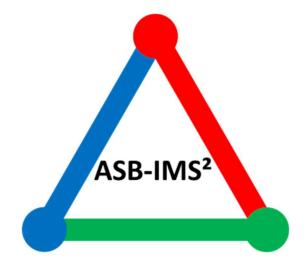# ANTI-SUPERBUGS PCP

Grant Agreement: 688878

ANTI-SUPERBUGS PCP - Phase 1

ASB-IMS² - Anti-SuperBugs – Infection Control, Monitoring and Information Systems based on Ion Mobility Spectrometry

D1.5- Summary of main results (Each contractor) & conclusions- Phase 1

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File Name	D1.5 – ASB-IMS² Summary of main results and conclusions

To tackle the problem of Superbugs and thereby resulting Healthcare Associated Infections (HAIs), four companies from Germany have teamed up to develop the modern ASB-IMS² solution. The Anti-SuperBugs Infection Control, Monitoring and Information Systems based on Ion Mobility Spectrometry (ASB-IMS²) is a multi-dimensional medical device which will comprise of a package of modern technologies that will offer multiple approaches and outputs at various levels of infection management. These include early non-invasive detection, first patient screening, environmental safety and specific therapy with modern point of care diagnostics support.

The ASB-IMS² solution will comprise of three modules namely; a bacteria identification system based on microbial volatile organic compound (mVOC) Detection, non-invasively from exhaled breath and from wound or surface wipe tests, a modern Prevention system for a cleaner hospital environment and a high-tech Monitoring system that combines the other systems together into its surveillance thereby providing the next generation healthcare to patients and the cleanest hospital environment to healthcare workers.

At the end of Phase 1 of the ANTI-SUPERBUGS PCP project, the ASB-IMS² team have completed the design and concept of each individual module of the medical device and most importantly, the interlinking of each module to provide a unified solution in tackling the above-mentioned Superbugs.

Bacteria Identification by mVOC Detection – ION-GAS GmbH

Non-invasive breath based, as well as wound and surface analysis will be carried out using the technique of Ion Mobility Spectrometry (IMS). As the first step concerning the non-invasive detection of microbial volatile organic compounds, literature and market studies were completed establishing the lists of published mVOCs emanated by the 3 major bacteria namely *C. Difficile*, *K. Pneumoniae* and *S. aureus*. The system will enable the rapid, on-site identification of bacteria on behalf of their characteristic mVOC patterns. Additionally, it was established that there are currently no breath-based IMS products in the worldwide market available commercially to identify bacteria in humans. Our mobile, battery operated module will comprise of a state-of-the art sample pre-concentration technique to detect and identify volatiles in the ppt range. Additionally, with miniaturised pre-separation techniques combined with an ultrasensitive in house IMS system, the whole process of sampling, measurement, detection, analysis and communication with the Infection Prevention Surveillance System (IPSS) will be carried out within 90 seconds. With intuitive GUIs, and automated analysis, various levels of results and details will be available to respective staff from simple signal based yes or no for bacterial presence to the 3-dimensional chromatograms and time-based bacterial development spectra. Results including the timestamp with patient and staff ID including ward number will be sent to the monitoring module to be incorporated into the database for specific therapy.

Spread Prevention – Logic Way GmbH & UCEF GmbH

Hand hygiene has proven to be the most effective way to prevent the spread of infection and thus will be an important vector in isolating Superbugs. Our modern and smart prevention system will work on this ideology by providing smart ID cards and installing dispenser modules at all vantage points in an hospital environment making sure that the health care workers adhere to good hygiene practices. With data about individual healthcare worker's hygiene routines monitored, it will be easy to see who keeps up with these regulations and who don't. A triple nudging system including an audible beep, a vibrational feedback and a visual smiley feedback will ensure that healthcare workers disinfect their hands before entering critical areas of the hospital and their disinfection logged. Patients can also see if their caretaker have adhered to these measures with a smiley face that will be displayed in the ID card. Additionally, a hight-tech sector guard will be installed in critical wards of the hospital environment wherein if there is a healthcare worker who enters the ward with

below par hygiene practices, there will be an immediate audio alarm to alert the staff to disinfect before entering. Furthermore, continuous station-wise monitoring of the hygiene status is available from those data as a user-friendly dashboard which will be managed and evaluated by the monitoring module.

Monitoring – Meta IT GmbH

Detection before Infection is the mantra with which a high-tech Infection Prevention Surveillance System (IPSS) has been conceptualised. IPSS will actively and comprehensively support all relevant processes in the hygiene management of a hospital and will be a vital development focus of Meta IT GmbH. From the time of a patient's admission until their discharge, the complete workflow of all hygiene related processes will be mapped and monitored. This will directly improve patient safety. The system can be fully parameterised with regard to hospital-specific, hygiene related documentation requirements and will contain all necessary interfaces e.g. HL7, FHIR to hospital information and laboratory systems.

IPSS will serve as the central system combining a bundle of medical technologies, laboratories and modular systems together in providing one complete medical device, the ASB-IMS². The IPSS will entail the Hospital Information System (HIS), the internal and external Laboratory Information System (LIS), the Electronic Health Records (EHR) and information received from the mVOC detection system - about bacteria identified in exhaled breath, in wounds or on surfaces - and the Spread prevention system to guarantee specific antibiotic therapy with modern point of care diagnostics support in tackling the problem of Superbugs.

To conclude, the ASB-IMS² system comprising of a non-invasive breath-based mVOC detector for bacteria identification which will include the three major superbugs in the initial database to monitor human breath, alongside wounds, surfaces and room air for possible infections within 90 seconds combined with a modern disinfection system promoting hand hygiene amongst staff members to prevent the spread of HAIs and with the IPSS functioning as the fulcrum with an interoperability engine, integrating the local HIS, LIS, HER et c along with the mVOC and disinfection data will be the apt medical device to reduce the economical and operational impact of the Superbugs by creating proving an ultra-modern Point of Care diagnostics in hospitals and thereby improving the healthcare system by providing targeted medicine in eliminating these Superbugs and other potential MDROs in the future.