climate change was assessed before their understanding of the nexus between the two tested. This was done to establish their grounding on these two leading problems of the 21st century. Table 3 & Table 4 below are a summary of the findings at baseline and endline respectively.

Table 3 Baseline findings

Response	Frequency	Percentage
They cannot be transmitted from person to person	57	81.4
They are diseases for the elderly	2	2.9
They are sexually transmitted	11	15.7
Total	**70**	**100**

Table 4 Endline findings

Definition	Frequency	Percentage
They cannot be transmitted from person to person	62	95.40%
They are diseases for the elderly	0	0.00%
They are sexually transmitted	3	4.60%
Total	**65**	**100**

Understanding/ Knowledge of Non-communicable diseases

At baseline, 81.4% (57) of the respondents accurately recognized NCDs as diseases that cannot be transmitted from one person to another followed by 15.7% (11) who mentioned that they are sexually transmitted and 2.9% (2) who indicated that these are diseases for the elderly.

At endline, 95.4% of the respondents accurately recognized NCDs as diseases that cannot be transmitted from one person to the other signaling increased knowledge of NCDs among participants (compared to baseline data). Those who indicated that NCDs are sexually transmitted dropped considerably from 15.7% at baseline to 4.6% at endline.

Understanding of examples of NCDs

At baseline and endline, the project beneficiaries were tested on their understanding of examples of NCDs. They were asked to identify the list comprised of NCDs only. At baseline, 58.6% correctly highlighted examples of NCDs while at endline, 78.5% correctly identified the list that comprised of examples of NCDs. Baseline findings, juxtaposed with endline findings are presented in Table 5 below.

Table 5 Baseline and endline

Examples	Baseline	Endline
TB, HIV, Cancer, Arthritis	5.7% (4)	3.1% (2)
Chicken Pox, Malaria, Measles, Meningitis	11.4% (8)	7.7% (5)
Cancer, Diabetes, Stroke, Obesity	58.6% (41)	78.5% (51)
High blood pressure, stroke, COVID-19	24.3% (17)	10.7% (7)
Total	**100%(70)**	**100% (65)**

Understanding of the 5 major NCD risk factors

The respondents were asked to identify the five major risk factors from the lists provided below. At baseline, slightly half (52.9%) of the participants correctly identified the 5 major risk factors for NCD; unhealthy food, alcohol use, tobacco use, physical inactivity, and air pollution. 25.7% of the respondents at baseline and 3.1% at endline selected the list comprising lack of social support, lack of enough sleep, age, poor education, and low income. The rest, 21.4% at baseline and 10.7% at endline selected the list containing poor sanitation, lack of vaccination, close contact with infected individuals, inadequate nutrition, and travel to areas with high disease prevalence. Table 6 below is a summary of the findings.

Table 6

Risk Factors	Baseline	Endline
Lack of social support, lack of enough sleep, age, poor education, low income	25.7% (18)	3.1% (2)
Unhealthy food, alcohol use, tobacco use, physical inactivity, air pollution	52.9% (37)	86.2% (56)
Poor sanitation, lack of vaccination, Close contact with infected individuals, inadequate nutrition, travel to areas with high disease prevalence	21.4% (15)	10.7% (7)
Total	**100% (70)**	**100% (65)**

Understanding/ Knowledge of climate change

In terms of definition of climate change, 44.3% at baseline and 76.9% at endline defined it as long-term shit in weather patterns; 40.0% at baseline vs 18.5% at endline as regular seasonal fluctuations in weather add 15.7% at baseline and 4.6% at endline defined climate change as sudden and temporary variation in daily weather (Table 7).

Table 7

Definition	Baseline	Endline
Long-term shifts in weather patterns	44.3% (31)	76.9% (50)
Sudden and temporary variations in daily weather	15.7% (11)	4.6% (3)
Regular seasonal fluctuations in weather	40.0% (28)	18.5% (12)
Total	**100% (70)**	**100% (65)**

Climate change perspective: Can climatic change cause non-communicable diseases?

Concerning whether climatic changes cause non-communicable diseases, this is how the respondents responded at baseline compared to endline; 57.1% vs 86.2% responded with a "yes", 38.6% vs 13.8% responded with a "No" and 4.3% vs 0.0% indicated that they don't know (Figure 1).

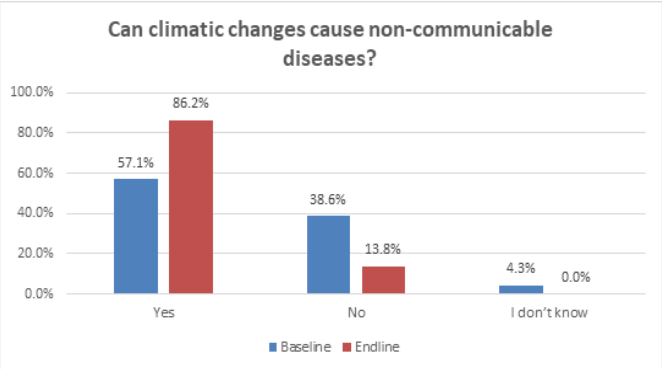

Figure 1 Can climatic changes cause non-communicable diseases?

How would you describe your current understanding of how climatic change contributes to non-communicable diseases?

At baseline, 24.3% of participants had "no understanding" of how climatic changes contribute to NCDs, while only 6.2% remained in this category during the endline survey. Those with "limited understanding" decreased from 37.1% at baseline to 10.8% at endline. Participants with a "moderate understanding" decreased from 18.6% to 7.7% between the baseline and endline assessments. Those with a "good understanding" increased from 12.9% to 47.7% from baseline to endline. Additionally, individuals with a "full understanding" rose from 7.1% at baseline to 27.7% at endline (Figure 2).

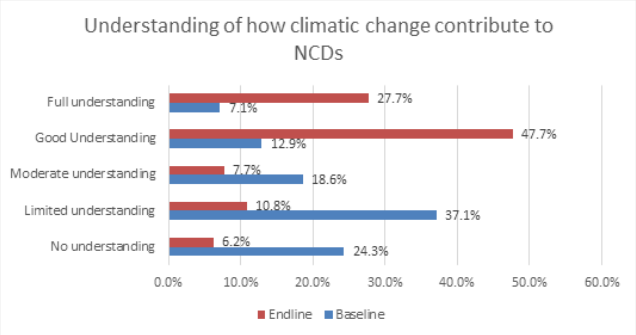

Figure 2 Understanding of how climatic change contributes to NCDs.

How do environmental and climatic changes cause non-communicable diseases?

This was an open-ended question designed to assess the project participants' ability to highlight ways through which climate change exacerbates non-communicable diseases. This question was introduced at the endline evaluation hence no baseline information to compare against. The responses were grouped into themes including; Extreme Temperatures, Air Pollution, and Unhealthy agricultural practices.

Extreme Temperatures

A majority of the project participants were able to link increased global temperatures to the rising burden of non-communicable diseases, citing heat-related illnesses such as cancer of the skin due to UV rays and heatstroke, and mental health issues due to disruption of sleep patterns. The participants also talked about the effects of extremely cold temperatures that can have a strain on cardiovascular systems, increasing the risk of conditions like heart failure and heart attacks.

"When there is global warming, the ozone layer is destroyed making it possible for people to develop cancer of the skin."

"High temperatures interfere with sleep patterns and cause mental health issues."

Sample of responses at endline when project beneficiaries were asked about how climate changes exacerbate NCDs.

Air Pollution

A majority of the project beneficiaries observed that increasing temperature and changing precipitation patterns fueled by greenhouse gas emissions, particularly carbon dioxide (CO2), methane (CH4), and nitrous oxide (N20), have devastating respiratory and cardiovascular effects. Asthma and chronic obstructive pulmonary disease (COPD) are some of the conditions that are exacerbated due to climate change caused by greenhouse gases.

"Many people are now living with asthma and other respiratory conditions because climate change caused by greenhouse gases released by industries."

NCDs and Climate Change Project beneficiary.

Unhealthy agricultural practices

Most of the project participants acknowledged that climate change is contributing to unhealthy agricultural practices when farmers are compelled to switch to crops that are more resilient to prevailing climatic conditions, even if those foods are less nutritious and not beneficial for a balanced diet. Additionally, it was clear from a majority of the responses, that extreme climate changes such as severe droughts may make farmers resort to excessive use of irrigation with water sources that are contaminated with heavy metals that cause several NCDs including cancer and heart conditions.

"Due to reduced amount of rain, some farmers use sewage water to irrigate their crops thereby putting innocent consumers at the risk of many NCDs including cancers."

NCDs and Climate Change Project beneficiary.

Positive behavior/attitudinal change regarding NCDS and climate change

The survey was intended to establish positive behavior/attitudinal change among the project beneficiaries. The findings are summarized below.

Would you participate in NCDs and climate change activities/campaigns in your community?

When asked whether they would participate in NCDs and Climate change activities/campaigns, 81.4% (57) vs 95.4% (62) at baseline and endline respectively responded with a "Yes." 18.6% (13) at baseline and 4.6% (3) at endline indicated that they would not participate in NCDs and climate change activities/campaigns in their community (Table 8).

Table 8

Response	Baseline	Endline
Yes	81.4% (57)	95.4% (62)
No	18.6% 13)	4.6% (3)
Total	**100% (70)**	**100% (65)**

How likely are you to adopt preventive measures to mitigate the impact of climate change on your health and prevent non-communicable diseases?

At the beginning of the project, 41.4% of respondents expressed a strong inclination to "very likely" participate in adopting preventive measures aimed at mitigating the impact of climate change on their health and preventing non-communicable diseases. This figure increased to 53.8% at the endline. Additionally, 30.0% of participants at baseline indicated they would "likely" adopt preventive measures, a proportion that rose to 36.9% at the endline. Furthermore, a portion of respondents who initially maintained a "neutral" stance decreased from 14.3% at baseline to 3.1% at the endline. Those who were "unlikely" to adopt preventive measures for non-communicable diseases and climate change decreased from 11.4% at baseline to 6.2% at the endline. Interestingly, at the baseline, 2.9% of participants expressed that they would be "very unlikely" to adopt preventive measures for non-communicable diseases and climate change. However, by the endline, no respondents selected this response (Figure 3).

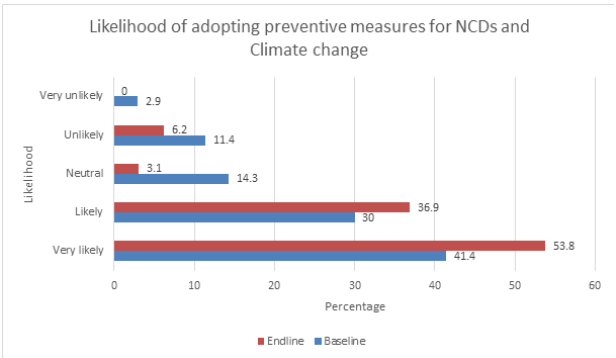

Figure 3 Likelihood of adopting preventive measures for NCDs and Climate change.

Do you think it is necessary to address NCD and climate change?

At baseline and endline, 64.3% (45) and 89.2% (58) respectively acknowledge that addressing NCDs and climate change is necessary. Those who believe it is not necessary were 27.1% (19) at the baseline and 6.2% (4) at endline. The rest, 8.6% (6) at baseline and 4.6% (3) at endline indicated that they don't know (Table 9).

Table 9

Response	Baseline	Endline
Yes	64.3% (45)	89.2% (58)
No	27.1% (19)	6.2% (4)
I don't know	8.6% (6)	4.6% (3)
Total	**100% (70)**	**100% (65)**

Digital health technologies (NCDS365 app) as resource for supporting health education and sustaining engagements with young people

The NCDs and Climate change project utilized innovative approaches to support health education and sustain engagements with the project beneficiaries. Stowelink's NCD 365 Health App and the NCDs for Public Health Course were integrated into the project and served as platforms to assess young people's enthusiasm for and uptake of digital health technologies. Summarized below are endline findings.

Have you downloaded the NCDs 356 App (Check Downloads through the link shared by Stowelink)

A majority of the project beneficiaries —87.7% have downloaded the NCD365 at the endline while 12.3% had not downloaded the app (Figure 4).

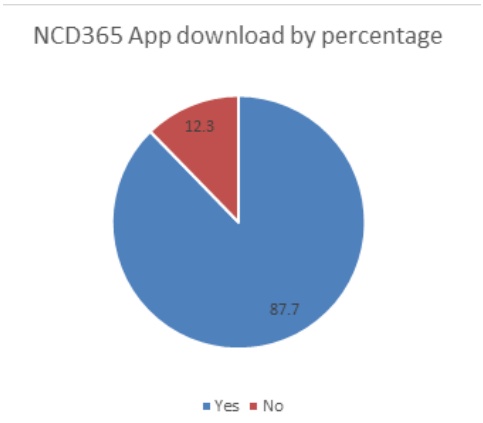

Figure 4 NCD365 App download by percentage.

How often have you used the NCD365 App to obtain information on NCDs and Climate Change? A majority of the project beneficiaries, about three-quarters of them (75.4%/43 people), frequently use the NCD365 App. A smaller group, around 12.3% (7 people), rarely use it, and a few, about 10.5% (6 people), use it occasionally (Table 10).

Table 10

Response	Frequency	Percentage
Rarely	7	12.3
Occasionally	6	10.5
Frequently	43	75.4
Total	**57**	**100% (65)**

Approximate number of times project beneficiaries accessed the NCD 265 App in the last three months

The study found in the last three months leading to the end of the project, 54.4% of the respondents had used the NCD365 11-20 times, 22.8% 5 to 10 times, 14.4% more than 20 times, and 8.8% less than 5 times (Figure 5).

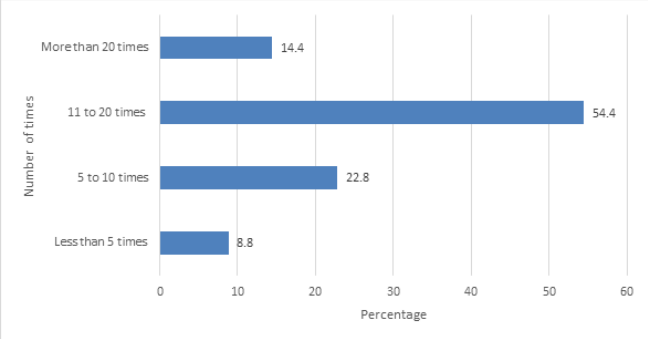

Figure 5

Would you recommend the NCD365 app to your friends?

Most of the project beneficiaries, 94.7% indicated that they would recommend the NCD365 app to friends while 5.3% said they wouldn't recommend the app. (Table 11).

Table 11

Response	Frequency	Percentage
Yes, definitely	54	94.7
No, not a chance	3	5.3
Total	**57**	**100% (65)**

Did you enroll for the NCDs for public health online course?

A majority of the project beneficiaries, 93.8% reported that they enrolled for the NCDs for Public Health online course while 6.2% reported that they did not enroll (Table 12).

Table 12

Response	Frequency	Percentage
Yes	61	93.8
No	4	6.2
Total	**65**	**100% (65)**

Did you successfully complete the course?

73.8% of the project beneficiaries successfully completed the course, 18.5% left halfway through the course and 7.7% enrolled but did not study (Figure 6).

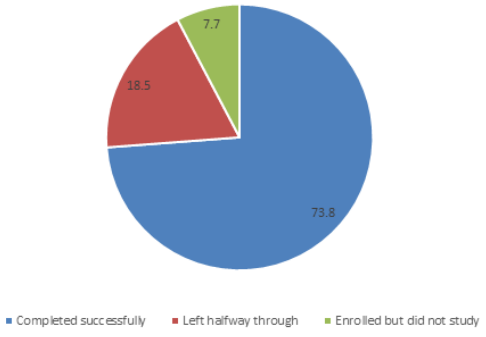

Figure 6

Citation: Oduor K, Ogweno S, Koech NC, et al. Assessing literacy on the interconnection between non-communicable diseases and climate change among youth in Nairobi, Kenya: An interventional study. *MOJ Public Health.* 2024;13(1):19–27. DOI: 10.15406/mojph.2024.13.00432

Would you recommend NCDs for public health online course to a friend?

89.2% (58) of the project beneficiaries intimated that they would recommend NCDs for Public Health online course to friends while 10.8% reported that they wouldn't recommend the course (Table 13).

Table 13

Response	Frequency	Percentage
Yes	58	89.2
No	7	10.8
Total	**65**	**100% (65)**

Discussion

The distribution of the key socio-demographic characteristics is fairly well balanced between the survey waves (baseline and endline), with a little variation brought about by a few project beneficiaries dropping out of the project. In total, 5 project beneficiaries dropped out of the project, and this could be linked to a number of reasons that the project did not capture. The project assumes that these project beneficiaries relocated to another area and hence could not participate in the project, or they were engaged in certain activities and commitments.

Literacy levels on NCDs and climate change

In looking at the key indicators, starting with the respondent's level of knowledge on NCDs, there was a notable increase in knowledge of NCDs among the project beneficiaries, from 81.4% at baseline to 95.4% at the endline. In terms of understanding of examples of NCDs, about half of the project participants could correctly identify the major 5 NCDs at baseline, increasing at the endline to over ¾ (78.5%). Additionally, at baseline, slightly half (52.9%) of the survey participants accurately identified the 5 major risk factors for NCDs as unhealthy food, alcohol use, tobacco use, physical inactivity, and air pollution. At the endline, participants who could accurately highlight the five major NCD risk factors rose exponentially to 86.2%. These improvement underscores the effectiveness of the project's educational initiatives in empowering individuals with a better understanding of NCDs and agrees with a study by Osborne and colleagues,[21] who submitted that health literacy development is crucial in the prevention and control of NCDs. A 2023 study explored health promotion efforts for NCD prevention and control in Ghana, concluding that NCD education initiatives play a central role in promoting healthy living and prevention of chronic diseases.[22] The authors cautioned, however, that while education and advocacy play a leading role in changing lifestyles and promoting healthy living, there should be sustained interventions rather than piecemeal and ad hoc approaches to NCD education that achieve trivial outcomes/impact.

Furthermore, the project has made significant strides in improving the knowledge and awareness of project beneficiaries regarding climate change and its impact on Non-Communicable Diseases (NCDs). The notable positive shift in the respondents' understanding of climate change, from 44.3% at baseline to 76.9% at the endline defining it as a long-term shift in weather patterns, reflects the effectiveness of the project's educational effort. Moreover, the increased awareness of the link between climatic changes and NCDs, with a rise from 57.1% to 86.2% of respondents acknowledging this association, indicates a successful dissemination of information. The substantial decrease in participants with "no understanding" and "limited understanding," coupled with a significant increase in those with a "good" and "full understanding" of how climatic changes contribute to NCDs, underscores the positive impact of the project in enhancing knowledge and fostering a more informed and NCD conscious generation of young people.

The link between NCDs and Climate change has not been exhaustively explored. While literature on this is emerging, the current dearth of evidence slows down response. This project played a vital role in enhancing knowledge of climate change and NCDs, among young people, contributing immensely to the current knowledge base. As observed by a study in 2011, the understanding of the link between climate change and NCDs is paramount as this understanding can inspire practical intervention to address these two leading challenges of the 21st century.[23] During project implementation, beneficiaries had the opportunity to add depth to their understanding of how different forms of climate change (increased average temperature, etc.) contribute to a number of NCDs. Consequently, at endline, the beneficiaries underscored the contribution of increasing temperature, air pollution, and unhealthy agricultural practices to the burgeoning cases of NCDs.

Attitudinal and behavioral changes toward NCDs and climate change

Regarding the shift in behavior and attitude towards NCD and climate change, the data reveals a positive shift in the attitude and behavior of project beneficiaries, reflecting a successful impact of the project on awareness and willingness to participate in NCDs and Climate Change related activities. The significant increase from 81.4% at baseline to 95.4% at the endline in respondents expressing intent to participate in NCDs and climate change activities/campaigns highlights the project's success in strengthening community engagement. Moreover, the rise in the percentage of participants inclined to adopt preventive measures, from 41.4% at baseline to 53.8% at endline, suggests a positive change in behavior towards mitigating the impact of climate change on health and preventing NCDs. The overwhelming acknowledgment of the necessity to address NCDs and climate change, with 89.2% at endline compared to 64.3% at baseline, indicates a transformative shift in the community's awareness and recognition of these issues as crucial, reflecting a commendable change in attitudes and behaviors. Indeed, health promotion interventions are fundamental in influencing attitudes and behaviors linked to improved health outcomes. Previous studies, including a study by Mark Owuso, et al[22] concur by observing that health promotion efforts aimed at addressing NCDs should target attitudinal and behavioral outcomes.

Digital health technologies as a resource in NCD and climate change intervention

The results demonstrate a commendable engagement and positive response among project beneficiaries towards the utilization of digital technologies for NCD and climate change education. The high percentage (87.7%) of beneficiaries who downloaded the NCD365 app at the endline signifies a strong interest and adoption of digital platforms for accessing information. The fact that three-quarters of the beneficiaries frequently use the NCD365 app underscores its effectiveness as a resource for supporting education on NCDs and climate change. The frequency of usage, with a majority using the app 11-20 times in the last three months, reflects sustained and regular engagement. Additionally, the successful enrollment of 93.8% in the NCDs for Public Health online course, with 73.8% completing it, indicates a substantial interest in utilizing digital platforms for structured educational programs. The high recommendation rates for both the NCD365 app (94.7%) and the online course (89.2%)

among beneficiaries further underscore the positive perception and endorsement of digital technologies as valuable resources for promoting awareness and understanding of NCDs and climate change. These results suggest that leveraging digital technologies is an effective strategy for engaging and educating young people on critical health and environmental issues. This has been highlighted in numerous studies including previous studies[24,25] among others. The widespread adoption of the app and online course, along with the positive feedback and recommendation rates, highlight the potential of digital platforms in facilitating accessible, user-friendly, and impactful education in the realm of NCDs and climate change.

Conclusion and recommendations

The project has demonstrated remarkable success in enhancing knowledge, attitudes, and behaviors among beneficiaries regarding climate change and Non-Communicable Diseases (NCDs). The positive shift in understanding, reflected in the increased awareness of climate change and NCDs definitions and the relationship between the two, underscores the efficacy of the educational efforts employed. Moreover, the encouraging response in terms of willingness to participate in NCDs and climate change activities, high adoption rates of the NCD365 app, and successful completion of the online course emphasize the effectiveness of digital technologies in disseminating information and fostering engagement. The change observed in beneficiaries' attitudes and behaviors signifies the project's impactful contribution to raising awareness and promoting proactive measures to mitigate the impact of climate change on health.

Recommendations

It is recommended that similar educational initiatives be expanded to reach a broader audience to further amplify the project's positive influence. Additionally, incorporating interactive features in the NCD365 app and online course, such as forums for discussions and knowledge-sharing, can enhance the sense of community and collaboration among users. Continuous monitoring and evaluation of this project is highly recommended to gauge its long-term impact and guide future improvements.

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None.

Conflicts of interest

The authors declare there is no conflict of interest.

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