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Evaluating a community health app with air quality warning to prevent noncommunicable diseases in rural Indonesia

Submission date	**Recruitment status**	[X] Prospectively registered
24/09/2025	No longer recruiting	[ ] Protocol
Registration date	**Overall study status**	[ ] Statistical analysis plan
29/09/2025	Ongoing	[ ] Results
Last Edited	**Condition category**	[ ] Individual participant data
18/06/2026	Other	[X] Record updated in last year

Plain English summary of protocol

Background and study aims

Air pollution poses a growing threat to public health in Indonesia, particularly in urban and peri-urban areas such as Malang and Banyuwangi. Chronic exposure to particulate matter and other pollutants contributes to the development of cardiovascular and respiratory diseases, as well as exacerbating mental health issues. Despite the significant burden, locally relevant interventions targeting air quality and health, as well as their integration into primary care, remain scarce. Addressing this gap is crucial to reducing disease prevalence and alleviating health system pressures.

This study aims to evaluate the implementation of technology-enabled primary healthcare interventions facilitating early warnings on air quality and community-based screening and management of cardiovascular disease (CVD) and chronic obstructive pulmonary disease (COPD) to improve health outcomes for those exposed to air pollution in Indonesia.

Who can participate?

CVD: Adults aged 40 years and over who have: (1) a history of CVD confirmed by a physician; (2) a 10-year estimated CVD risk of ≥10% and systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg; or (3) a 10-year estimated CVD risk of >20%.

COPD: Adults aged 40 years and over with a diagnosis of COPD made by general practitioners at Puskesmas based on (1) clinical anamnesis, (2) clinical examination findings, and spirometry assessment following national guidelines.

What does the study involve?

Participants will receive a digital health intervention called SMARTHealth Climate. It is a multi-component, community-based intervention that combines digital health technologies, environmental health data, and workforce capacity-building to improve the early detection, prevention, and management of CVD and COPD in air pollution-exposed rural communities.

What are the possible benefits and risks of participating?

Taking part on this study is unlikely to cause any harm. Instead, participants can benefit from this study through:

1. Improved detection of CVD and/or COPD
2. Improve access to health services for CVD and/or COPD
3. Reduced exposure to air pollution
4. Personalised health advice
5. Strengthened community-based healthcare systems to address CVD and COPD

Where is the study run from?
Six villages in Malang and six villages in Banyuwangi (Indonesia)

When is the study starting and how long is it expected to run for?
July 2026 to December 2027

Who is funding the study?
National Institute for Health and Care Research (NIHR) (UK)

Who is the main contact?
NIHR GHRC Indonesia Team, globalhealth@ub.ac.id

Contact information

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Public, Scientific, Principal investigator

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Study information

Scientific Title
Evaluating a community-based digital health intervention with air quality warnings for non-communicable diseases prevention in rural Indonesia

Acronym
SMARTHealth Climate Study

Study objectives
Evaluate the implementation of technology-enabled primary healthcare interventions facilitating early warnings on air quality and community-based screening and management of cardiovascular disease (CVD) and chronic obstructive pulmonary disease (COPD) to improve health outcomes for those exposed to air pollution in Indonesia.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 14/04/2024, Health Research Committee Faculty of Medicine Brawijaya University (Jalan Veteran, Malang, 65145, Indonesia; +62 (0)341569117; sekr.fk@ub.ac.id), ref: 77.1/EC/KEPK/04/2025

Primary study design
Interventional

Study design
Controlled quasi-experimental design with a difference-in-differences (DiD) approach

Study type(s)
Prevention

Health condition(s) or problem(s) studied
Cardiovascular disease (CVD) and chronic obstructive pulmonary disease (COPD)

Interventions
The intervention consists of three interlinked components:
Component 1: SMARTHealth Climate App (Digital Clinical Support for CVD and COPD)
This component centres on the use of the SMARTHealth Climate mobile application by

community health workers or "Kader" in Indonesia and GPs based at Puskesmas. The app enables comprehensive, community-based screening for CVD and COPD using validated tools, including the WHO-SEAR B risk chart and the PUMA score. Screening data are recorded digitally and shared through an electronic health record system accessible to both Kader and GPs, facilitating seamless referral and continuity of care. GPs are supported by clinical decision algorithms integrated into the app to guide diagnosis, treatment planning, and referral where necessary. GPS at primary health care (PHCs) will be trained and equipped with spirometry to diagnose COPD. Patients identified with stable conditions are managed within the PHC system, while complex cases are referred to secondary care. Kader provides monthly follow-up to CVD and COPD patients through structured health checks that assess symptoms, medication adherence, and basic clinical indicators such as weight, blood pressure, and respiratory rate. In addition, the app supports health promotion by enabling Kader to deliver tailored lifestyle advice and preventive messages via in-app tools and pre-recorded voice messages.

Component 2: Air Pollution Real-time Warning System (RWS)
The second component of the intervention introduces a community-based Air Pollution Real-time Warning System (RWS) designed to reduce exposure to hazardous air quality, particularly among individuals at high risk of CVD and COPD. This system relies on locally installed air quality sensors placed in each intervention village to continuously monitor fine particulate matter (PM2.5) and other air pollution indicators from all types of sources over a 24-hour cycle. When pollution levels exceed defined thresholds, or are predicted to rise, the system generates alerts that are disseminated through two channels. The first channel is through automated notification or messages sent from SMARTHealth Air Pollution Real-time Warning System (RWS) application to community members aged 40+ whose contact details are recorded in the SMARTHealth Climate app and who have installed the SMARTHealth Air Pollution RWS app. These messages are tailored to the severity of air pollution and include simple, actionable advice such as staying indoors, wearing masks, reducing outdoor activity, or using cleaner cooking fuels where possible. The second channel is through real-time notifications sent to Kader, who then relay preventive guidance directly to patients during follow-up home visits or community sessions. The Kader will then send messages to the participants by tailoring for their health status. By leveraging trusted community health workers to contextualise and reinforce these messages, the RWS enhances public understanding of environmental risks and supports behaviour change to reduce exposure during pollution events. This system is not a standalone digital platform but rather an integrated feature of the SMARTHealth Climate approach, complementing clinical management with environmental risk mitigation in real-time.

Component 3: Training and Capacity Building
The third component of the SMARTHealth Climate intervention focuses on building the capacity of frontline health workers, including Kader and GPs, to effectively deliver and sustain the intervention. This component ensures that all actors involved are equipped with the knowledge, skills, and confidence to use the SMARTHealth application, interpret air quality alerts, and deliver appropriate clinical care and health education.

Intervention Type
Other

Primary outcome(s)
CVD cohort:
Mean systolic blood pressure measured using validated automated digital sphygmomanometers at baseline and after 1 year of intervention implementation

COPD cohort:
Health-related quality of life measured using WHOQOL-BREF at baseline and after 1 year of intervention implementation

Key secondary outcome(s)
CVD cohort:
1. Blood pressure control measured by the proportion of participants achieving guideline-recommended blood pressure control
2. Health-related quality of life measured using WHOQOL-BREF

COPD cohort:
1. Incidence of acute exacerbation measured by the proportion of participants experiencing acute exacerbations during the study period using validated structured questionnaire and clinical records where available
2. Depressive symptoms measured using Center of Epidemiologic Studies Depression Scale, 10-item version (CES-D-10), at baseline and after 1 year

Both cohorts:
1. Prescribed preventive medications and adherence measured by the proportion of participants who are both prescribed and adherent to guideline- recommended medications, assessed at baseline and after 1 year through prescription records and self-reported adherence questionnaires
2. Behavioural risk factors:
2.1. Tobacco use measured using a structured questionnaire adapted from WHO tobacco surveillance items (STEPS/GATS)
2.2. Physical activity measured using questionnaires adapted from WHO Global Physical Activity Questionnaire (GPAQ) and International Physical Activity Questionnaire (IPAQ)
2.3. Body mass index measured by calculating height (stadiometer) and weight (calibrated digital scale) using the formula kg/m^2

All secondary outcomes will be measured at baseline and after 1 year of intervention program implementation.

Completion date
30/12/2027

Eligibility

Key inclusion criteria
Participants will be eligible for inclusion in the study if they meet any of the following criteria

1. High CVD risk:
Adults aged ≥40 years who meet one or more of the following conditions:
1.1. A history of CVD confirmed by a physician
1.2. A 10-year estimated CVD risk of ≥10% and systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg
1.3. A 10-year estimated CVD risk of >20%

2. COPD:
Adults aged ≥40 years with a diagnosis of COPD made by general practitioners at Puskesmas based on

2.1. Clinical anamnesis
2.2. Clinical examination findings
2.3. Spirometry assessment following national guidelines

Participant type(s)
Population

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
40 Years

Upper age limit
114 Years

Sex
All

Total final enrolment
0

Key exclusion criteria
1. Individuals with severe physical or cognitive impairments that would prevent participation in screening, follow-up, or completion of study assessments
2. Pregnant women, due to differing cardiovascular and respiratory physiological parameters
3. Individuals currently enrolled in other clinical studies targeting cardiovascular or respiratory conditions
4. Those who decline or are unable to provide informed consent

Date of first enrolment
01/07/2026

Date of final enrolment
30/09/2026

Locations

Countries of recruitment
Indonesia

Study participating centre
University of Brawijaya
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Sponsor information

Organisation
National Institute for Health Research

ROR
https://ror.org/0187kwz08

Funder(s)

Funder type
Government

Funder Name
National Institute for Health and Care Research

Alternative Name(s)
National Institute for Health Research, NIHR Research, NIHRresearch, NIHR - National Institute for Health Research, NIHR (The National Institute for Health and Care Research), NIHR

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet			28/11/2025	No	Yes