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OK-AIR: Testing classroom air cleaners and upper-room UV air treatment to improve indoor air quality and reduce sick-related absences in Oklahoma early care and education (ECE) schools

Submission date
04/03/2026

Recruitment status
No longer recruiting

Registration date
05/03/2026

Overall study status
Ongoing

Last Edited
05/03/2026

Condition category
Infections and Infestations

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
Young children (from birth to 5 years old) spend many hours each week in early care and education classrooms. During the school year, viruses that cause colds, flu, stomach illness, and other infections can spread easily in busy classrooms. Air in classrooms can also contain particles and other pollutants that may affect children's breathing and comfort. Two commonly used approaches to improve indoor air are: (1) portable air cleaners with highefficiency filters, and (2) upperroom ultraviolet germicidal irradiation (UVGI), which uses UV light near the ceiling to help inactivate germs in the air. However, there is limited realworld randomized evidence in Head Start/early childhood classrooms on whether these approaches reduce illnessrelated absences.

The OKAIR study aims to find out whether adding portable air cleaning and/or upperroom UVGI in Head Start classrooms can: (1) reduce sickrelated (infectious illnessrelated) absences among children, (2) improve indoor air quality, and (3) reduce detection of selected viruses on classroom surfaces. We will also explore whether improved classroom environments relate to children's socialemotional development as rated by teachers.

Who can participate?
Participation involves Head Start centers and classrooms in Oklahoma. Children include aged birth to 5 years who are enrolled in participating Head Start classrooms may be included if their parent/guardian provides consent (and any required authorization for relevant program health information). Parents/guardians will be asked to complete a questionnaire about the child's health and home environment and to provide consent/authorization. Teachers and center directors/staff in participating sites will complete surveys and provide information needed for study procedures (such as daily attendance reasons and teacher ratings).

What does the study involve?
This is a schoolbased study where classrooms are assigned by chance (randomized) to different indoor air approaches. Depending on the cohort and classroom assignment, classrooms may receive: (1) No added devices beyond usual operations (control), (2) Portable air cleaning /filtration using standalone units with highefficiency filters, (3) Upperroom UVGI fixtures installed high on the wall/near the ceiling, or (4) Both portable air cleaning and upperroom UVGI (Cohort 1 only).

Study activities include: (1) Daily attendance tracking, where teachers record whether each child is present and, if absent, the reason (including whether the absence is sickrelated); (2) Indoor air quality monitoring, where each classroom has a monitor that measures indoor air conditions such as particle levels and temperature/humidity during the school year; (3) Environmental surface sampling, where a few times per year, trained staff collect swabs from classroom surfaces (for example dining tables and bathroom flooring), and these swabs are tested in a laboratory for genetic material from selected viruses (e.g., influenza, RSV, SARSCoV2, norovirus); (4) Questionnaires, where directors, teachers, and parents/guardians complete surveys about building/classroom practices and relevant health or environmental factors; and (5) Child socialemotional development (exploratory), where teachers complete a standard checklist used in early childhood settings that describes children's social and emotional skills (the DECA), following the program's schedule.

What are the possible benefits and risks of participating?
Possible benefits: (1) Classrooms that receive portable filtration and/or UVGI may have improved indoor air quality, which could potentially help reduce exposure to airborne particles and germs; and (2) The study may help Head Start and other early childhood programs make informed decisions about practical, costeffective ways to support child health and attendance.

Possible risks/inconveniences: (1) Air cleaning units and monitors may produce some noise or require space in the classroom; (2) Upperroom UVGI fixtures are installed and checked to meet safety guidelines so that UV exposure for children and staff remains below recommended limits; (3) Teachers, parents, and staff may spend time completing surveys and attendance logs; and (4) As with any study collecting information, there is a small risk of confidentiality breach, and the study uses secure data handling practices to reduce this risk.

Where is the study run from?
The study is coordinated by the University of Oklahoma research team and conducted in participating Head Start centers and classrooms in Oklahoma in the United States.

When is the study starting and how long is it expected to run for?
The OKAIR study includes two implementation cohorts. Cohort 1 is from 2023 to 2024 school year, and Cohort 2 is from 2025 to 2026 school year (with portable filtration only).

Who is funding the study?
The Oklahoma Partnership for School Readiness (OPSR) Clearinghouse award is our original sponsor to support the OK-AIR Cohort 1 study. Cohort 2 was initially supported through an EPA Children's Environmental Health Center award, which was later terminated due to changes in agency research priorities (not due to project performance). The study team submitted an appeal, which remains under review at the time of this trial registry.

Who is the main contact?
Drs. Diane Horm and Changjie Cai from the University of Oklahoma (OU). Dr. Horm is the Founding Director of the Early Childhood Education Institute, and Professor from the College of

Education at OU. Dr. Cai is the Founding Director of the Children's Environmental Health Center in U.S. Southern Great Plains, and Associate Professor from the Hudson College of Public Health at OU.
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Registration at Open Science Framework (OSF)
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Study information

Scientific Title
OK-AIR study protocol: a longitudinal cluster-randomised 2×2 factorial trial of portable air purification and upper-room UVGI on sick-related absences, indoor air quality, environmental pathogens and social-emotional development in early care and education classrooms (birth–5 years)

Acronym
OK-AIR

Study objectives
Primary objective: To determine whether classroom portable air purification and/or upperroom ultraviolet germicidal irradiation (UVGI) reduce sickrelated (infectious disease–related) absence rates among children aged birth to 5 years attending Head Start early care and education (ECE) classrooms.

Secondary objectives:
1. To quantify intervention effects on classroom indoor air quality (IAQ) (including particulate matter size fractions and other environmental parameters)
2. To evaluate whether interventions reduce environmental detection/burden of selected pathogens on classroom surfaces (Influenza A/B, RSV, HPIV3, SARSCoV2, Norovirus) measured by RTqPCR.

Exploratory objectives: To examine relationships between IAQ/pathogen indicators and children' s socialemotional development (teacherrated DECA) and to explore contextual moderators (e.g., ventilation practices, building conditions, household exposures) from Director/Teacher/Parent surveys; and to estimate incremental intervention costs and costeffectiveness (e.g., cost per sickrelated absence day averted).

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 12/10/2023, The Institutional Review Board (IRB) at the University of Oklahoma (201 Stephenson Parkway, Norman, 73019, United States of America; +1 (405)325-8110; irb@ou.edu), ref: IRB#: 16282

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Active

Assignment
Factorial

Purpose
Device feasibility, Health services research, Prevention

Study type(s)

Health condition(s) or problem(s) studied
Illnessrelated (infectious disease–related) absences among children (birth to 5 years) attending Head Start early care and education (ECE) classrooms; associated indoor air quality and environmental detection of respiratory/enteric viruses (Influenza A/B, RSV, HPIV3, SARSCoV2, Norovirus) in classroom environments; and children's social-emotional development.

Interventions
OKAIR is a longitudinal, pragmatic clusterrandomised trial in Oklahoma Head Start/ECE classrooms enrolling children aged birth to 5 years. The unit of randomisation is the classroom (cluster), nested within Head Start centers.

Cohort 1 (2023–2024): Within each participating center, classrooms are allocated to one of four parallel arms in a 2×2 factorial design: (1) Control (no additional intervention beyond usual center operations), (2) Portable air purification (standalone units with HEPAclass filtration; placement based on room volume and coverage; filters replaced on the recommended schedule; units secured to prevent children from switching them off), (3) Upperroom UVGI (wallmounted fixtures creating an irradiated upperroom zone; installed and commissioned to maintain occupant exposure below applicable safety limits; lamps maintained per manufacturer guidance), and (4) Combined (portable filtration + upperroom UVGI).

Cohort 2 (2025–2026): Cohort 2 was originally planned as a second factorial cohort but was amended due to funding changes; Cohort 2 retains portable filtration only.

Data collection: Child attendance and absence reasons are recorded daily by classroom teachers using a standardized log. Classrooms undergo continuous IAQ monitoring (PM_1, $PM_{2.5}$, PM_4, PM_{10}, temperature, relative humidity, CO, noise, and gas indices) across the attendance year with a seasonal monitoring framework (Winter/Spring/Summer/Fall) including designated baseline /offperiod weeks to characterize temporal and seasonal variability. Seasonal environmental surface swabs (dining tables and toilet flooring) are analyzed by RTqPCR for selected respiratory /enteric viruses. Contextual surveys (Director/Teacher/Parent) capture center, classroom, and household factors relevant to IAQ and child health. Children’s socialemotional development is assessed using teacher ratings on the DECA (exploratory). A health economic evaluation will estimate intervention costs and costeffectiveness/costbenefit.

Intervention Type
Device

Phase
Not Applicable

Drug/device/biological/vaccine name(s)
Portable air purifier and upper-room ultraviolet germicidal irradiation (UVGI)

Primary outcome(s)
1. Sickrelated absence rate among Head Start children (birth–5 years) measured using Daily teachercompleted attendance logs record each child’s presence/absence and the reason for

absence using standardized categories. Absences are classified as sickrelated, not sick, or unknown; sickrelated absences are further categorized (e.g., respiratory, gastrointestinal, other /unknown). The primary endpoint is the cumulative sickrelated absence rate, defined as sickrelated absence days divided by enrolled childdays, analyzed with clustering accounted for at classroom (and center) level at daily throughout the Head Start attendance year; primary analysis uses the cumulative sickrelated absence rate over the full attendance academic year.

Key secondary outcome(s))

1. Classroom indoor air quality (IAQ): PM1/PM2.5/PM4/PM10 (school-hours mean) measured using continuous classroom monitoring using the study IAQ monitor; PM1/PM2.5/PM4/PM10 measured via the particulate sensor and summarized as school-hours mean concentration (with daily/weekly aggregation as prespecified). Analyses use repeated measures with clustering by classroom/center as appropriate at continuously throughout the Head Start attendance year; summarized by season (Winter/Spring/Summer/Fall) and over the full year.

2. Classroom IAQ comeasures: temperature, relative humidity, CO, CO2, noise (dBA), VOC Index, NOx Index, SO2 Index, Ozone Index, etc. measured using continuous classroom monitoring using the study IAQ monitor; they are measured via various sensors and summarized as school-hours mean concentration (with daily/weekly aggregation as prespecified). Analyses use repeated measures with clustering by classroom/center as appropriate at continuously throughout the Head Start attendance year; summarized by season (Winter/Spring/Summer/Fall) and over the full year.

3. Environmental pathogen presence on classroom surfaces (RTqPCR detection) measured using seasonal environmental surface swabs from dining tables and toilet flooring tested by RTqPCR for: Influenza A, Influenza B, RSV, HPIV3, SARSCoV2, and Norovirus (GI/GII/GIV). Outcomes include pathogenspecific detection (detected/not detected) and a composite indicator (≥1 pathogen detected per sampling round) at seasonal sampling rounds during the attendance year (aligned to Winter/Spring/Summer/Fall monitoring periods).

4. Environmental pathogen burden on classroom surfaces (RTqPCR semiquantitative RNA copy number) measured using for each pathogen target, RTqPCR quantification using standard curves to estimate RNA copy numbers (reported as copies per swab; analyzed on log10 scale as semiquantitative environmental burden). Analyses account for clustering (classroom/center) and repeated seasonal measures at seasonal sampling rounds during the attendance year (aligned to Winter/Spring/Summer/Fall monitoring periods).

5. Child socialemotional development: DECA Total Protective Factors (and domain scores where available) measured using teachercompleted Devereux Early Childhood Assessment (DECA) using ageappropriate forms (DECAI/T for infants/toddlers; DECAP2 for preschoolers). Outcomes analyzed primarily as Tscores for Total Protective Factors (and domain scores such as Initiative, Attachment/Relationships, and SelfRegulation when available). Exploratory analyses may include Behavioral Concerns for ages 2–5 where applicable at routine DECA administration timepoints during the attendance year.

6. Economic outcomes: incremental intervention cost and costeffectiveness/costbenefit measured using microcosting of intervention purchase, installation/commissioning, maintenance (filters/lamps), electricity and related operational costs; combined with modelbased estimates of sickrelated absence days averted to estimate cost per sickrelated absence day averted and costbenefit metrics (e.g., benefit–cost ratio / net monetary benefit, as specified) at primary economic evaluation at end of attendance year (trial-year costs/outcomes), with exploratory multiyear scenario analyses (e.g., 3–5 years) as specified.

Completion date
31/03/2027

Eligibility

Key inclusion criteria
Head Start centers and classrooms:
1. Head Start centers in Oklahoma willing to participate in the OKAIR study
2. Classrooms able and willing to participate in study procedures, including installation /operation of assigned intervention(s) (portable filtration and/or upperroom UVGI, where applicable), continuous indoor air quality monitoring, daily attendance and absencereason logging, and seasonal environmental surface sampling.

Children participants:
1. Child is enrolled in a participating Head Start classroom during the study period
2. Child is within the eligible age range (birth to 5 years) at enrollment
3. Parent/guardian provides informed consent for the child's participation and data collection (including attendance outcomes and teacherrated DECA, as applicable)
4. Parent/guardian provides HIPAA authorization for release of the child's Head Start health records (where applicable/required by the study).

School staff participants: Classroom teacher(s)/staff and center leadership in participating sites who agree to complete study procedures relevant to their role (e.g., attendance logs, surveys, DECA ratings).

Healthy volunteers allowed
Yes

Age group
Mixed

Lower age limit
0 years

Upper age limit
5 years

Sex
All

Total final enrolment
666

Key exclusion criteria
Head Start centers and classrooms
1. Classrooms are excluded if physical constraints prevent safe/feasible installation of required intervention equipment (e.g., ceiling height or room layout constraints for upperroom UVGI)
2. Classroom/center declines required study procedures (installation/monitoring/sampling /attendance logging).

Individual participants:
1. Child is not enrolled in a participating classroom/center or outside the eligible age range
2. Parent/guardian does not provide required consent (and HIPAA authorization where applicable), such that childlevel outcomes cannot be included per study procedures.

Date of first enrolment
13/10/2023

Date of final enrolment
30/09/2025

Locations

Countries of recruitment
United States of America

Sponsor information

Organisation
University of Oklahoma

ROR
https://ror.org/02aqsxs83

Funder(s)

Funder type

Funder Name
Oklahoma Partnership for School Readiness (OPSR) Clearinghouse

Funder Name
U.S. Environmental Protection Agency

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available