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useless. Their detailed and sophisticated microbiological work showed that the genes encoding VIM-2 are most often borne by a specific integron, In559, which also contains genes conferring resistance to trimethoprim and aminoglycosides.

The reported rise in prevalence of VIM-2 strains, from less than 5% in 2002–04, to nearly 30% in 2008–10 is large, even though the rates are questionable because the method of strain collection used was not a representative sampling scheme. Nevertheless, this spread of resistance probably led to increased use of colistin, the last available antibiotic to which *P aeruginosa* are susceptible. In turn, this rise in colistin use unsurprisingly resulted in the emergence in 2010 of strains resistant to all available drugs—a situation that could not be much worse.

But what about the patients? What were the risk factors for acquiring an epidemic strain? Edelstein and colleagues compared patients infected with VIM-2-positive *P aeruginosa* with those infected with *P aeruginosa* insusceptible to carbapenems probably by other variable mechanisms of resistance, which are not described. The results did not clearly point to specific risks for acquisition of the epidemic strain. The more frequent use of broad-spectrum antibiotics in patients infected with VIM-2-producing strains suggests that such patients were exposed to high-risk procedures or to high-risk units for prolonged periods. In this regard, Edelstein and colleagues' report largely confirms what was already known. Specific control measures are not suggested.

What is the real burden of diseases associated with these VIM-2 strains? Mortality in the patients infected with VIM-2-producing strains was 29%, but probably varied greatly between those only colonised with the bacteria and those with severe invasive infections. Was mortality

lower in patients infected with non-VIM-2-producing *P aeruginosa* strains? To what extent mortality was attributable to resistance was not addressed by the authors. More sophisticated epidemiological methods would have been needed to provide an answer. Thus we cannot assess the true clinical consequences of this epidemic.

Although increasingly precise data for bacterial resistance are accumulating, progress is needed in the measurement of the clinical effects of resistance. At a time when the G8 has issued a statement² about their concerns about antimicrobial resistance, clinical epidemiologists have to provide decision makers with quantitative estimates of the resulting medical and economic burdens of disease and effects on public health so that appropriate responses can be made.

This is the second major warning from Timothy Walsh's group—3 years ago, they reported³ the dissemination of NDM-1, another potent enzyme that hydrolyses carbapenems. Let's take global action before a third and maybe even worse report of antibiotic resistance.

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We declare that we have no conflicts of interest

- 1 Edelstein MV, Skleenova EN, Shevchenko OV, et al. Spread of extensively resistant VIM-2-positive ST235 *Pseudomonas aeruginosa* in Belarus, Kazakhstan, and Russia: a longitudinal epidemiological and clinical study. *Lancet Infect Dis* 2013; published online July 9. [http://dx.doi.org/10.1016/S1473-3099\(13\)70168-3](http://dx.doi.org/10.1016/S1473-3099(13)70168-3).
- 2 G8 Science Ministers. G8 Science Ministers Statement London UK, 12 June, 2013. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/206801/G8_Science_Meeting_Statement_12_June_2013.pdf (accessed June 29, 2013).
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Preventive measures against MERS-CoV for Hajj pilgrims

Assiri and colleagues¹ provide a clinical synopsis of 47 cases of Middle East respiratory syndrome coronavirus (MERS-CoV) infection identified between September, 2012, and June, 2013, in Saudi Arabia. Of note is the high rate of underlying comorbidity in patients with MERS (table). Since the first cases were reported in April, 2012, from Jordan, most cases have been reported from Saudi Arabia where the Hajj, the largest religious mass gathering, takes place annually. Given the predicted

population movements out of Saudi Arabia, potential for worldwide spread of MERS-CoV exists according to Kahn and colleagues.² By contrast, Breban and colleagues³ calculated that the risk of MERS-CoV to have pandemic potential does not exceed 5%, but they did not take into account the effect of Hajj mass gathering in their scenario.

The Saudi Ministry of Health (MoH) recommends that elderly people (older than 65 years), people with chronic diseases (eg, heart disease, kidney disease,



For the WHO MERS-CoV summary and literature update August 13, 2013 see http://www.who.int/csr/disease/coronavirus_infections/update_20130813/en/index.html

For the Saudi Arabia Ministry of Health Health Regulations for Travellers to KSA for Hajj see <http://www.moh.gov.sa/en/HealthAwareness/Hajj/Pages/005.aspx>

For the Centers for Disease Control and Prevention Hajj and Umrah, 2013 Travel Notice see <http://www.cdc.gov/travel/notices/watch/hajj-umrah-2013>

For the WHO Middle East respiratory syndrome international travel and health page see <http://www.who.int/ith/updates/20130605/en/index.html>

For the European Centers for Disease Control MERS-CoV Updated Risk Assessment June, 2013 see <http://www.ecdc.europa.eu/en/publications/Publications/MERS-CoV-novel-coronavirus-risk-assessment.pdf>

	Patients with MERS (n=47)	French pilgrims participating to the Hajj 2012 (n=167)	French pilgrims in preparation for the Hajj 2013 (n=114)
Mean (range) age (years)	56 (14–94); 43% >60; 0% <12	59 (21–83); 39% >65; 0% <12	55 (10–83); 30% >65, 2% <12
Any comorbidity	45 (96%)	96 (58%)	33 (29%)
Diabetes	32 (68%)	46 (28%)	21 (18%)
Chronic kidney disease*	23 (40%)	0 (0%)	1 (1%)
Chronic heart disease	13 (28%)	12 (7%)	6 (5%)
Chronic lung disease	12 (26%)	13 (8%)	7 (6%)
Malignant disease	1 (2%)	0 (0%)	0 (0%)
Immune deficiency	3 (6%)†	0 (0%)	0 (0%)
Pregnancy	Not documented	0 (0%)	0 (0%)
Disorder for which the MoH recommends postponing Hajj	..	99 (59%)	55 (48%)

MoH=Saudi Ministry of Health. *23 patients were part of an outbreak centered around a haemodialysis unit. †Steroid use.

Table: Age and comorbidities in patients with Middle East respiratory syndrome coronavirus and in French Hajj pilgrims

respiratory disease, and diabetes), and pilgrims with immune deficiency (congenital and acquired), malignant disease, and terminal illnesses, as well as pregnant women and children (younger than 12 years), postpone the performance of the Hajj and Umrah for their own safety. The US CDC also encourages pilgrims travelling to Saudi Arabia for Hajj or Umrah to consider this advice. By contrast, WHO and the European CDC do not recommend the application of any travel restriction in relation with MERS-CoV.

During the Hajj, 2012, we did a cohort survey of 167 French pilgrims with the purpose of investigating nasal virus carriage acquisition.^{4,5} In our cohort, 59% had at least one disorder for which the Saudi MoH recommends potential participant postpone doing the Hajj this year. No case of MERS-CoV nasal carriage was identified in our cohort, despite high rates of respiratory symptoms.⁴ However, we reported rapid acquisition of other respiratory viruses in pilgrims during their stay in Saudi Arabia—most notably, rhinovirus—emphasising the potential of these infections to spread in the pilgrims’ home countries on their return.⁵ The 2013 mandatory meningococcal vaccination campaign for Hajj was started on Aug 19, at our institution. Early results of the first week show that pilgrims preparing for Hajj this year were younger and less likely to present with comorbidity than in 2012; however, 48% had at least one disorder for which the Saudi MoH recommends to postpone the performance of the Hajj. Although our results cannot be extrapolated to all Hajj pilgrims, they clearly show

that a substantial proportion of European pilgrims departing from southern France are unlikely to heed the recommendations set out by the Saudi MoH.

Public health agencies are unanimous in recommending that pilgrims apply personal protective measures against respiratory infection (wearing of face masks, cough etiquette, hand hygiene, use of disposable tissues, and avoiding contact with sick people). Such measures have already been highly accepted by pilgrims.⁶ The presence of MERS-CoV neutralising antibodies in dromedary camels in Oman and the Canary Islands might provide a clue as to a potential source for human infection, although the presence of MERS-CoV in camels has not been established.⁷ We recently investigated the willingness of French pilgrims to consume raw camel milk if offered during their stay in Saudi Arabia; 41% said that they would drink it if offered.⁸ Given that camel milk consumption in the Middle East is associated with several zoonotic infections, we recommend that Hajj pilgrims be cautioned against consuming unpasteurised dairy products. Following recent isolation of MERS-CoV from the faeces of a bat in Saudi Arabia, we recommend people avoid contact with both farm and wild animals.⁹

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