DELIVERABLE D1.5: SUMMARY OF MAIN RESULTS ACHIEVED BY EACH CONTRACTOR AND CONCLUSIONS FROM PHASE 1

Our BugWatcher solution will be composed by two main parts. First, it will have two different types of screening devices that will allow the detection of the three type of bacteria: paper strips for detection in humans and in hospital fomites, and an air monitoring device to detect the bacteria in air. Secondly, it will also have an ICT Platform composed by a mobile application and a website, which will be in constant communication with HIS/LIS/EHR.
Regarding the different results achieved by our BugWatcher consortia, we will divide them taking into account the different solution components.

Air monitoring screening device:

One of the primary objectives of Phase 1 was the concept design of a cartridge system that would contain the fluidics control system and all of the necessary reagents required to process the airborne biological samples in preparation for the nucleic acid amplification and detection. The development of a new nucleic acid cartridge-based system was considered essential for the high sensitivity and specificity necessary for the robust and reliable detection of the target airborne pathogens.

A microfluidics-based method was chosen to process the sample through the necessary extraction and amplification stages while maintaining a small footprint within the cartridge and the device itself. Additionally, the sampler can be multiplexed to individual internal reaction chambers for subsequent detection and analysis in order to target several pathogens simultaneously, and it can carry out multiple individual samples from a single cartridge. This has significant cost benefits and is an operationally and environmentally efficient process when compared to existing manual air sampling methods.

Appropriate chemistries necessary for *Clostridium difficile*, Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Klebsiella pneumoniae* were identified and assessed for their extraction and purification efficiency, sensitivity and specificity, environmental stability, and compatibility with the microfluidics processing design.

We confirmed that although the target pathogens can be identified using the system, it is also extendable to a broad range of other problematic viral, bacterial and fungal pathogens.
A number of new air sampling systems were assessed in phase 1. The sampling system concept was chosen based on its high sampling efficiency and compatibility with the microfluidics cartridge system.

Lateral flow strips screening device:

Identification of three target antigens to be detected using lateral flow strips (LFs), each one of them present in one of the three superbugs: *Clostridium difficile*, Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Klebsiella spp* collected from human samples and contaminated surfaces like fomites.

LFs have been redesigned to include magnetic beads (MBs) due the possibility to use this material as an element for removing the targets from the sample, avoiding matrix effects and interferences and also to pre-concentrate the sample before its addition to the LFs, helping to achieve lower detection limits.

Sample collection can be performed by using buccal or rectal swabs (transport mediums), saliva collectors and a portable vacuum cleaner by an innovative collector system.

Bugwatcher software (ICT component):

The main task of Phase 1 related to the software component of BugWatcher was to design and define the software architecture, taking into account all the different technological requirements, presented in the CB.

Together with this definition, another main outcome of this phase 1 has been the design of BugWatcher's interface. This means we have obtained a first draft of both the app and the web screens together with their flow. However, one of the first tasks of phase 2 will be the redefinition and "fine-tuning" of the proposed draft, while performing co-creation sessions which will include both our technical and design team and BugWatcher's final users (healthcare professionals).

The mobile application will be used by healthcare professionals that want to include the results of the paper strips' tests performed in humans and in the hospital fomites. They will be able to register an infection (by taking a picture of the lateral flow test, which will be analyzed by our system and will return the degree of infection of a certain bacteria) of a patient already registered in a specific room -by scanning his/her hospital wristband or by inserting manually all the identification data-, or the group of fomites inside a hospital stay (room, hallway, waiting room, elevators zone…; wherever the sample was taken).

The website platform will be in charge of receiving all the alerts gathered by the screening devices, together with the adequate identifications (patient/fomite/room ID where the infection was detected, timestamp of the detection, type of contamination, source of information…). All this information will be stored in our BugWatcher independent SQL-based database and will be sent to HIS/LIS/EHR, thanks to our MIRTH middleware connection.

In addition, this website platform will be available for healthcare professionals (doctors, nurses…), the medical center coordinators, the system administrator and microbiologists or laboratory personnel. What will change are the permissions, which will vary depending on the role -and therefore functions- of the user accessing to the platform.

Main conclusions of phase 1:

First of all, we confirmed and improved some of the measuring methods and techniques that we will use during Phase 2.

At the air monitoring device level, we confirm that our solution could be extended to a broad range of other problematic viral, bacterial and fungal pathogens. Also, we define a new air sampling system with high sampling efficiency and compatibility with the microfluidics cartridge system.

At the LFs level, we have confirmed the three target antigens that we will use for the detection. Additionally, we consider viable the sample collection by using buccal or rectal swabs, saliva collectors or even with a vacuum cleaner system.

Finally, at ICT level we analyzed and defined in detail the functionality, confirmed the role of all users, notification strategy and integration requirements very clearly. It was very useful to have a draft design of all interfaces (App and Web) as a tool to better explain to all stakeholders its functionality but mainly to confirm and validate the complete system. Thanks to that, all consortium members are fully aligned to the needs and how we will address them.

Signatures: