



## **Action E1**

### **Sub-Action E1.3**

Deliverable E1.8: Open-source web application to be downloaded in a smartphone, PDA etc with the overall utilities and interactive features regarding MEDEA study.

Beneficiary responsible for implementation: UCY

Date: 30/08/2022



This project is co-financed by the European Union within the framework of the LIFE Program under the Grant Agreement LIFE16CCA/CY/000041

Action E1, Sub-Action E.1.3, Deliverable E1.8

**Open-source web application to be downloaded in a smartphone, PDA etc with the overall utilities and interactive features regarding MEDEA study**

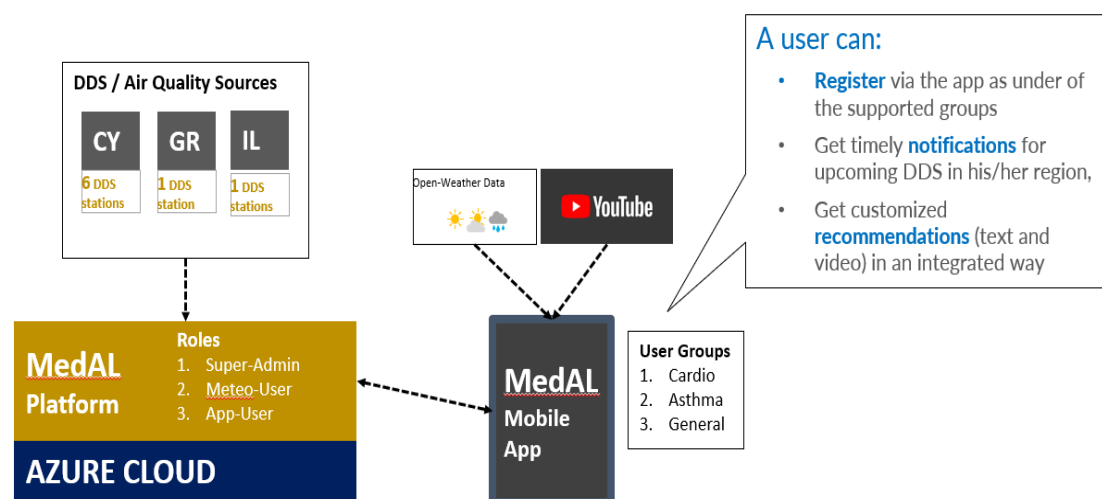
The LIFE MEDEA project aimed to establish a user-friendly and freely available tool for early population warning of upcoming Desert Dust Storm (DDS) events, accurate provision of information of when a DDS event starts and when it ends and personalised provision of evidence-based recommendations that can be followed during DDS events in order to reduce indoor and outdoor exposure to harmful particulate air pollution. In summary the main aim was to:

1. Upscale the early warning dissemination system.
2. Include and disseminate forecasting for DDS events.
3. Include and disseminate exposure reduction guidelines targeted to the general population and specific susceptible groups (asthmatic children and Atrial Fibrillation).
4. The guidelines will be made available in text and video format.
5. Every citizen will be able to register and receive warnings for a specific and chosen area (Cyprus, Greece, Israel)

Towards this goal, the MEDEA associated beneficiary ENA Consulting, with the support of MEDEA personnel from other beneficiaries developed the web-based application (after-LIFE web application) which covered the stated objectives, and which constitutes the third and final component of the project's replication and sustainability plan. The after-LIFE application includes the web-based platform (MedAL platform) and the mobile application (MedAL application) downloaded freely on individual smartphones of members of the public. The system and application were based on the original bidirectional platform developed for the purposes of the LIFE-MEDEA asthma and atrial fibrillation panel studies. Compared to the original bidirectional platform the after-LIFE application has deactivated the option to collect and store data from smartwatches as this option was only relevant during the asthma

and atrial fibrillation panel studies. However, some important features were added. The most important addition and critical component for the sustainability of this tool, is the automation of air quality (DDS) alerts. This addition relies on the continuous and automatic feed of the after-LIFE application with real-time air-quality data (particulate matter with diameter less than 10 micrograms-PM<sub>10</sub> concentrations) from regulatory authorities or other external sources in the three regions. The continuous feed of air quality data to the MedAL platform will be complemented with continuous feed of open weather data and manual forecasting information on upcoming DDS events. The whole after-LIFE web-based MEDEA system was developed by the project's information technology partner E.n.A Consulting.

The overall system architecture of the after-LIFE application is summarized in the diagram below:



Along with E.n.A Consulting, several other MEDEA members were involved in the design and testing phase of the development process to ensure alignment with project objectives, interoperability between the MedAL platform and data providers and sustainability of the provided solutions. The development phase included the development of detailed design note by E.n.A Consulting and a series of online and face-to-face meetings between the different members of the team and between E.n.A Consulting and the project management team. The main activities of the development process were initiated in January 2021 and were completed in August 2021. The list

of the main MEDEA members, their organization and their role in the design phase is provided below:

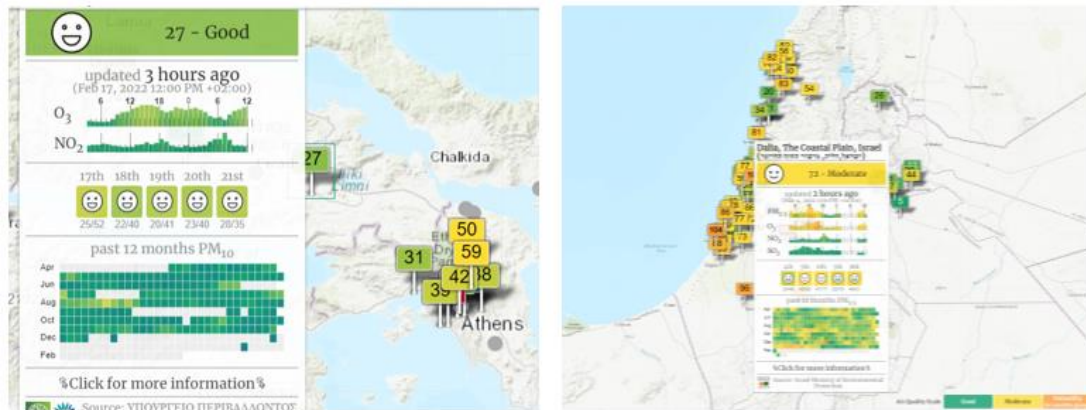
| Name               | Organisation | Key Role                                | Main Task  |
|--------------------|--------------|---|--|
| Filippos Tymvios   | CyMET        | C9 Coordinator<br>Weather forecaster    | METEO data provision<br>(manual)                               |
| Makis Stamatelatos | EnA          | Technology Provider                     | System design and<br>development                               |
| Panayiotis Kouis   | UCY          | MEDEA Coordinator<br>Medical            | Medical Recommendations<br>and Guidelines provision            |
| Petros Mouzourides | UCY          | Weather forecaster input and<br>testing | MedAL Testing - Inputs   |
| Souzana Achileos   | CUT          | Medical                                 | Support medical<br>recommendations and<br>guidelines provision |
| Emily Vasiliadou   | DLI          | Air quality                             | Air quality data provision for<br>Cyprus                       |
| Nikos Kalivitis    | UOC          | Weather forecaster<br>Air quality       | METEO and Air quality data<br>provision for Greece             |
| Itzhak Katra       | SCRC         | Air quality                             | Air quality data provision                                     |

#### **MedAL Early Warning and Alert apparatus:**

The main characteristic and key component of the MedAL platform is the Early Warning and Alert apparatus. This component relies on the continuous availability of air quality data from regulatory authorities and open sources. The sources for each country are the following:

1. Cyprus State Air Quality System
  - Cyprus (DLI, 6 stations)
2. Publicly available air-quality data (World Air Quality Index project)
  - Greece (1 station)
  - Israel (1 station)

The picture below presents a characteristic example of air pollution data available from different stations in Greece and Israel.



For Cyprus the data are provided directly from the Department of Labour Inspection (DLI) of the Ministry of Labour and Social Insurance, which is the authority responsible for the assessment, monitoring and reporting air quality in Cyprus. The participation of DLI in the Early Warning and Alert apparatus of the MedAL platform ensures the accuracy and sustainability of the system. The data are provided in hourly values by DLI using a specific Application Programming Interface (API). The DLI API used for data sharing with the MedAL platform is provided below:

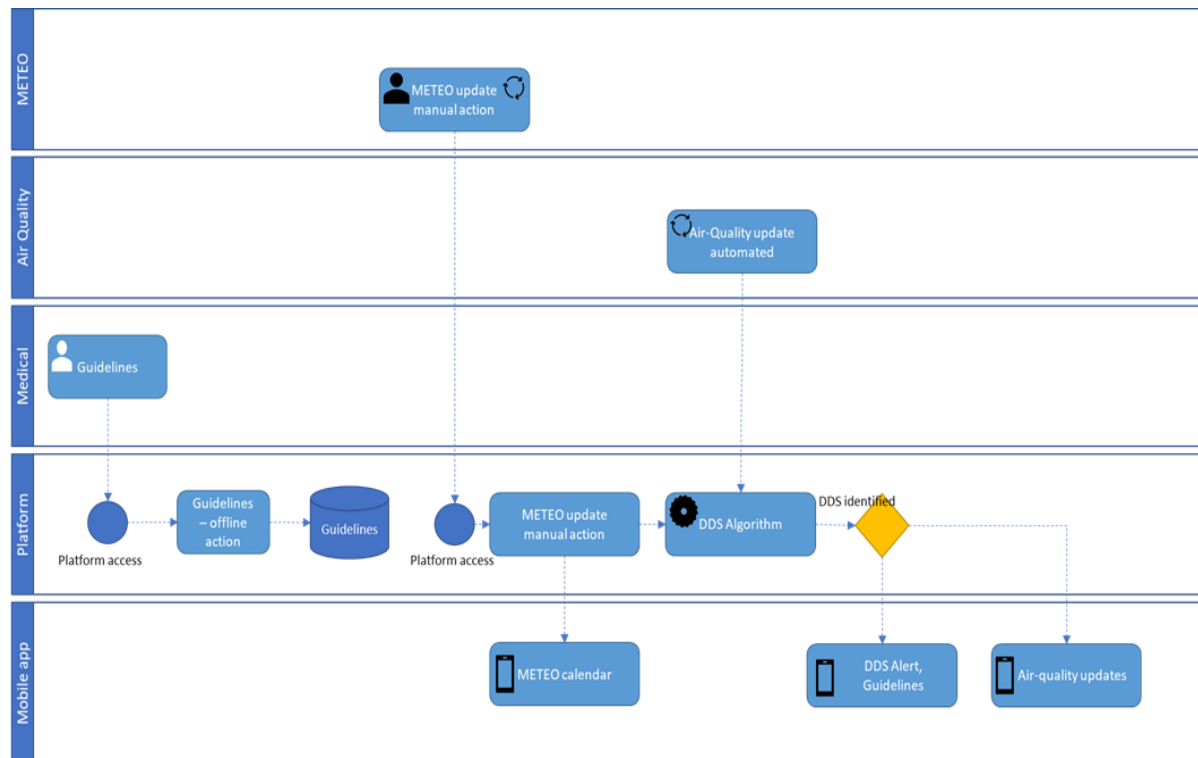
For live data: [https://www.airquality.dli.mlsi.gov.cy/all\\_stations\\_data\\_PM](https://www.airquality.dli.mlsi.gov.cy/all_stations_data_PM)

In terms of forecasting, and considering the complexities of DDS forecasting, a manual approach is utilized which takes in to account the relevant outputs of LIFE-MEDEA project in terms of the accuracy of different meteorological models in DDS forecasting. It is noted, that for each region the best performing meteorological model was identified and prioritized for regional DDS forecasting. Nevertheless, the forecaster at each region will still have the option to rely on additional or in different forecasting models on a case-by-case basis, according to their personal judgment. However, in terms of air quality data and alerting for DDS events the Early Warning and Alert apparatus is completely automatic and data driven. Overall, depending on the availability of data a region-specific alerting algorithm has been developed and embedded in the MedAL platform. Due to the fact that available data from Cyprus originate from a dense network of air quality stations, the alerting algorithm in

Cyprus is more complex compared to the other regions. The table below demonstrates the alerting algorithms for all three regions:

| <b>Cyprus – alerting algorithm</b>   |
|--|
| <p>If at least 2 out of 3 internal criteria listed below are met for 3 consecutive hours the alert is automatically activated:</p> <ul style="list-style-type: none"> <li>• [Criterion 1] Ag. Marina Xyliatou (EMEP – background station) exhibits hourly-averaged concentrations of PM<sub>10</sub> &gt; 50 µg/m<sup>3</sup></li> <li>• [Criterion 2] Any AQMS exhibits hourly-averaged concentrations of PM<sub>10</sub> &gt;100 µg/m<sup>3</sup></li> <li>• [Criterion 3] Any 3 stations exhibit hourly-averaged concentrations of PM<sub>10</sub> &gt; 50 µg/m<sup>3</sup></li> </ul> <p>Remarks on maintain alert status:</p> <ul style="list-style-type: none"> <li>• The alert will be stopped if &lt;2 criteria are no longer met after 3 hours of DDS alert.</li> </ul> <p>In practice:</p> <ul style="list-style-type: none"> <li>• After DDS identification, get measurements after 3 hours and check criteria. If at least 2 out of 3 then DDS alert is still valid so check after 3 hours again etc.</li> </ul> |
| <b>Greece</b>  |
| <p>If the internal criterion [Criterion 1] is met for 3 consecutive hours, the alert is automatically activated:</p> <ul style="list-style-type: none"> <li>• [Criterion 1] Heraklion (Finokalia) station exhibits hourly-averaged concentrations of PM<sub>10</sub> &gt; 50 µgm<sup>3</sup></li> </ul> <p>Remarks on maintaining alert status</p> <ul style="list-style-type: none"> <li>• The alert will be stopped if Criterion 1 criterion is no longer met after 3 hours of DDS alert.</li> </ul> <p>In practice:</p> <ul style="list-style-type: none"> <li>• After DDS identification, get measurements after 3 hours and check criterion.If B1 is met then DDS alert is still valid so check after 3 hours etc.</li> </ul>   |
| <b>Israel</b>  |
| <p>If the internal criterion [Criterion 1] is met for 3 consecutive hours, the alert is automatically activated:</p> <ul style="list-style-type: none"> <li>• [Criterion 1] Beer Sheva station exhibits hourly-averaged concentrations of PM<sub>10</sub>&gt; 100 µg/m<sup>3</sup></li> </ul> <p>Remark</p> <ul style="list-style-type: none"> <li>• The alert will be stopped if Criterion 1 criterion is no longer met after 3 hours of DDS alert.</li> </ul> <p>In practice:</p> <ul style="list-style-type: none"> <li>• After DDS identification, get measurements after 3 hours and check criterion.If B1 is met then DDS alert is still valid so check after 3 hours etc.</li> </ul>  |

A summary of the MedAL Early Warning and Alert apparatus is presented in the diagram below:



### User interface:

The MedAL smartphone application, in general features a user-friendly design in an effort to maximize the usability of the application and maximize the engagement of the participant with its different features. It includes sections that provide information on the local weather and provide an overview of active or past DDS alerts. A user of the MedAL application can:

- Register via the app as under of the supported groups
- Get Weather forecasting
- Get timely notifications for upcoming DDS in his/her region,
- Get exposure reduction guidelines (text and video) in an integrated way
- Get historical data of DDS events

The application also offers fast & reliable responsiveness, autosense black/dark theme, automatic content refreshing on DDS alerts. In addition the whole system is

characterised by event-driven architecture, role-based user management with access control list and maintains the capacity for slack alerting (administrative roles), SMS messaging while on the same time it relies on minimum personal data maintenance and is GDPR compliant. Finally, the system is easily expandable to include additional regions. The different roles the users can register to correspond to the particular population groups that can receive exposure reduction guidelines. These groups are:

- General public
- Asthmatic children (and their families)
- Atrial Fibrillation patients (and their families)

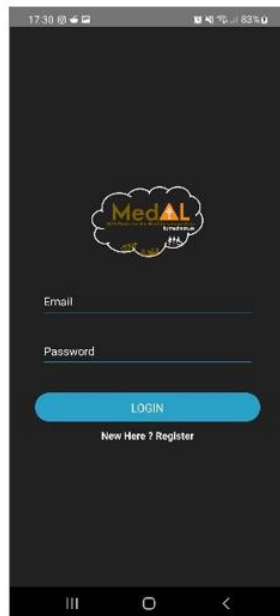
The full text of the guidelines developed for each group are presented in Appendix I for the general public, Appendix II for the asthmatic children and Appendix III for the Atrial Fibrillation patients. ). In case of a DDS alert, a notification is displayed along with all the pre-defined exposure reduction guidelines and corresponding video with animated instructions according to each user's role. The video is also continuously available in the mobile application to further enhance familiarity of the user with the exposure reduction guidelines. The user interface is presented in the image below:

## Mobile App

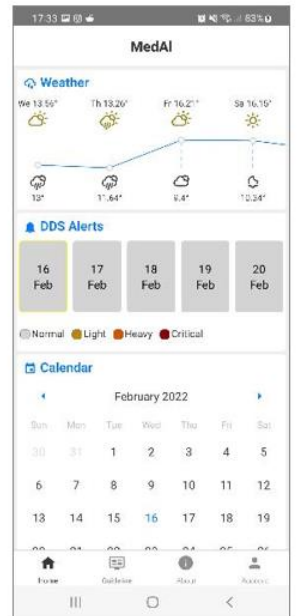
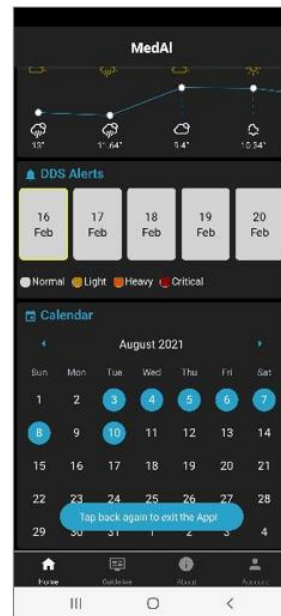
Welcome Screen



Login Screen



Home Screen





The logo and welcome screen of the MedAL smartphone application is presented here:



For the promotion of the smartphone application the project developed a printed and digital brochure: The front and back side of the brochure are displayed below:



The smartphone application is freely available using the link below:

<https://play.google.com/store/apps/details?id=com.ena.lifeafterlife>

Alternatively, the QR code can be scanned:



The Google Play page of the MedAL application is displayed below:



The Life+ MEDEA project provides tools for early population warning of upcoming Desert Dust Storm (DDS) events and a set of evidence-based recommendations during DDS events aiming at reducing indoor and outdoor exposure to harmful particulate air pollution.

The MedAL app, available at Google Play and iOS app stores, acts as the personal monitoring and

## **APPENDIX I**

### **Guidelines for the General Population**

#### **PRECAUTIONARY MEASURES FOR EXPOSURE REDUCTION TO DESERT DUST**

##### **Outdoor precautionary measures**

- Minimize the time spent outdoors as much as possible:
  - Stay at home or at the office as much as possible.
  - If it is necessary to go out, minimize your transportation time and limit the time you spend outdoors.
- If it is necessary to go out, use a car for transportation.
  - Keep the windows closed.
  - Activate the cars' ventilation system in recirculation mode.
  - Avoid smoking in the car.
- Avoid rigorous outdoor physical activity such as:
  - Exercising
  - Cycling
  - Jogging or walking

##### **Indoor precautionary measures**

- Maintain good air quality at home:
  - Minimize outside air penetration by keeping the windows and doors closed as much as possible.
  - Avoid activities that may worsen indoor air quality such as:
    - Smoking
    - Using vacuum cleaners
    - Cooking with gas
    - Lighting candle and fireplaces
  - If you have a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office, make sure is properly functioning and place the unit in the room(s) you spend the most time in( kitchen, living room).
  - If you have a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office make sure the airflow is not obstructed. Keep air cleaners away from curtains/furniture and anything that might block airflow
- Avoid using vacuum cleaners. Clean contact surfaces (e.g. tables, benches) with a wet cloth and mop the floor at least once a day.

##### **CARE FOR CHILDREN**

- Minimize time children spent outdoors as much as possible:
  - Keep the child at home after school, as much as possible, for playing and studying
- If it is necessary to go out, minimize the transportation time and limit the time spend outdoors.
- Cancel any outdoor activities or excursions
- Avoid rigorous outdoor physical activity for your child such as:
  - Outdoor sports practice
  - Cycling

- Playing after school
- If your child has chronic conditions causing respiratory problems, please call your physician for further instructions.
- If your child has chronic conditions causing respiratory problems and is taking medication, please consult your physician for personalised medical advice.

### **CARE FOR ELDERLY PERSONS**

- Move them to cooler places or areas in the house with small penetration from outside air, keep the windows and doors closed.
- If the elderly person has chronic conditions causing cardio and/or respiratory problems, please consult your physician for further instructions.
- If the elderly person has chronic conditions (cardio, respiratory problems) and takes medications, please consult your doctor for a personalised medical advice.
- Do not leave elderly persons alone during many days' absence from home. In the opposite case, make sure that a person takes care of them.

Please click on the following link to watch a short video on the precautionary measures on exposure to desert dust.

#### **For more information**

Please visit the website <https://www.life-medea.eu/>

#### **Short Edition**

#### **General Public Guidelines**

- **Minimize** the time spent outdoors as much as possible:
- **Maintain** air quality at home by keeping the windows and doors closed as much as possible.
- **If you have** a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office, make sure is properly functioning, the airflow is not obstructed. Keep air cleaners away from curtains/furniture and anything that might block airflow
- **If it is necessary to go out**, use a car for transportation, keep the windows closed, activate the cars' ventilation system in recirculation mode and avoid smoking in the car.
- **Avoid** rigorous outdoor physical activity
- **Contact your doctor** if you have cardiorespiratory symptoms particularly chest pain and shortness of breath.

## **APPENDIX II**

### **Guidelines for families with asthmatic children**

#### **PRECAUTIONARY MEASURES FOR EXPOSURE REDUCTION TO DESERT DUST**

##### **Outdoor precautionary measures**

- Minimize time children spent outdoors as much as possible:
  - Keep the child at home after school, as much as possible, for playing and studying
- If it is necessary to go out, minimize the transportation time and limit the time spend outdoors.
- Cancel any outdoor activities or excursions
- Avoid rigorous outdoor physical activity for your child such as:
  - Outdoor sports practice
  - Cycling
  - Playing after school

##### **Indoor precautionary measures**

- Maintain good air quality at home:
  - Minimize outside air penetration by keeping the windows and doors closed as much as possible.
  - Avoid activities that may worsen indoor air quality such as:
    - Smoking
    - Using vacuum cleaners
    - Cooking with gas
    - Lighting candle and fireplaces
  - If you have a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office, make sure is properly functioning and place the unit in the room(s) you spend the most time in( kitchen, living room).
  - If you have a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office make sure the airflow is not obstructed. Keep air cleaners away from curtains/furniture and anything that might block airflow
- Avoid using vacuum cleaners. Clean contact surfaces (e.g. tables, benches) with a wet cloth and mop the floor at least once a day.
- Be cautious about the symptoms of your child. If your child is showing symptoms and warning signs of asthma attack in the form of a persistent cough or wheezing, contact your paediatrician to learn more about ways to help your child better control their asthma symptoms.
- Be cautious about the symptoms of your child. If your child is showing symptoms and warning signs of asthma attack in the form of a persistent cough or wheezing and takes medication, consult your paediatrician about your child asthma treatment and make sure it is right for it.

Please click on the following link to watch a short video on the precautionary measures on exposure to desert dust.

**For more information**

Please visit the website <https://www.life-medea.eu/>

### **Short Edition**

#### **Asthmatic Patients Guidelines**

- **Minimize** children transportation time and limit the time they spend outdoors spent
- **Maintain** air quality at home by keeping the windows and doors closed as much as possible.
- **If you have** a portable high-efficiency particulate air (HEPA) cleaner in your house make sure is properly functioning, the airflow is not obstructed. Keep air cleaners away from curtains/furniture and anything that might block airflow
- **If it is necessary to go out**, use a car for transportation, keep the windows closed, activate the cars' ventilation system in recirculation mode and avoid smoking in the car.
- **Avoid** rigorous outdoor physical activity for your child
- **If your child is showing symptoms** of asthma attack, contact your paediatrician

## **APPENDIX III**

### **Guidelines for patients with Atrial Fibrillation**

#### **PRECAUTIONARY MEASURES FOR EXPOSURE REDUCTION TO DESERT DUST**

##### **Outdoor precautionary measures**

- Minimize the time spent outdoors as much as possible:
  - Stay at home or at the office as much as possible.
  - If it is necessary to go out, minimize your transportation time and limit the time you spend outdoors.
- If it is necessary to go out, use a car for transportation.
  - Keep the windows closed.
  - Activate the cars' ventilation system in recirculation mode.
  - Avoid smoking in the car.
- Avoid rigorous outdoor physical activity such as:
  - Exercising
  - Cycling
  - Jogging or walking

##### **Indoor precautionary measures**

- Maintain good air quality at home:
  - Minimize outside air penetration by keeping the windows and doors closed as much as possible.
  - Avoid activities that may worsen indoor air quality such as:
    - Smoking
    - Using vacuum cleaners
    - Cooking with gas
    - Lighting candle and fireplaces
  - If you have a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office, make sure it is properly functioning and place the unit in the room(s) you spend the most time in (kitchen, living room).
  - If you have a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office make sure the airflow is not obstructed. Keep air cleaners away from curtains/furniture and anything that might block airflow
- Avoid using vacuum cleaners. Clean contact surfaces (e.g. tables, benches) with a wet cloth and mop the floor at least once a day.
- If you feel light headedness, unexplained fatigue, chest discomfort that feels like pressure, fullness, or a squeezing pain or any other symptoms that persist, please consult your physician for further instructions.
- If you feel light headedness, unexplained fatigue, chest discomfort that feels like pressure, fullness, or a squeezing pain or any other symptoms that persist and take medications, consult your doctor about your medication treatment plan and make sure it is right for you.

Please click on the following link to watch a short video on the precautionary measures on exposure to desert dust.

**For more information**

Please visit the website <https://www.life-medea.eu/>

Short Edition

**Cardiac Patients guidelines**

- **Minimize** the time spent outdoors as much as possible:
- **Maintain** air quality at home by keeping the windows and doors closed as much as possible.
- **If you have** a portable high-efficiency particulate air (HEPA) cleaner in your house or in your office, make sure is properly functioning, the airflow is not obstructed. Keep air cleaners away from curtains/furniture and anything that might block airflow
- **If it is necessary to go out**, use a car for transportation, keep the windows closed, activate the cars' ventilation system in recirculation mode and avoid smoking in the car.
- **Avoid** rigorous outdoor physical activity
- Contact your doctor if you have cardiorespiratory symptoms particularly chest pain and shortness of breath.