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Teaming Up for Excellence in Patient Care
معاً للتميز في رعاية المريض

Clinical and Economic Impact of Urinary Tract Infections Caused by Escherichia coli Resistant Isolates

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Disclosure

“Katia A. ISKANDAR” declare to meeting attendees that there are no financial relationships with any for-profit companies that are directly or indirectly related to the subject of this presentation



Antimicrobial Resistance

- Antimicrobial resistance (AMR) is **a global health threat**
 - World Health Organization. (2014). *Antimicrobial resistance: global report on surveillance*. World Health Organization
 - de Kraker, M. E., Stewardson, A. J., & Harbarth, S. (2016). **Will 10 million people die a year due to antimicrobial resistance by 2050?**. *PLoS medicine*, *13*(11), e1002184
 - O'Neill, J. (2014). **Antimicrobial resistance: tackling a crisis for the health and wealth of nations**. *Rev. Antimicrob. Resist*, *20*, 1-16



Sustainable Development : Health target

“AMR can compromise the achievement of the Sustainable Development Goals, affecting health security, poverty, economic growth and food security”¹

The One Health Triad



1.Fact sheet on SDGs - Antimicrobial Resistance (SDG target 3.3) (2017). At: <http://www.euro.WHO.int/sustainable-development/>

2.General Assembly Resolution 70/1. Transforming our world: the 2030 Agenda for Sustainable Development - A/RES/70/1. New York, USA: United Nations; 2015

3.World Health Organization Health in 2015: from MDGs to SDGs. Geneva: World Health Organization; 2015
Transforming our world: the 2030 agenda for sustainable development. New York: United Nations;



Antimicrobial and Sustainable Development Goals



AMR strikes hardest on the Poor-treatment of resistant infections is more expensive



Antibiotic residues from hospitals, Pharma companies and agriculture contaminates water



Untreatable infections in animals threatens sustainable food production for our growing population.



Cost of AMR is predicted to be US \$100 trillion by 2050



Antimicrobials are fundamental components of all health systems



It's crucial to balance access, innovation, conservation of antimicrobials to contain AMR.




All of which require multi-stakeholder partnership

Source: WHO



Question 1:


- If no action is taken to contain AMR, the economic cost in terms of lost global production between now and 2050 would be:
 - a. US\$ 100 trillion 
 - b. US\$ 100 billions
 - c. US\$ 6 billions
 - d. US\$ 2 billions

O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. London: The Review on Antimicrobial Resistance; 2016
Drug-resistant infections: a threat to our economic future. Washington (DC): World Bank; 2016



Question 2

■ Global consumption of antimicrobials in food/animal production was estimated at tonnes in 2010 and is projected to rise by 70% by 2030 :

- a. 13
- b. 103
- c. 63000 
- d. 103000

O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. London: The Review on Antimicrobial Resistance; 2016
Antimicrobial resistance 101: get the basics, challenges and outlooks on this global health threat. Rome: Food and Agriculture Organization of the United Nations; 2016
Laxminarayan R, Van Boeckel T, Teillant A. Global antimicrobial use in the livestock sector. Paris: Trade and Agricultural Directorate Committee for Agriculture; 2014



Question 3

■ It is estimated that AMR causesdeaths annually in the European Union alone :

- a. 7000
- b. 10000
- c. 25000
- d. 75000



European Centre for Disease Prevention and Control, European Medicines Agency. The bacterial challenge: time to react. Stockholm: European Centre for Disease Prevention and Control; 2009 (EMEA/576176/2009;



Impact of AMR

The consequences of antibiotic resistance move **FAR BEYOND HEALTH**





Economic Burden of AMR: How Much Do We Really know?

- There is a paucity of data especially in low and low middle income countries
- Lack of properly designed economic analysis
- Quantifying the disease burden with any degree of accuracy has proven very difficult and challenging
- Existing studies have major methodological limitations and biases

Gandra S et al. Economic burden of antibiotic resistance: how much do we really know? *Clin Microbiol Infect.* 2014;20:973–80. doi: 10.1111/1469-0691.12798.
World Health Organization. (2014). *Antimicrobial resistance: global report on surveillance.* World Health Organization.



Systematic Literature Review

- Smith R, Coast J. **The economic burden of antimicrobial resistance: why it is more serious than current studies suggest.** London: London School of Hygiene & Tropical Medicine; 2012
- Naylor, N. R. et al(2018). **Estimating the burden of antimicrobial resistance: a systematic literature review.** *Antimicrobial Resistance & Infection Control*, 7(1), 58
- Wilton, P. et al(2002). **Strategies to contain the emergence of antimicrobial resistance: a systematic review of effectiveness and cost-effectiveness.** *Journal of health services research & policy*, 7(2), 111-117
- Founou, R. C. et al(2017). **Clinical and economic impact of antibiotic resistance in developing countries: A systematic review and meta-analysis.** *PloS one*, 12(12), e0189621.



Antimicrobial resistance: global report on surveillance



- Whether AMR poses a significant health and economic burden is a key question
- There is a need for high quality studies tackling the economic burden of antibiotic resistance
- Are clinical outcomes and economic outcomes and costs different in patients who are treated for infections caused by bacteria with a specific resistance compared to those who are treated for infections without this resistance?

World Health Organization. (2014). *Antimicrobial resistance: global report on surveillance*. World Health Organization.

Clinical and Economic Impact of Urinary Tract Infections Caused by Escherichia coli Resistant Isolates



Urinary Tract Infections Caused by E. coli

- Escherichia coli (E. coli), is the most frequently isolated gram-negative uropathogen
 - The emergence of E. coli isolates resistant carries a risk of poorer clinical outcomes
- Data on the economic burden of UTIs due to E. coli in hospital settings, are scarce, and pertaining studies are narrow in their focus and may suffer from bias reducing generalizability of their findings



Economic Burden Of UTIs Due To E. Coli In Developed Countries

- Literature search shows that most data arise from the United States of America
 - In 2011, the estimated healthcare cost of approximately 400,000 hospitalizations due to UTIs in the USA was \$2.8 billion
- Data from European countries is limited
 - A study conducted in one hospital in Spain, the estimated a mean cost per hospitalized patients with UTIs caused by ESBL-producing *E. coli* of €4980 compared to €2612 among patients with non ESBL-producing *E. coli*

1. Simmering JE, et al. In Open forum infectious diseases 2017 Jan 1 (Vol. 4, No. 1). Oxford University Press
2. Cardwell SM, et al. Hospital Practice. 2016 Jan 1;44(1):33-40.
3. Rosenberg M. International journal of antimicrobial agents. 1999 May 1;11(3-4):247-51.
4. Foxman B, et al. Ann Epidemiol 2000;10:509-15
5. Litwin MS, et al. J Urol. 2005;173(3):933-937
6. Lee SY, et al. Infect Control Hos Epidemiol. 2006;27(11):1226-1232
7. Neidell MJ, et al. Clinical Infectious Diseases. 2012 Jun 14;55(6):807-15.
8. MacVane Sh, et al. Journal of hospital medicine. 2014 Apr;9(4):232-8.
10. Alam MF, et al. International journal of antimicrobial agents. 2009 Mar 1;33(3):255-7
11. Cassini A, et al. PLoS medicine. 2016 Oct 18;13(10):e1002150.
12. Ciani O, et al. Clinical drug investigation. 2013 Apr 1;33(4):255-61.
13. Finlay AS, et al. BMC health services research 2016 Dec 16;16(1):365



Economic Burden Of UTIs Due To E. Coli In Developing Countries


- Despite the high prevalence of antimicrobial resistance , there are few published studies related to the economic and clinical burden of antimicrobial resistance
- None that have targeted the impact of UTIs caused by antimicrobial susceptible- versus resistant E. coli isolates

1. Ayukekbong JA, et al. Antimicrobial Resistance & Infection Control. 2017 Dec;6(1):47.
2. Founou RC et al. PloS one. 2017 Dec 21;12(12):e0189621.
3. Ndir A et al. Antimicrobial Resistance & Infection Control. 2016 Dec;5(1):13.
4. Rosenthal VD et al. Journal of Infection. 2011 Feb 1;62(2):136-41



Economic Burden Of UTIs Due To E. Coli In Lebanon

- The rates of ESBL-positive E. coli increased from 4% in 2000 to 30% in 2011
- No study has ever been conducted in Lebanon about the costs of antimicrobial resistant uropathogens

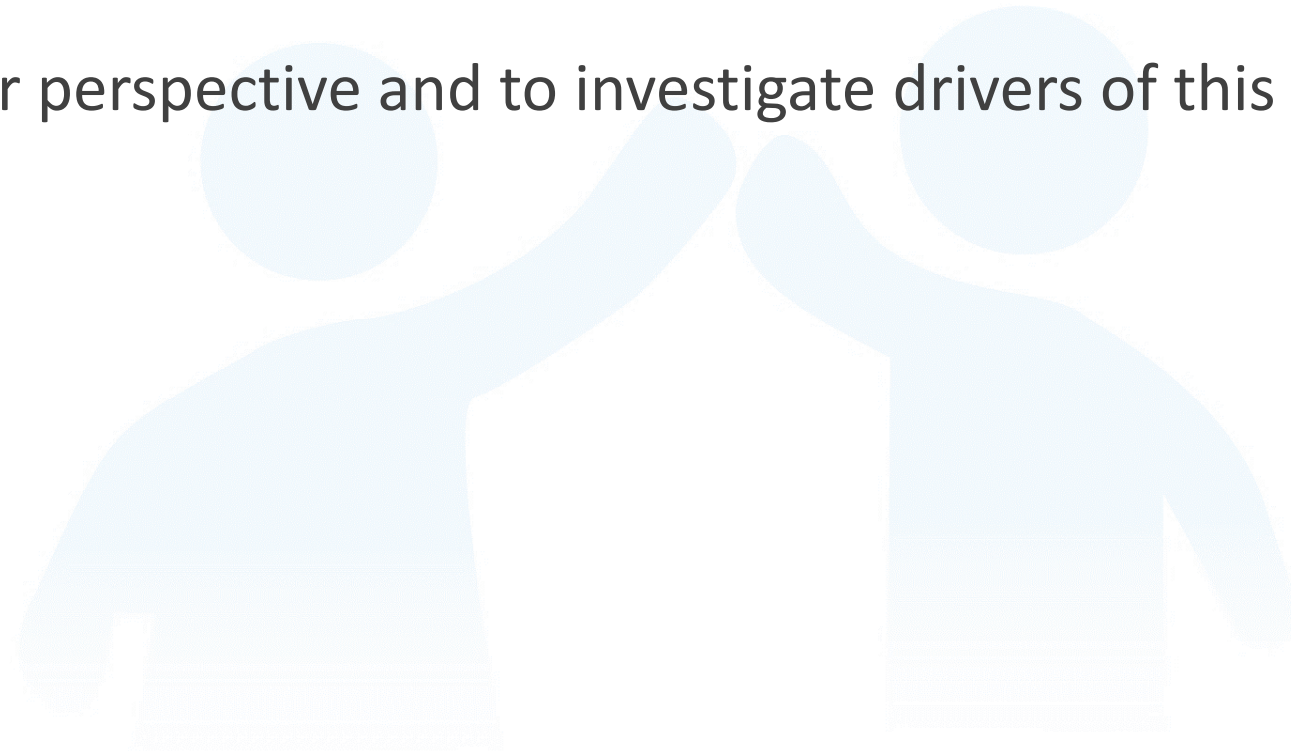


Daoud Z . Et al Escherichia coli isolated from urinary tract infections of Lebanese patients between 2005 and 2012: epidemiology and profiles of resistance. *Frontiers in medicine*. 2015 Apr 28;2:26.



Objective

To study aims to estimate the economic burden of UTIs associated with antimicrobial-susceptible versus -resistant E. coli isolates per hospitalized patient case from a payer perspective and to investigate drivers of this cost



Methods

Clinical and Economic Impact of Urinary Tract Infections Caused by Escherichia coli Resistant Isolates: a cohort study



Methods

■ Study design and settings

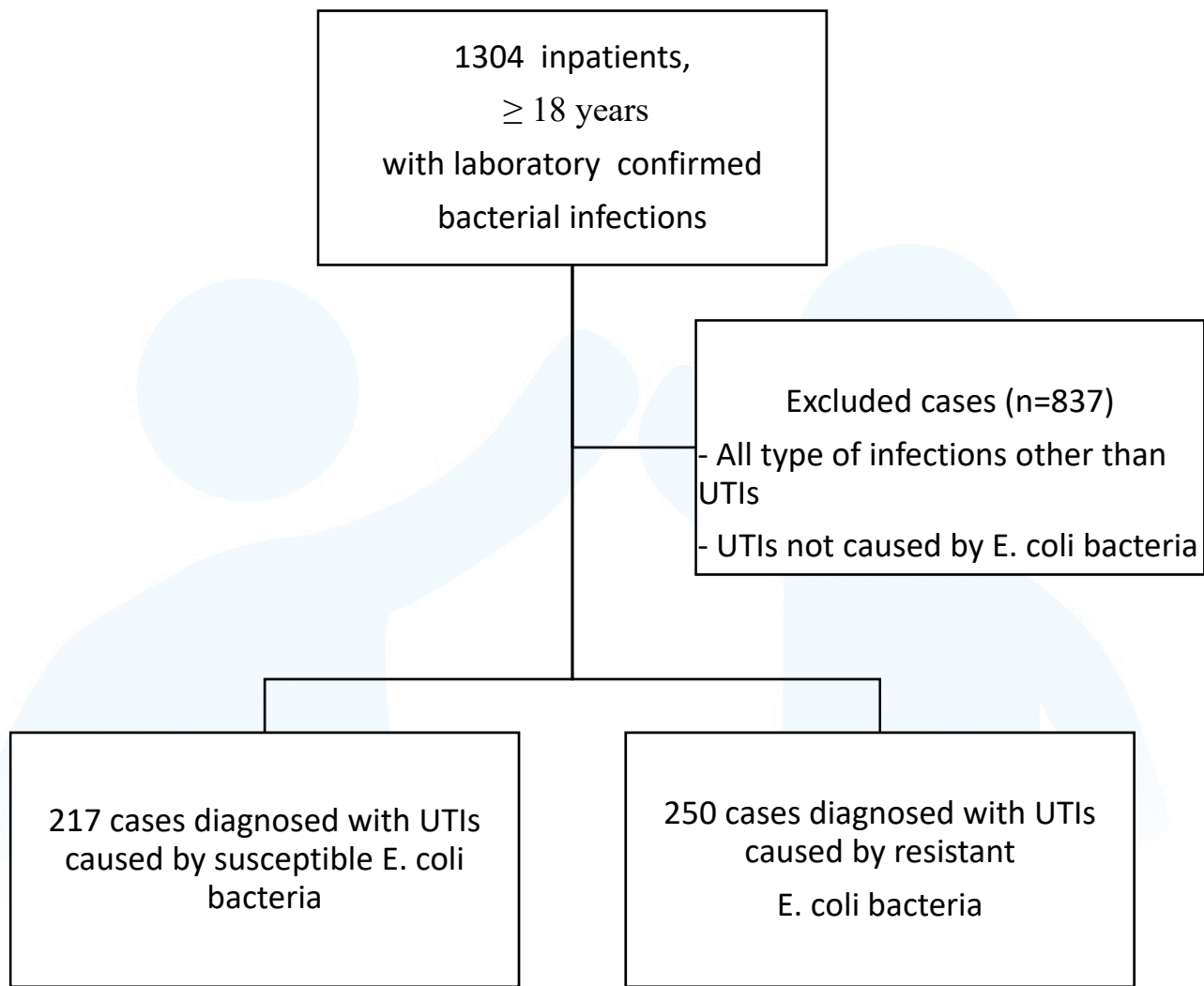
- A prospective multicenter cohort study conducted in ten hospitals from all regions across Lebanon. Ethical approval was granted from each hospital before proceeding to data collection in January 2016 till the end of December 2017.

■ Participants:

- Enrolled patients consisted of all hospitalized adult patients, aged 18 years and above diagnosed with UTIs caused by E. coli bacteria infection either community-acquired or healthcare- associated

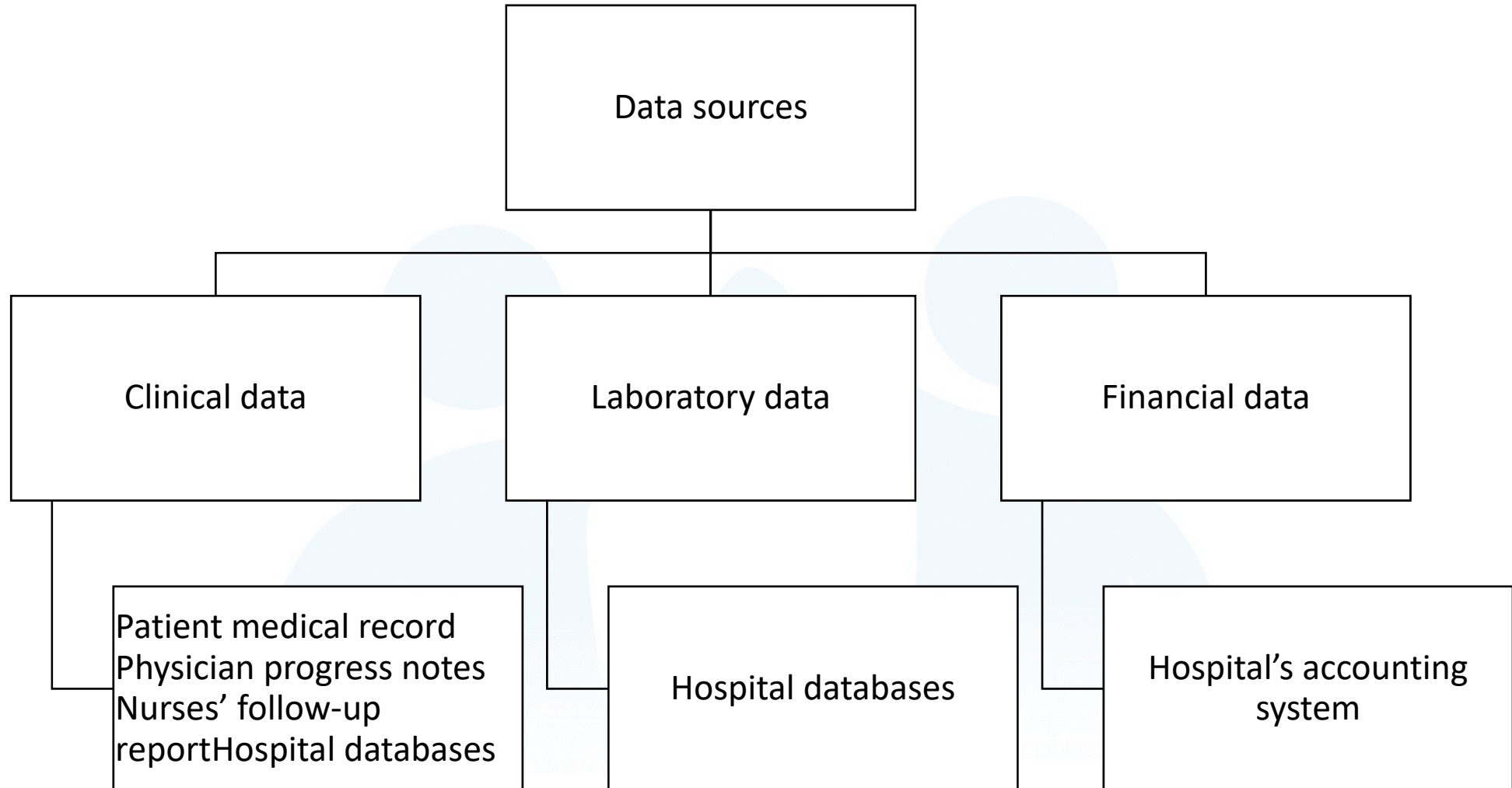


Methods - Flowchart of study participants





Methods – Data sources

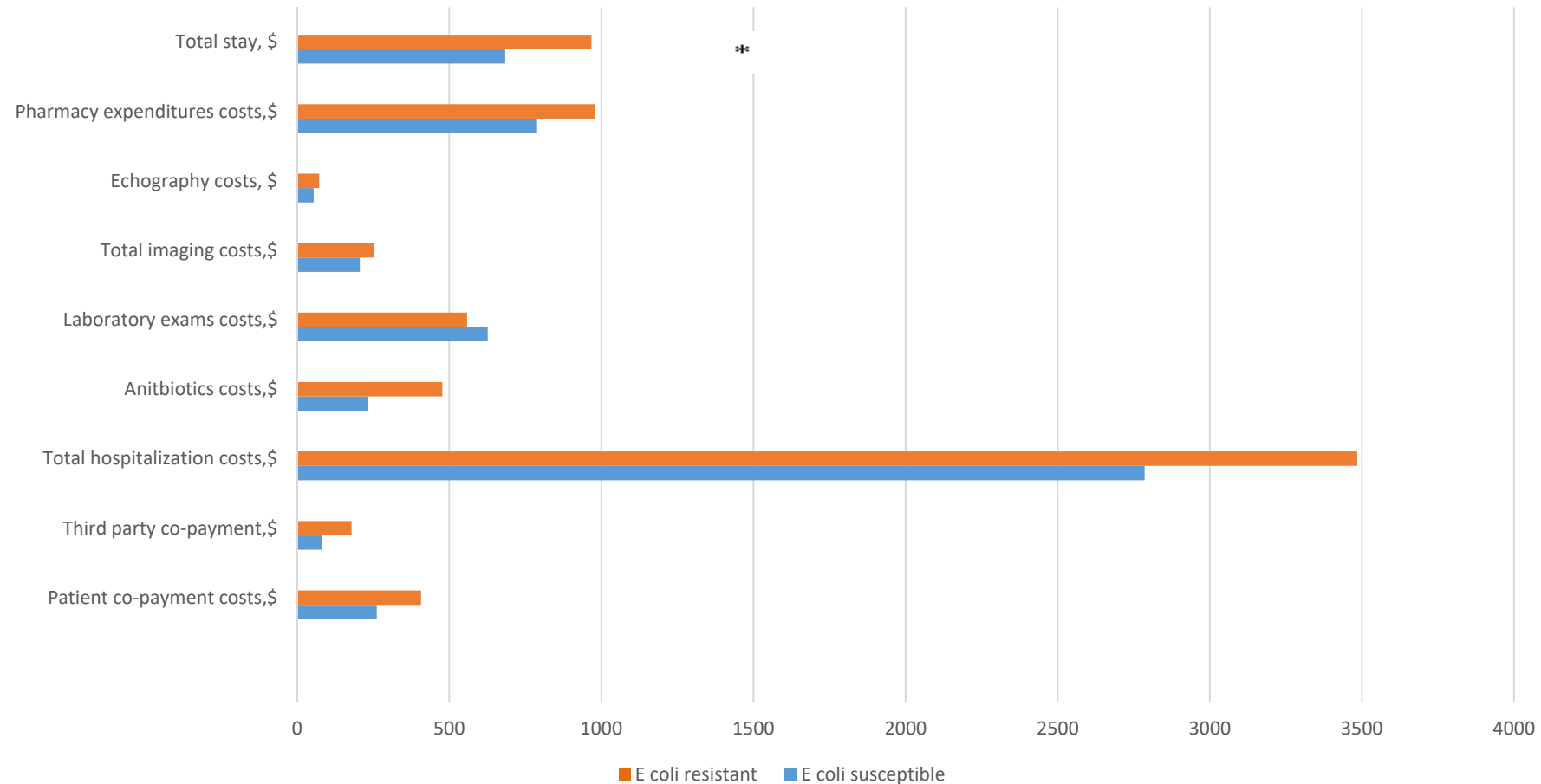


Results

Clinical and Economic Impact of Urinary Tract Infections Caused by Escherichia coli Resistant Isolates: a cohort study

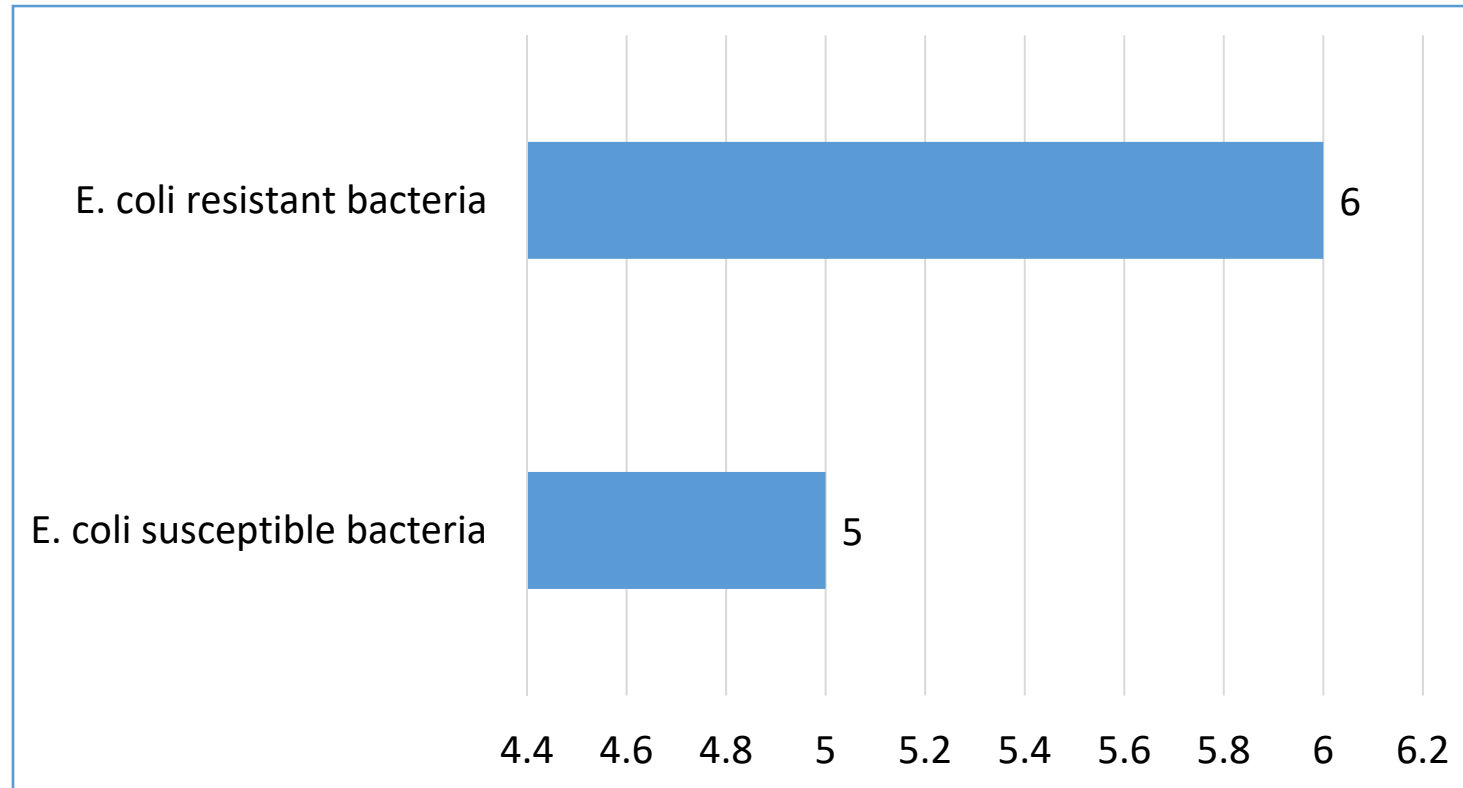


Hospital adjusted costs in mean, US\$





Length of stay post infection, Median, years





Strengths

- To the best of our knowledge, this is the first multicenter nationwide study in the Middle East that examined the economic burden of UTIs caused by E. coli
- The study accounted for time-dependency, patient co-morbidities upon admission and appropriateness of antibiotic therapy



Implications

- Study results are useful for :
 - Quantifying the economic impact of antibacterial resistance in Lebanon
 - Evaluating interventions to contain AMR
 - Allocate resources efficiently
 - Estimate the potential cost savings if the incidence of UTIs caused by resistant bacteria decreases



Interventions to contain AMR in Lebanon

- Effective communication, education and training
- National surveillance and reporting to the Ministry of Public health
- Antibiotic stewardship
- Research in this field
- Effective sanitation, hygiene and infection-prevention measures
- Optimize the use of antimicrobial medicines in human and animal health

1. Fact sheet on SDGs - Antimicrobial Resistance (SDG target 3.3) (2017). At: <http://www.euro.WHO.int/sustainable-development>



UTIs: Patient Education And Communication

- Raising **patient** awareness about the management of UTIs:
 - Auto-medication
 - Antibiotic leftover
 - Hygiene
 - Evidence based non-pharmacologic approach
- Refer directly to the **physician** in cases of UTIs
 - Refer to the published guidelines for the treatment of UTIs
- Refer to the pharmacist for the right use of antibiotics (administration , uses, duration of treatment) and for enhancing patient awareness about the disease



Key Takeaways

- AMR can compromise the achievement of the SDGs including economic growth
- Research in this field is needed to establish the magnitude of this global threat in terms of both health and cost, and to inform health policies makers to prioritize interventions that tackle this serious problem

THANK YOU

