The LIFE MEDEA childhood asthma study for mitigation of desert dust health effects: novel methods for air pollution exposure assessment and lessons learned

MITIGATING THE HEALTH EFFECTS OF DESERT DUST STORMS USING EXPOSURE-REDUCTION APPROACHES- THE MEDEA STUDY

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Medical School

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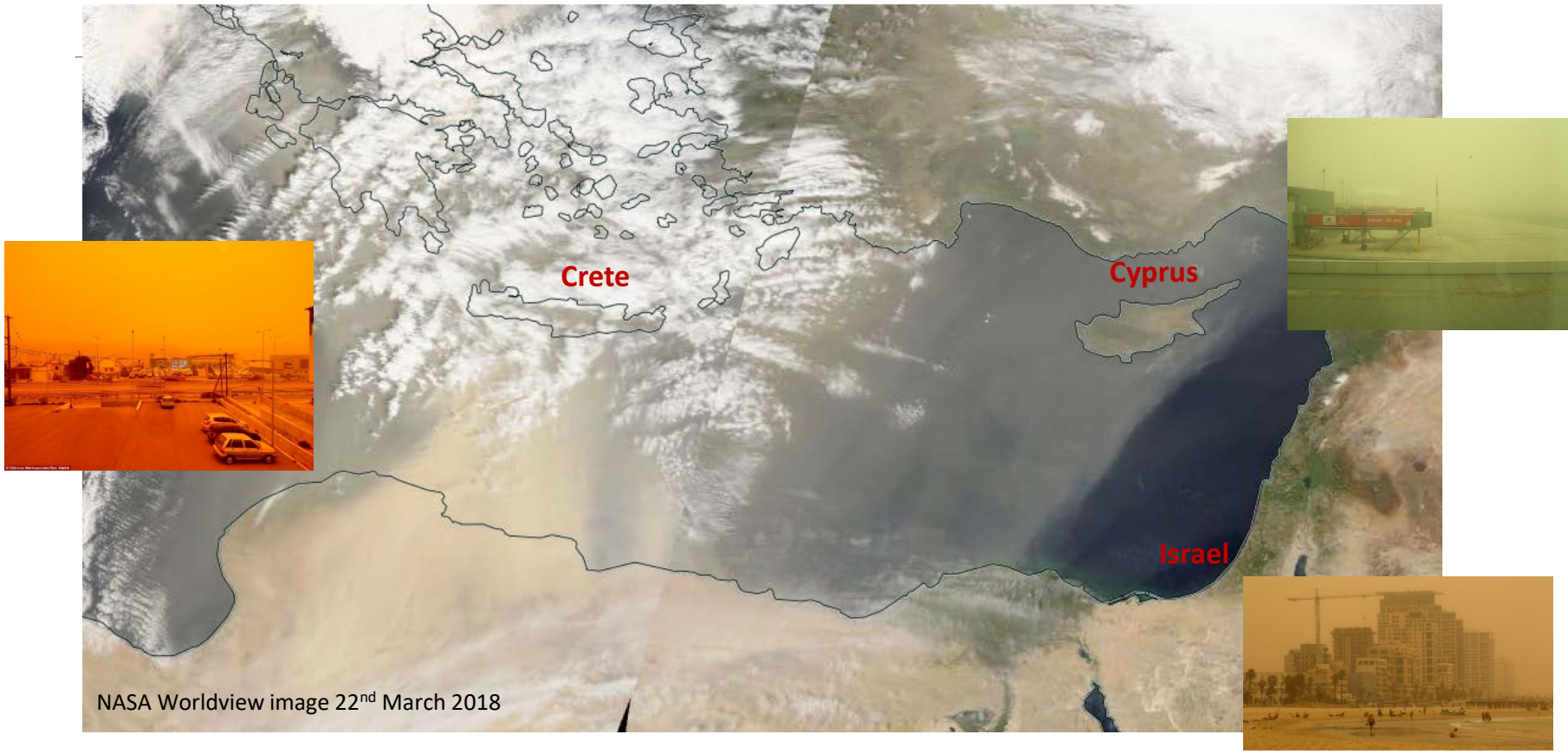


NASA Worldview image 22nd March 2018

LIFE MEDEA Project

Project Objectives

1. Development of a strategic plan to mitigate the health effects of DDS through exposure reduction approaches.
2. Feasibility of meteorological models for early forecasting of DDS events.
3. Design of practical and susceptible guidelines for exposure reduction to air pollutants during DDS events.
4. Evaluation of these guidelines in studies involving Atrial Fibrillation patients and asthmatic children.
5. Transfer of results to competent authorities, to the scientific community and the general public.

MEDEA study populations

Patient recruitment from two susceptible populations:

- Asthmatic children
- Atrial Fibrillation patients

Participants will be trained in MEDEA guidelines.

Early warning messages for DDS events (mobile application, text and email).

Evaluation of guidelines' compliance and effectiveness.

Asthma panel study

Children with chronic asthma aged 6-11 years will be recruited from primary schools:

a) Nicosia-Cyprus (n=150), and

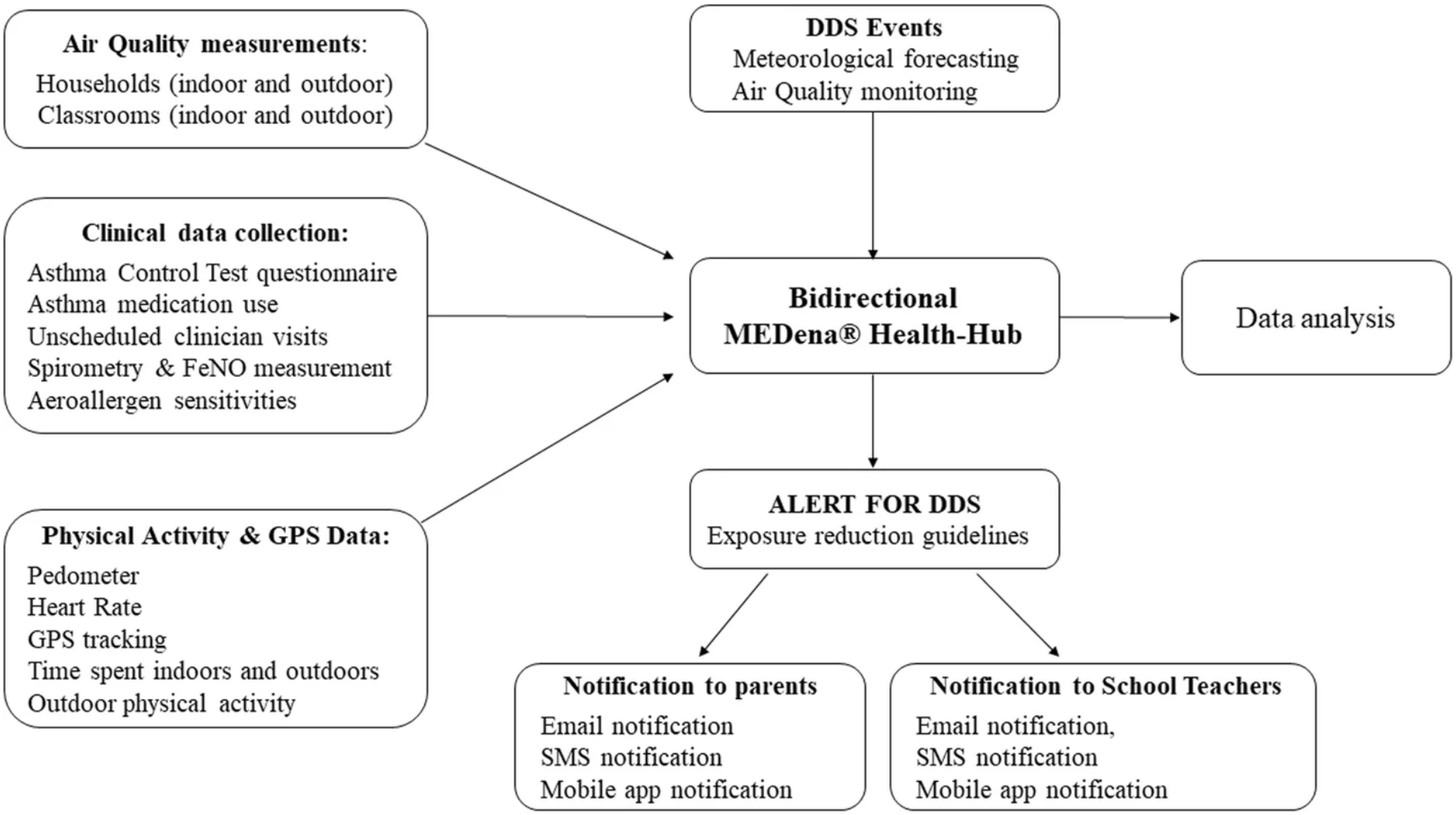
b) Heraklion-Crete (n=150)

in project years 2018-2019 and 2019-2020 and 2020-2021

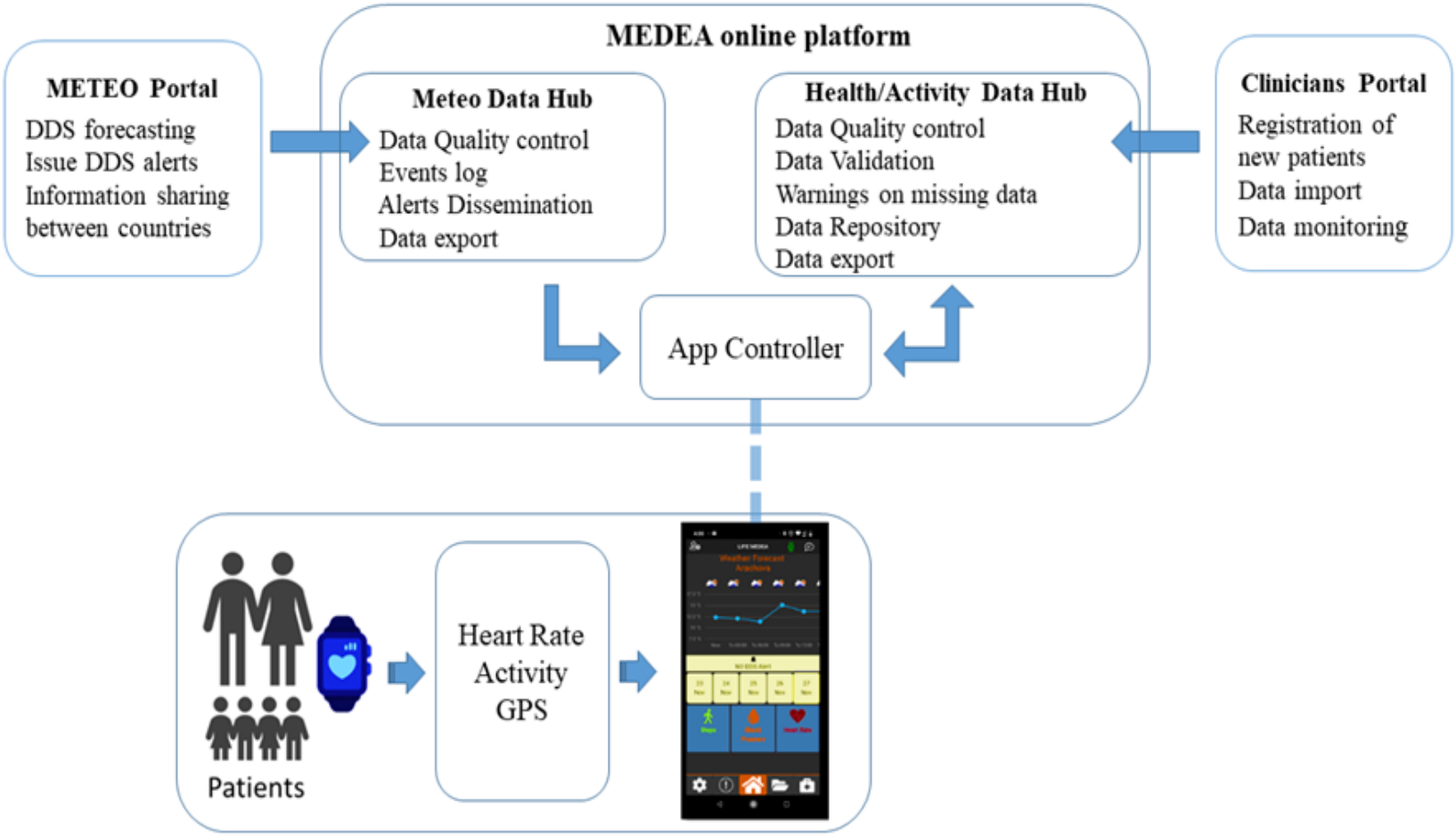
Randomisation of participants to 1:1:1 ratio in three parallel groups:

- a) No intervention (controls)
- b) Outdoor Intervention
- c) Outdoor and Indoor Intervention

Asthma Panel study diagram



MEDEA Bidirectional platform

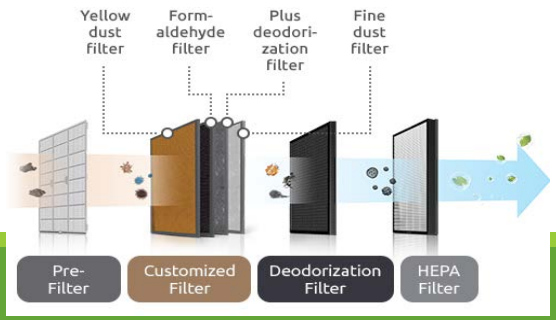


Exposure Reduction Guidelines

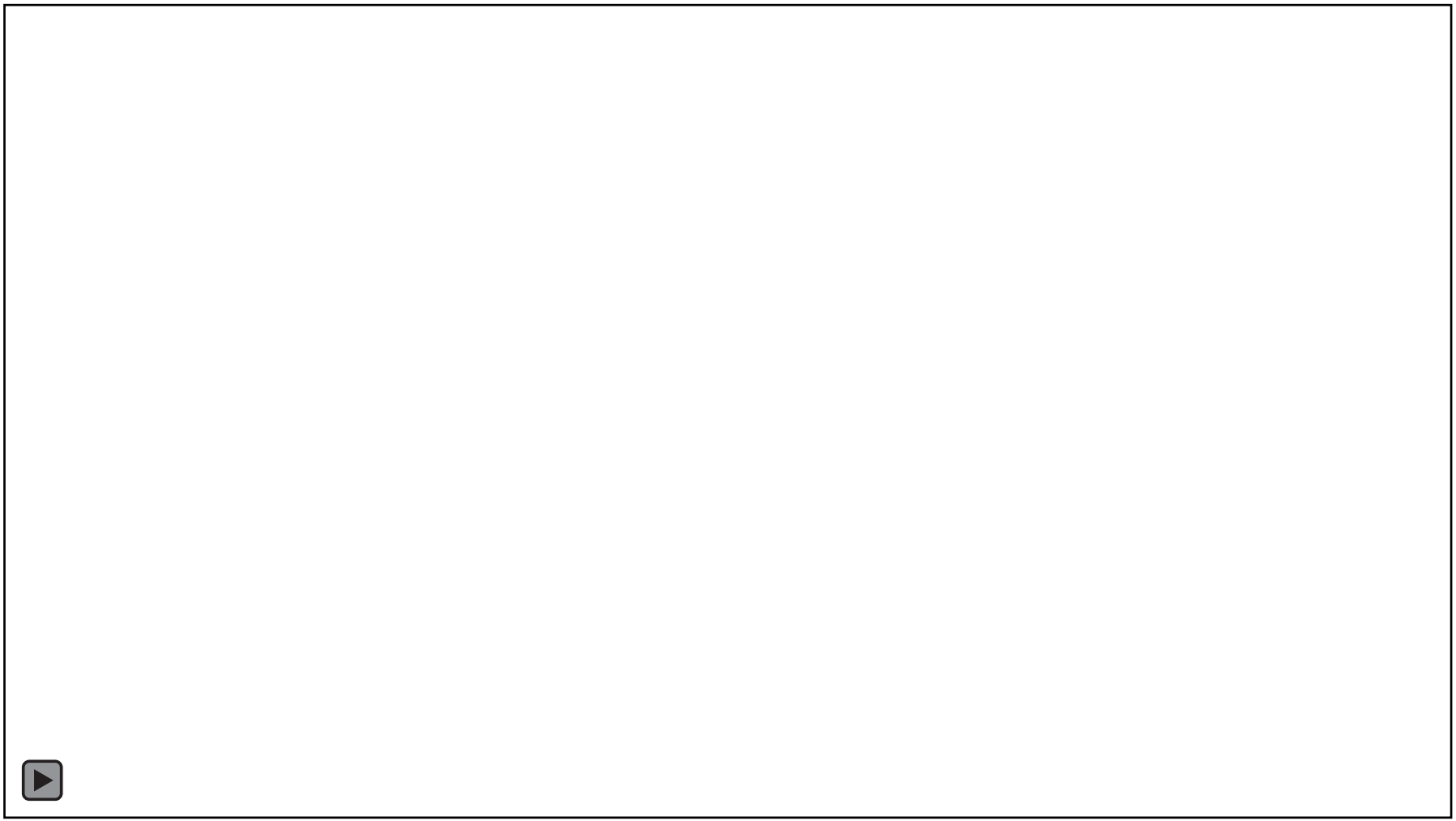
Development of simple and sustainable evidence-based guidelines for DDS events:

1. Limit time outdoors
2. Limit physical activity
3. Reduction of exposure in indoor spaces

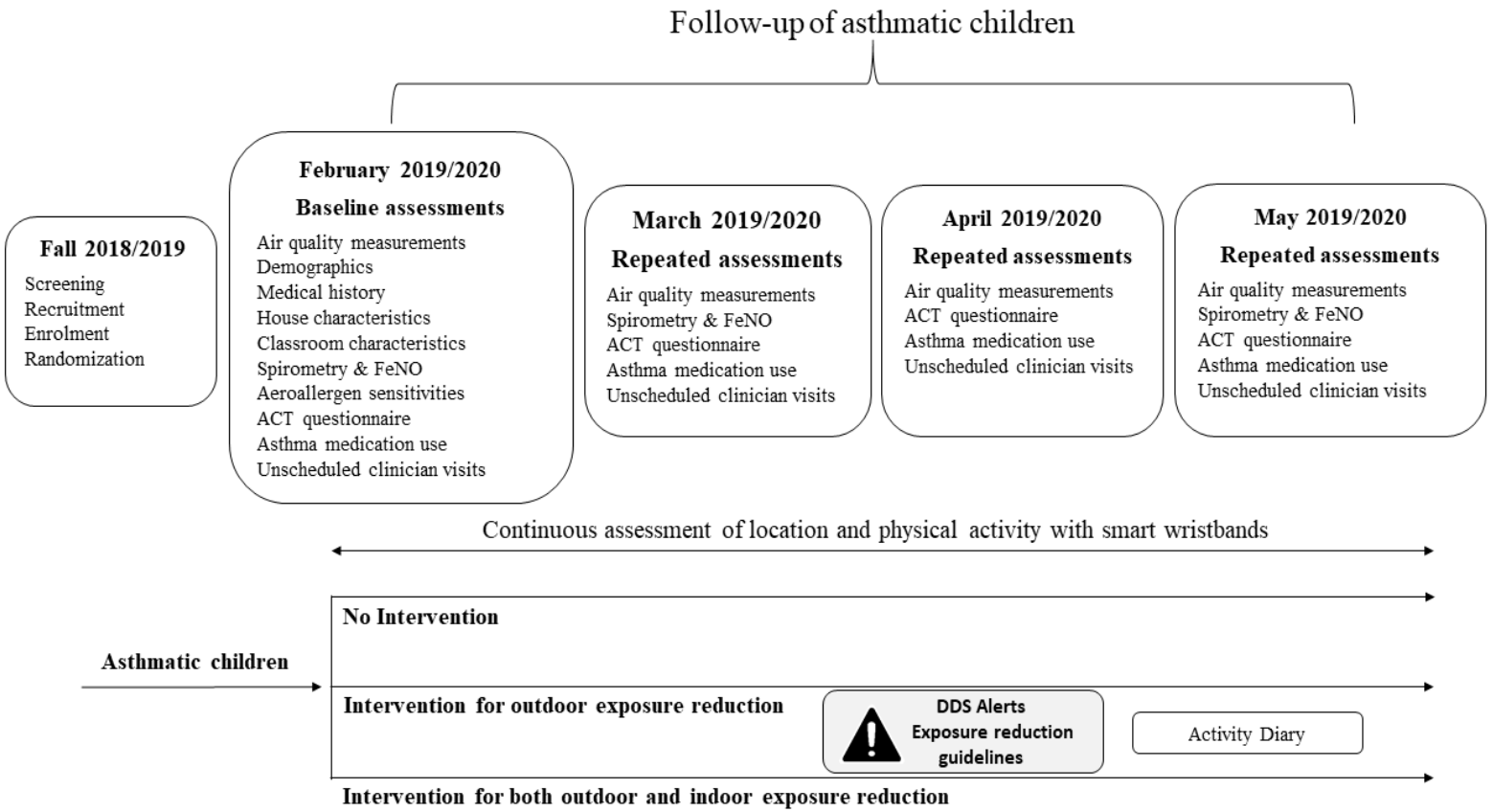
- Reduce ventilation
- Air-cleaners (Houses and Classrooms):
- Removal of particulate matter, air pollutants, microbes/bacteria and odours of indoor space



Animated Guidelines - Asthmatics



Asthma panel study assessments timeline



Recruitment of participants Asthma panel study

Recruitment campaign:

- Fall of 2018
- Fall of 2019
- Fall of 2020
- >50 primary schools
- Global Asthma Network questionnaire
  - > 8000 students targeted
  - > 5500 students returned GAN (≈ 70%)

Eligibility criteria

- Asthma diagnosis by a physician
- & at least one of the following
  - Daily asthma medication
  - Episodes of wheezing (last 12 months)
  - Unscheduled physician visit (last 12 months)
  - >200 eligible asthmatic children are expected to successfully complete the study

Assessment of health outcomes
Asthma Panel Study

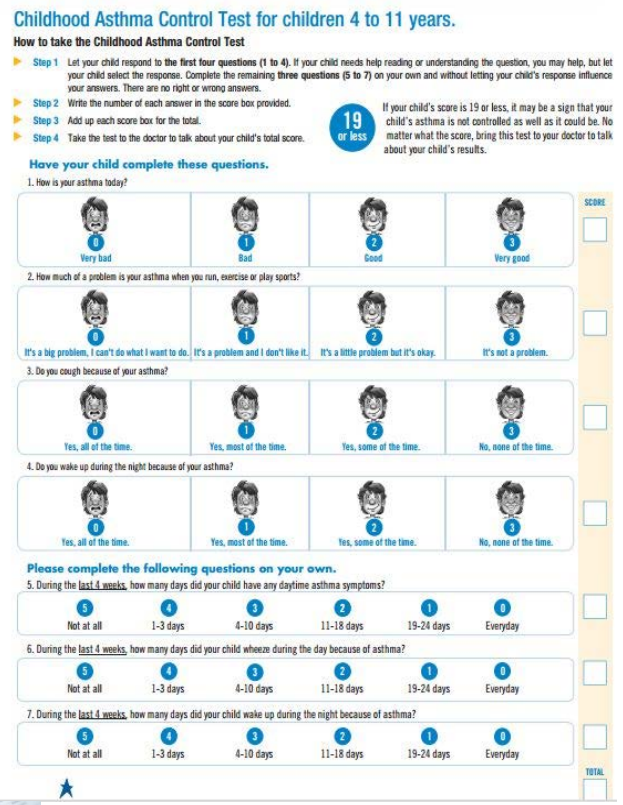
Outcomes assessed at baseline and then at every 1 month throughout the high DDS period

Primary Outcome

- Telephone Asthma Control Test (ACT):
  - Validated Greek version
  - Daytime and nighttime respiratory symptoms assessed via caregiver and child's responses

Secondary Outcomes

- Asthma medication use
- Unscheduled visits to health professionals for asthma
- FeNO
- Lung Function



Childhood Asthma Control Test for children 4 to 11 years.

How to take the Childhood Asthma Control Test

Step 1 Let your child respond to the first four questions (1 to 4). If your child needs help reading or understanding the question, you may help, but let your child select the response. Complete the remaining three questions (5 to 7) on your own and without letting your child's response influence your answers. There are no right or wrong answers.

Step 2 Write the number of each answer in the score box provided.

Step 3 Add up each score box for the total.

Step 4 Take the test to the doctor to talk about your child's total score.

19 or less

If your child's score is 19 or less, it may be a sign that your child's asthma is not controlled as well as it could be. No matter what the score, bring this test to your doctor to talk about your child's results.

Have your child complete these questions.

1. How is your asthma today?
   0 Very bad | 1 Bad | 2 Good | 3 Very good
2. How much of a problem is your asthma when you run, exercise or play sports?
   0 It's a big problem, I can't do what I want to do. | 1 It's a problem and I don't like it. | 2 It's a little problem but it's okay. | 3 It's not a problem.
3. Do you cough because of your asthma?
   0 Yes, all of the time. | 1 Yes, most of the time. | 2 Yes, some of the time. | 3 No, none of the time.
4. Do you wake up during the night because of your asthma?
   0 Yes, all of the time. | 1 Yes, most of the time. | 2 Yes, some of the time. | 3 No, none of the time.

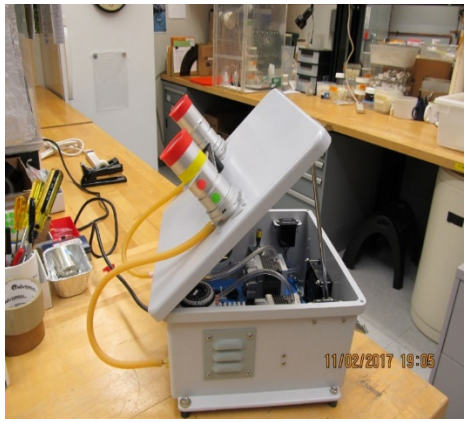
Please complete the following questions on your own.

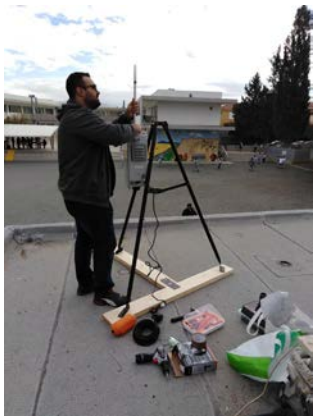
5. During the last 4 weeks, how many days did your child have any daytime asthma symptoms?
   5 Not at all | 4 1-3 days | 3 4-10 days | 2 11-18 days | 1 19-24 days | 0 Everyday
6. During the last 4 weeks, how many days did your child wheeze during the day because of asthma?
   5 Not at all | 4 1-3 days | 3 4-10 days | 2 11-18 days | 1 19-24 days | 0 Everyday
7. During the last 4 weeks, how many days did your child wake up during the night because of asthma?
   5 Not at all | 4 1-3 days | 3 4-10 days | 2 11-18 days | 1 19-24 days | 0 Everyday

SCORE

TOTAL

Air Quality Measurements





- Indoor and outdoor particle cascade samplers
- During dust weeks and dust-free weeks
- PM10 and PM2.5 filter samples (mass, BC, elements)
- Indoor Dust penetration

Challenges & Lessons Learned

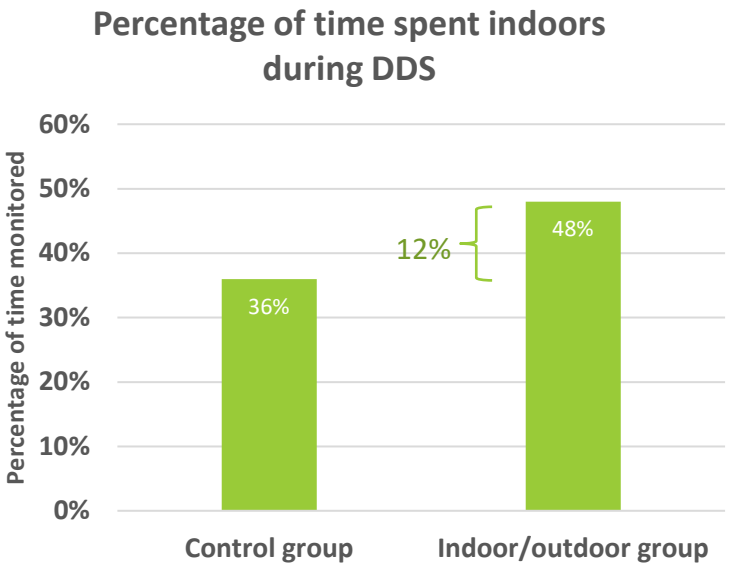
-Selection of Wearable devices – battery issues, interface with platform, equipment cost, size, compliance with schools policy and many more….

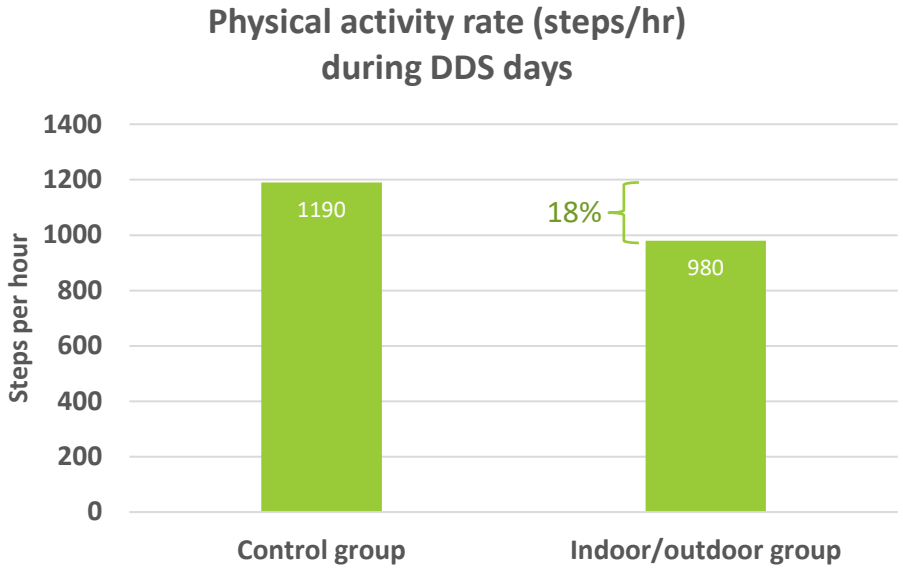
- Missing data
- Loss of GPS signal
- Developed and validated microenvironment classification algorithms that include spatial and temporal buffering.

- Environmental monitoring at homes and schools is challenging
  - Requires commitment by participating families and school administrations
  - Regular phone calls and home/school visits

Preliminary Comparisons between intervention groups

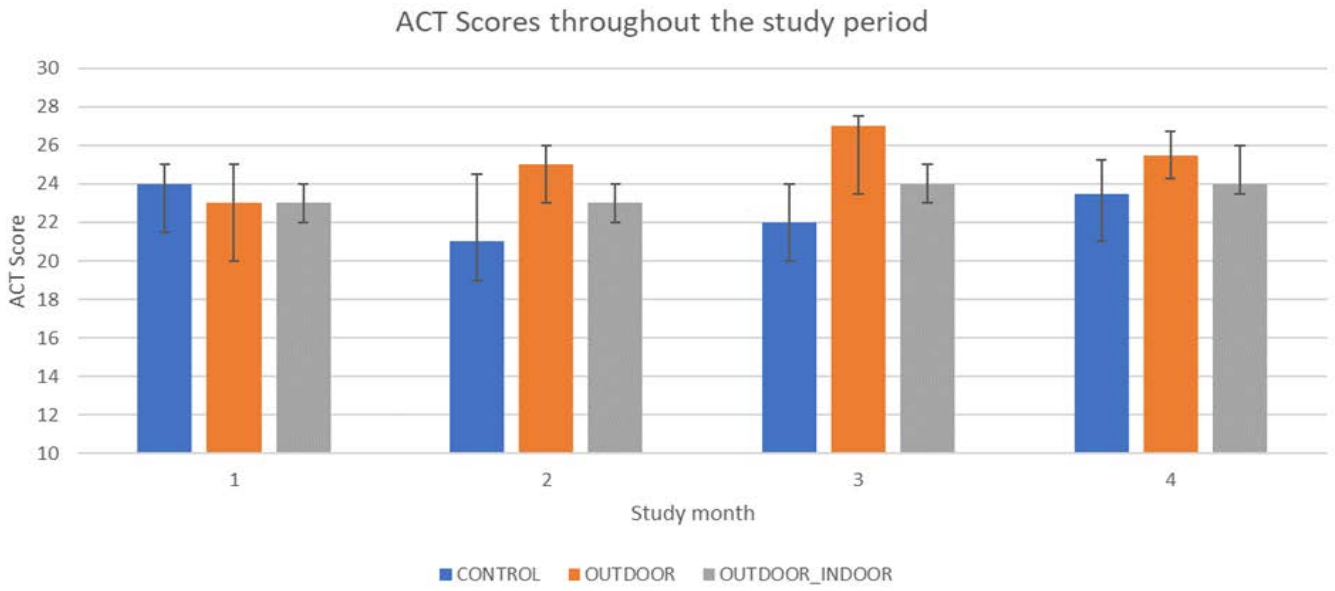
Preliminary data: study year 1 ≈ 90 asthmatic children





Preliminary Comparisons between intervention groups

- No differences between baseline and follow-up measurements
  - Lung Function (FEV1%, FVC%, FEF_{25-75}%)
  - FeNO measurements
  - Some evidence of effect based on ACT results from Cyprus
    - Lower scores indicate worst asthma symptom control



n=39

MEDEA Policy Implications

MEDEA Advisory Committee (35 members)

- Direct Involvement and communication with regulatory authorities and social stakeholders

Following the evaluation of MEDEA practices

- DDS forecasting on a systematic and permanent basis.
- Maintenance of internet platform - early warning dissemination
- Incorporation of MEDEA practices in public policies
- In the long term: Cyprus – Model country in DDS events management
- Transfer of MEDEA guidelines and Practices to other countries

LIFE MEDEA consortium

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