

Klebsiella pneumoniae: general overview

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ERFAN Laboratory training course 17-21 October 2022

“Detection and characterization of *Listeria monocytogenes*, *Klebsiella pneumoniae* and *Salmonella* spp.”

Klebsiella pneumoniae

- Gram-negative rods
- Family *Enterobacteriaceae*
- Non-motile
- Possess a polysaccharide capsule
- Mucoid phenotype
- Oxidase-negative
- Lactose-fermenting
- Aerobe and facultative anaerobe
- Growth temperature 10-45 °C



Klebsiella pneumoniae: from commensal to pathogen

Kp can play the role of commensal, opportunistic pathogen or pathogen.

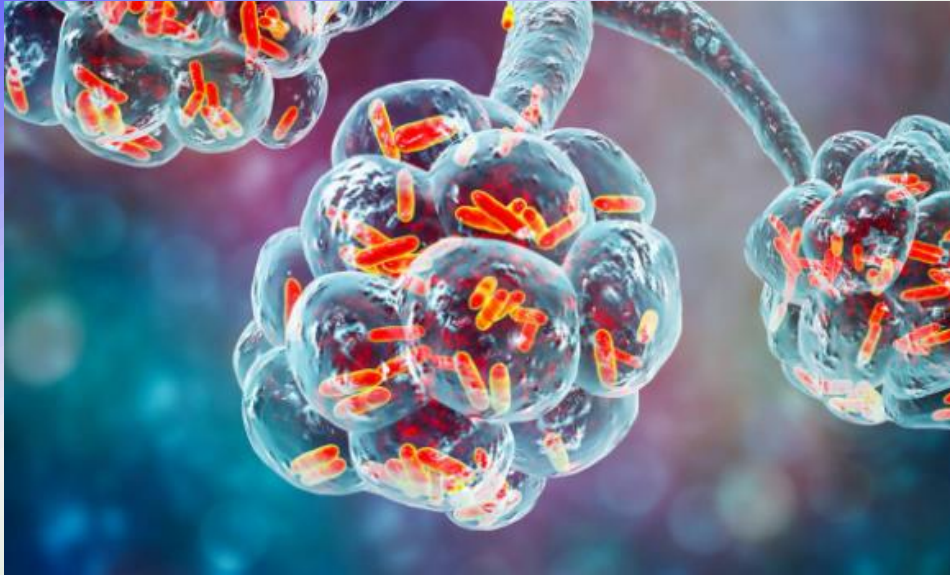
Commensal

Kp can colonize some part of our body:

- intestine;
- faeces;
- skin;
- mouth.



Klebsiella pneumoniae: from commensal to pathogen



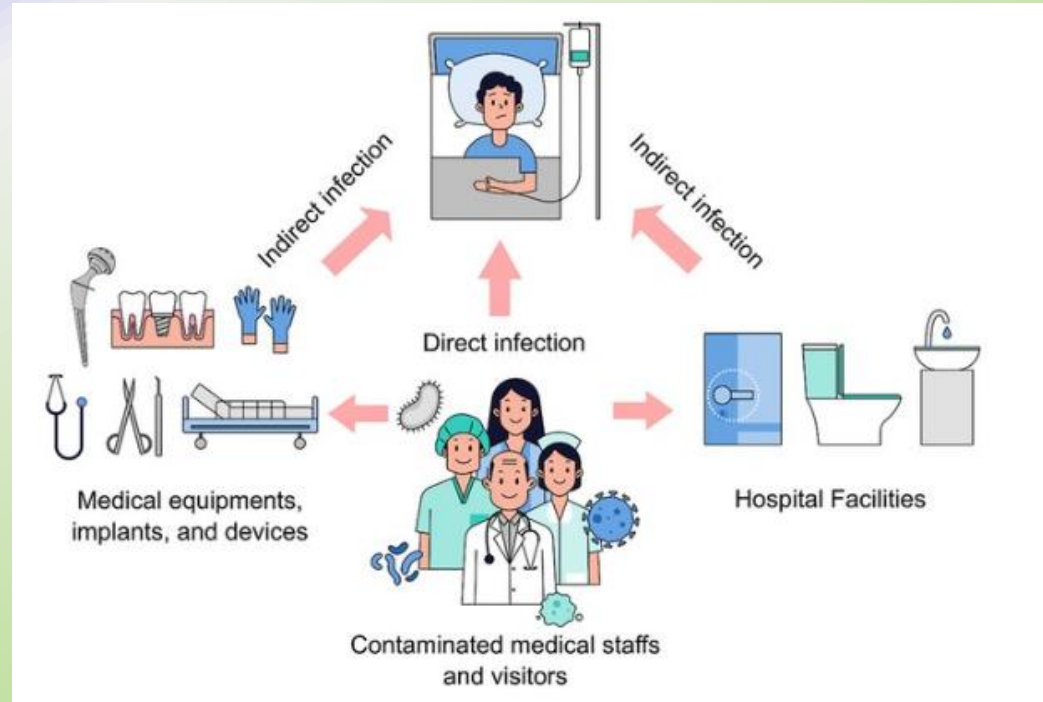
In most vulnerable patients such as neonates and the elderly, immunocompromised *Kp* can cause important infections at multiple sites:

- Lung
- Urinary tract
- Lower biliary tract
- Bloodstream
- Wound or surgical sites
- Brain

Klebsiella pneumoniae: Hospital-acquired infections

The majority of *Kp* infections globally are opportunistic **hospital-acquired infections (HAIs)**.

- 1) Transmission is person-to-person contact between healthcare workers or visitors and patients
- 2) Contaminated surfaces and medical devices



Klebsiella pneumoniae: Hospital-acquired infections

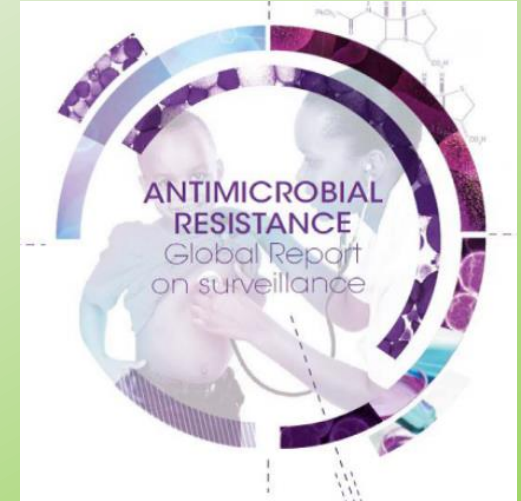


In the Hospital settings the rise of Multidrug Resistant (MDR) strains and particularly Carbapenem Resistant strains (CRKp) is of greatest clinical concern.

Unfortunately, carbapenem antibiotics often are the last line of defense against Gram-negative infections that are severe and difficult-to-treat.

Klebsiella pneumoniae: Hospital-acquired infections

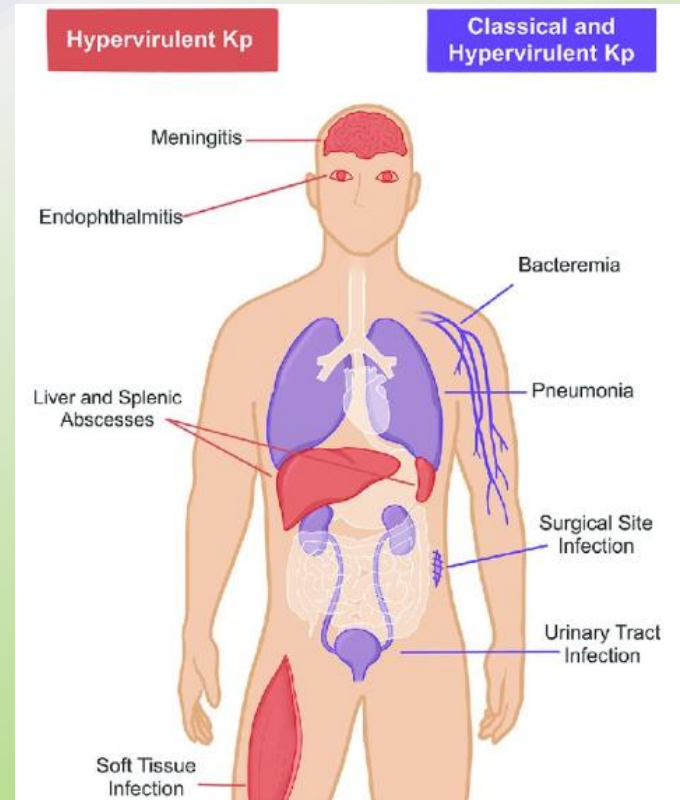
In 2014, WHO's global report on AMR revealed that the resistance to the treatment of last resort (carbapenem antibiotics) for life-threatening infections caused by a common intestinal bacteria, *Klebsiella pneumoniae* (*Kp*), has spread to all regions of the world. In the western world, *Kp* represents nearly 10% of nosocomial infections and is one of the most problematic multidrug resistant (MDR) organisms, with increasing resistance to carbapenem and other 'last resort' antimicrobial agents (colistin, tigecycline). The European Parliament report on Antimicrobial Resistance (IP/A/STOA/SC/2005-173) stated: "The increasing development of such pan-resistant organisms has the potential to become a worldwide catastrophe."



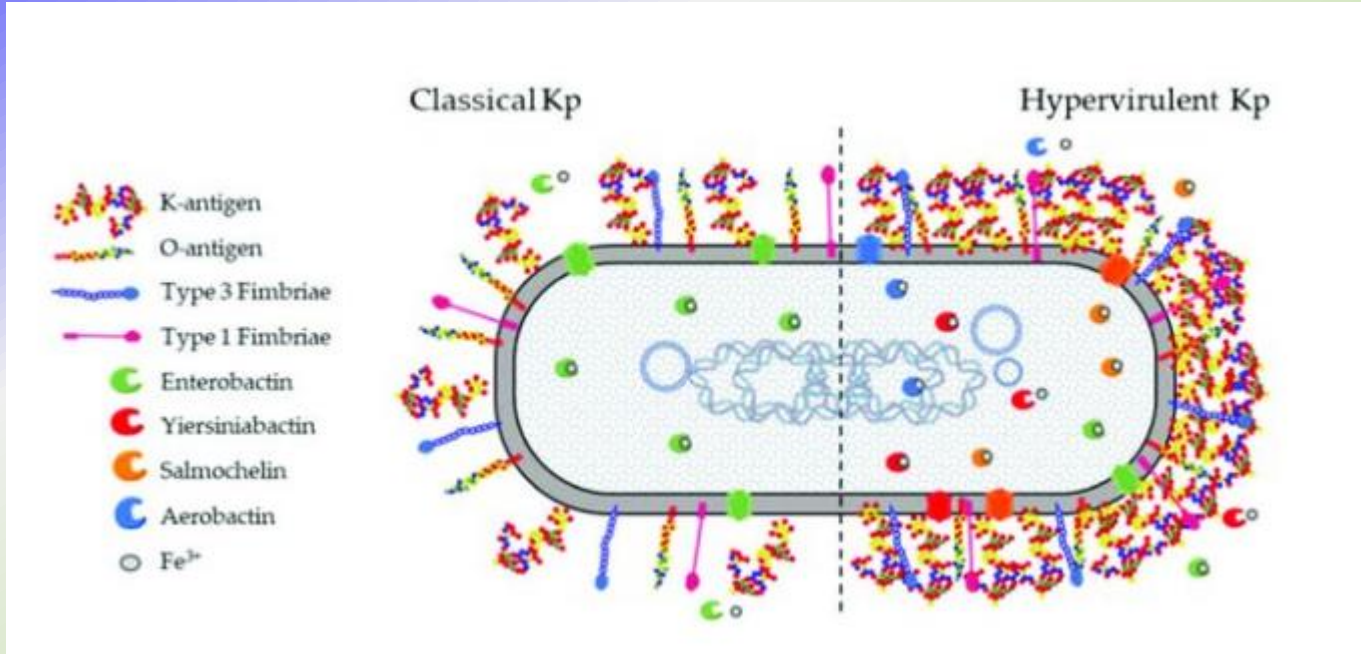
Klebsiella pneumoniae: Community-acquired infections

Kp can act as a 'true' pathogen and can cause **severe community-acquired infections (CAIs)** outside the hospital setting.


The presence of **hypervirulent Kp** strains has an important contribution to the development of severe and invasive forms of CAIs infection also in healthy people. Host risk factors for CAIs include cancer, diabetes mellitus, and alcoholism.



Klebsiella pneumoniae: from commensal to pathogen



Klebsiella pneumoniae: from commensal to pathogen



RAPID RISK ASSESSMENT

Emergence of hypervirulent *Klebsiella pneumoniae* ST23 carrying carbapenemase genes in EU/EEA countries

17 March 2021

Summary

In an urgent inquiry in ECDC's Epidemic Intelligence Information System (EPIS) Antimicrobial Resistance and Healthcare-Associated Infections (AMR-HAI) platform, Ireland reported the isolation of hypervirulent *Klebsiella pneumoniae* (hvKp) ST23, from diagnostic samples and from rectal or faecal samples collected for the surveillance of carriage of carbapenemase-producing Enterobacterales (CPE) since March 2019 with two distinct geographical clusters as well as sporadic cases. Information on further hvKp ST23 isolates detected in

This emergence of *K. pneumoniae* isolates with combined hypervirulence and resistance to reserve antibiotics such as carbapenems is of concern as, in contrast to 'classic' *K. pneumoniae* strains, hvKp strains are capable of causing severe infections in healthy individuals, often complicated by dissemination to various body sites. hvKp strains were primarily found in Asia.

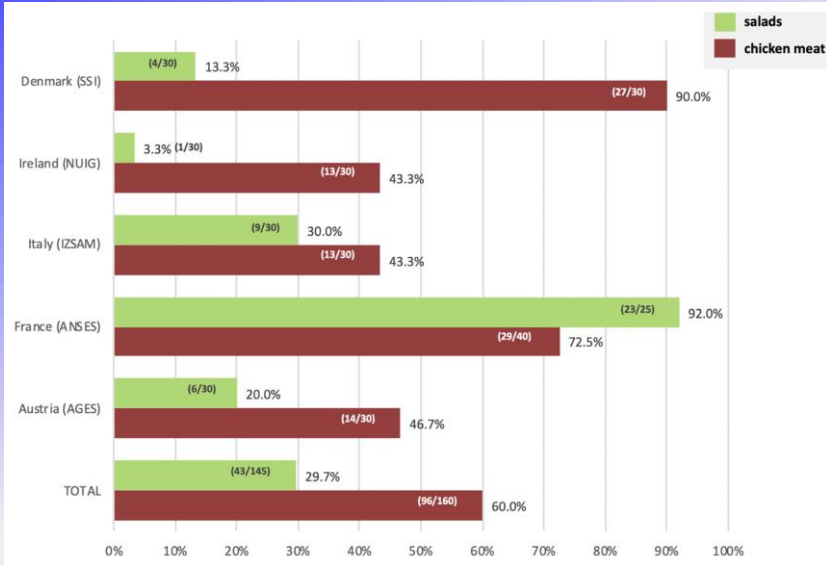
Klebsiella pneumoniae: a One Health bacteria



Kp can survive in a multitude of ecological niches, both free-living and host-associated:

- soil;
- water (freshwater and saltwater);
- plant species;
- insects, birds, reptiles;
- mammals (wild and companion animals);
- food.

Klebsiella pneumoniae: an emergent foodborne pathogen



Kp has been isolated from raw meat, poultry products, raw vegetables, fish and live bivalve mollusks, street foods, and ready-to-eat (RTE) food.



Rodrigues et al., 2022

<https://doi.org/10.1128/spectrum.02376-21>

Anatomy of an extensively drug-resistant *Klebsiella pneumoniae* outbreak in Tuscany, Italy

Melissa J. Martin, Brendan W. Corey , Filomena Sannio, , and Jean-Denis Docquier   [Authors Info & Affiliations](#)

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November 24, 2021 | 118 (48) e2110227118 | <https://doi.org/10.1073/pnas.2110227118>

JOURNAL ARTICLE

The changing epidemiology of carbapenemase-producing *Klebsiella pneumoniae* in Italy: toward polyclonal evolution with emergence of high-risk lineages

Vincenzo Di Pilato, Giulia Errico, Monica Monaco, Tommaso Giani, Maria Del Grosso, Alberto Antonelli, Sophia David, Erika Lindh, Romina Camilli, David M Aanensen ... [Show more](#)

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Journal of Antimicrobial Chemotherapy, Volume 76, Issue 2, February 2021, Pages 355–361, <https://doi.org/10.1093/jac/dkaa431>

Published: 14 November 2020 **Article history** ▼



Article

Phenotypic and Genetic Characterization of *Klebsiella pneumoniae* Isolates from Wild Animals in Central Italy

Alexandra Chiaverini ¹, Alessandra Cornacchia ^{2*}, Gabriella Centorotola ³, Elga Ersilia Tieri ⁴, Nadia Sulli, Ilaria Del Matto ⁵, Giorgio Iannitto, Domenico Petrone, Antonio Petrini ⁶ and Francesco Pomilio ⁷



RESEARCH ARTICLE
January/February 2022 Volume 10 Issue 1 e02376-21
<https://doi.org/10.1128/spectrum.02376-21>

High Prevalence of *Klebsiella pneumoniae* in European Food Products: a Multicentric Study Comparing Culture and Molecular Detection Methods

Carla Rodrigues ¹, Kathrin Hauser ², Niamh Cahill ³, Małgorzata Ligowska-Marzeta ⁴, Gabriella Centorotola ⁵, Alessandra Cornacchia ⁶, Raquel Garcia Fierro ⁷, Marisa Haenni ⁸, Eva Møller Nielsen ⁹, Pascal Piveteau ¹⁰, Elodie Barbier ¹¹, Dearbháile Morris ¹², Francesco Pomilio ¹³, Sylvain Brisse ¹⁴

Klebsiella pneumoniae: African countries

> Future Microbiol. 2021 Jul;16:811-824. doi: 10.2217/fmb-2021-0104. Epub 2021 Jun 29.

Antimicrobial resistance patterns of bacterial pathogens their distribution in university teaching hospitals in Zambia

Maisa Kasanga ^{1 2}, Raphael Mukosha ³, Maika Kasanga ², Makomani Siyanga ⁴, Steward Mudenda ^{5 6}, Benjamin Bisesa Solochi ², Misheck Chileshe ⁷, Mark J Mwiikisa ⁸, Theodore Gondwe ¹, Timothy Kantenga ², Aaron Lunda Shibemba ^{2 9}, Ruth Nakazwe ², Mwansa Chitalu ², Jian Wu ¹

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PMID: 34184556 DOI: 10.2217/fmb-2021-0104

> Clin Infect Dis. 2021 Dec 1;73(Suppl_4):S308-S315. doi: 10.1093/cid/ciab769.

Clones and Clusters of Antimicrobial-Resistant *Klebsiella* From Southwestern Nigeria

Ayorinde O Afolayan ¹, Anderson O Oaikhena ¹, Aaron O Aboderin ², Olatunde F Olabisi ², Adewale A Amupitan ², Oyekola V Abiri ², Veronica O Ogunleye ³, Erkison Ewomazino Odih ¹, Abolaji T Adeyemo ⁴, Adeyemi T Adeyemo ², Temitope O Obadare ², Monica Abrudan ^{5 6}, Silvia Argimón ^{5 6}, Sophia David ^{5 6}, Mihir Kekre ^{5 6}, Anthony Underwood ^{5 6}, Abiodun Egwuenu ⁷, Chikwe Ihekweazu ⁷, David M Aanensen ⁵, Iruka N Okeke ¹, NIHR Global Health Research Unit on Genomic Surveillance of Antimicrobial Resistance

Collaborators, Affiliations + expand

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journal homepage: www.elsevier.com/locate/jgar

Outbreak of colistin-resistant carbapenemase-producing *Klebsiella pneumoniae* in Tunisia[☆]

Wejdène Mansour^{a,b,*}, Marisa Haenni^c, Estelle Saras^c, Raoudha Grami^{a,c}, Yosra Mani^a, Anis Ben Haj Khalifa^{d,e}, Souhail el Atrouss^f, Mohamed Kheder^d, Mohamed Fekih Hassen^f, Nouredine Boujâafar^{a,c}, Olfa Bouallegue^{a,d}, Jean-Yves Madec^c

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Klebsiella pneumoniae: African countries



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Antimicrobial Resistance and Comparative Genome Analysis of *Klebsiella pneumoniae* Strains Isolated in Egypt

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Multiclonal spread of *Klebsiella pneumoniae* across hospitals in Khartoum, Sudan ☆

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Comparative Study > Int J Infect Dis. 2021 Feb;103:201-207. doi: 10.1016/j.ijid.2020.11.169.

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Laboratory-confirmed bloodstream infections in two large neonatal units in sub-Saharan Africa

Alemayehu Mekonnen Gezmu¹, Andre N H Bulabula², Angela Dramowski³, Adrie Bekker⁴, Marina Aucamp⁵, Sajini Souda⁶, Britt Nakstad⁷

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