

# Detection of multidrug-resistant bacteria in the occupied Palestinian territory: a cross-sectional study

Isabella Sjölander, Frank Hansen, Abdelraouf Elmanama, Rasha Khayyat, Alaeddin Abu-Zant, Ayman Hussein, Adham Abu Taha, Anette M Hammerum, Oana Ciofu

## Abstract

**Background** Antimicrobial resistance is a worldwide threat to public health. WHO has created several resolutions and strategies on this subject at the World Health Assembly. In May, 2015, WHO published a global action plan to mitigate antimicrobial resistance, including tracking and global surveillance focusing on improving awareness and understanding of this issue. The aim of this study was to screen for carbapenem-resistant bacteria in the occupied Palestinian Territory, to investigate the mechanisms behind the resistance, and to assess the scope of this difficulty in the area.

**Methods** During 6 weeks in 2012, we collected all available Gram-negative isolates taken from inpatients and outpatients in hospital laboratories at Al-Shifa Hospital and five additional hospitals in the West Bank to screen for carbapenem resistance. Resistant isolates were identified with MALDI-TOF, mapped for their resistance pattern, and further analysed for mechanism of resistance by multiplex PCR and gene sequencing. Pulsed-field gel electrophoresis (PFGE) and multilocus sequence typing (MLST) were used to type bacteria to compare the resistant isolates locally and internationally.

**Findings** Of the 248 Gram-negative isolates we collected, 21 (8%) showed significant in-vitro resistance to carbapenems and several other antibiotics. These 21 were identified as 15 isolates of *Acinetobacter baumannii* and six of *Pseudomonas aeruginosa*. Carbapenemase gene investigations showed intrinsic OXA-51 group in all isolates and one isolate from Gaza was positive for NDM-2. Of the six *P aeruginosa* isolates, one VIM-4 and three VIM-2 producers were recorded and MLST reported three new sequence types named ST1562, ST1563, and ST1564.

**Interpretation** We identified a high ratio of multidrug-resistant bacteria in the occupied Palestinian territory, to our knowledge the first documented isolates showing production of NDM-2 and VIM carbapenemases as a contributing mechanism. These findings emphasise the importance of this growing health threat in the occupied Palestinian territory and the need for further investigation and adequate surveillance of antibiotic resistance.

**Funding** Danish Ministry of Health and Prevention—the Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (DANMAP).

## Contributors

IS and OC conceived the idea. IS wrote the Abstract, collected the samples in the West Bank, and did the screening with RK, AA, AH, and AAT. AE collected samples and did the screening in Gaza. FH, AH, and OC did the analyses in Copenhagen. All authors approved the final version of the Abstract for publication.

## Declaration of interests

We declare no competing interests.

## Acknowledgments

We thank Abdel Jaleel Hunjul, Tony Lawrence, Tina Wasserman, Ulla R Johansen, and all the lab workers in Gaza and Nablus for their contributions to this Abstract

Published Online  
August 1, 2017

University of Copenhagen,  
Department of International  
Health and Microbiology  
(I Sjölander MD); Department of  
Microbiology and Infection  
Control, Statens Serum  
Institut, Copenhagen,  
Denmark (F Hansen MLS,  
A M Hammerum PhD); Medical  
Laboratory Sciences  
Department, Islamic  
University, Gaza, occupied  
Palestinian territory  
(A Elmanama PhD); Faculty of  
Medicine and Health Sciences,  
An-Najah National University,  
Nablus West Bank, occupied  
Palestinian territory  
(R Khayyat PhD, A Abu-Zant PhD,  
A Hussein PhD); Department of  
Pharmacy, An-Najah National  
University, Nablus, West Bank,  
occupied Palestinian territory  
(A Abu Taha PhD); and  
Department of International  
Health and Microbiology,  
University of Copenhagen,  
Denmark (O Ciofu PhD)

Correspondence to:  
Ms Isabella Sjölander,  
Hudiksvall's Hospital, Sweden,  
82430 Hudiksvall, Sweden.  
isabella.sjolandere@gmail.com