**SUPPLEMENTARY MATERIAL**

Supplementary Table S1. Search strategies employed (for Embase Search).

|  |
| --- |
| Embase 1980 to 2016 Week 19 |
| **#** | **Searches** | **Results** | **Comment** |
| 1 | Klebsiella pneumoniae/ or ("b. friedlander" or (bacillus adj2 pneumoniae) or (Bacterium adj2 pneumoni\* adj2 crouposae) or klebsiella or (friedlaender adj2 bacillus) or (friedlander adj2 bacillus) or (hyalococcus adj2 pneumoniae) or pneumobacillus).ti,ab,kw. [\*\*\*EMBASE since 1974\*\*\*\*] | 40276  |  |
| 2 | extended spectrum beta lactamase producing Klebsiella pneumoniae/ [\*\*\*EMBASE since 2013\*\*\*\*] | 319  |  |
| 3 | Klebsiella infection/ [\*\*\*EMBASE previous indexing prior to 2009\*\*\*\*] | 764  |  |
| 4 | Klebsiella pneumoniae infection/ [\*\*\*EMBASE since 2009\*\*\*\*] | 1449  |  |
| 5 | Enterobacteriaceae infection/ | 1493  |  |
| 6 | Klebsiella.mp. | 47697  |  |
| 7 | or/1-6 | 48801  | Klebsiella terms |
| 8 | carbapenemase/ or carbapenemase.mp. | 3944  |  |
| 9 | antibiotic resistance/ or ((antibacterial adj3 resist\*) or (antimicrobial adj3 resist\*) or (bacter\* adj3 resist\*) or ("beta-lactam" adj3 resist\*) or (antibiotic\* adj3 resist\*)).ti,ab,kw. | 158249  |  |
| 10 | (carbapene\* adj3 resist\*).ti,ab,kw. | 4710  |  |
| 11 | antibiotic sensitivity/ | 63489  |  |
| 12 | or/8-11  | 193256  | Antibiotic resistance terms |
| 13 | sepsis/ or septic shock/ or septicemia/ or urosepsis/ | 155704  |  |
| 14 | (sepsis or septic\*).ti,ab,kw. | 161146  |  |
| 15 | bacteremia/ or gram negative sepsis/ | 33997  |  |
| 16 | (bacteremia\* or bacteraemia\*).ti,ab,kw. | 30754  |  |
| 17 | device infection/ or catheter infection/ | 17636  |  |
| 18 | ((device\* adj3 infect\*) or (catheter\* adj3 infect\*)).ti,ab,kw. | 11698  |  |
| 19 | bacterial infection/ or gram negative infection/ | 130026  |  |
| 20 | ("gram-negative" adj2 infect\*).ti,ab,kw. | 4228  |  |
| 21 | (gram adj2 negative\* adj2 infect\*).ti,ab,kw. | 4276  |  |
| 22 | bloodstream infection/ [\*\*\*\*EMBASE since 2009\*\*\*\*] | 6917  |  |
| 23 | ((bacterial\* or bloodstream\* or "blood-stream") adj2 infect\*).ti,ab,kw. | 54863  |  |
| 24 | healthcare associated infection/ or hospital infection/ or primary infection/ | 39457  |  |
| 25 | (((healthcare or hospital or "health-care") adj2 infect\*) or (health adj2 care adj2 infect\*)).ti,ab,kw. | 18372  |  |
| 26 | or/13-25  | 440326  | infection terms |
| 27 | 7 and 12 and 26 | 5761  | base clinical set |
| 28 | longitudinal study/ or "national longitudinal study of adolescent health"/ | 87562  |  |
| 29 | prospective study/ or retrospective study/ | 781504  |  |
| 30 | cohort analysis/ or cross-sectional study/ | 407893  |  |
| 31 | case control study/ or hospital based case control study/ or population based case control study/ | 114308  |  |
| 32 | comparative study/ or comparative effectiveness/ or device comparison/ or dosage schedule comparison/ or exp drug comparison/ or drug dosage form comparison/ or drug dose comparison/ or human versus animal comparison/ or intermethod comparison/ or species comparison/ | 1066610  |  |
| 33 | controlled study/ or observational study/ or validation study/ | 5015175  |  |
| 34 | ((cohort or restrospectiv\* or longitudinal\* or prospectiv\* or "follow-up" or followup or observational\*) adj2 (study or studies or review\*)).mp. | 852501  |  |
| 35 | or/28-35 [\*\*\*cohort studies terms\*\*\*\*] | 6715226  | cohort studies terms |
| 36 | 27 and 35 [\*\*\*Final revised results for review\*\*\*\*] | 2242  | Cohort Study results |
| 37 | remove duplicates from 36 | 2220 | FINAL results |

Supplementary Table S2. List of excluded studies (full-text review) with reason for exclusion. *Note*: some studies had multiple reasons for exclusion. Only the most important reason is given.

|  |  |  |
| --- | --- | --- |
| **Author** | **Year** | **Reason for exclusion** |
| Krcmery1 | 1998 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Blot2 | 2002 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Guillemot3 | 2005 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Kang4 | 2005 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Giamarellos-Bourboulis5 | 2006 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Moreno6 | 2007 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Ressner7 | 2008 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Patel8 | 2008 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Marschall9 | 2008 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Pawar10 | 2008 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Schwaber11 | 2008 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Petrikkos12 | 2009 | Data overlap with Daikos *et al.*13  |
| Garnica14 | 2009 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Gasink15 | 2009 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Tsitsopoulos16 | 2010 | Fewer than 10 cases or controls |
| Hyle17 | 2010 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Pien18 | 2010 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Bert19  | 2010 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Khan20 | 2010 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Orsi21 | 2011 | Fewer than 10 cases or controls |
| Tuon22 | 2012 | Mortality for resistant/susceptible bacteremia not reported |
| Lee23 | 2012 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Tabah24 | 2012 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Echeverri-Toro25 | 2012 | Fewer than 10 cases or controls |
| Raz-Pasteur26 | 2013 | Mortality for resistant/susceptible bacteremia not reported |
| Correa27 | 2013 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Orsi28 | 2013 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Samonis29 | 2013 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Metan30 | 2013 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Ortega31 | 2013 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Mouloudi32 | 2014 | Control group not bacteremic |
| Bartoletti33 | 2014 | Fewer than 10 cases or controls |
| Chetcuti Zammit34 | 2014 | Fewer than 10 cases or controls |
| Egozi35 | 2014 | Fewer than 10 cases or controls |
| Rosa36 | 2014 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Simkins37 | 2014 | Fewer than 10 cases or controls |
| Zilberberg38 | 2014 | Fewer than 10 cases or controls |
| Hajjej39 | 2014 | Mortality for resistant/susceptible bacteremia not reported |
| Marin40 | 2014 | Mortality for resistant/susceptible bacteremia not reported |
| Dizbay41 | 2014 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Chaisathaphol42 | 2014 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| **Author** | **Year** | **Reason for exclusion** |
| Patel43 | 2014 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Ye44 | 2014 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Bulut45 | 2014 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Poulakou46 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Candevir Ulu47 | 2015 | Fewer than 10 cases or controls |
| Wang48 | 2015 | Fewer than 10 cases or controls |
| Biehle49 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Delle Rose50 | 2015 | Mortality for resistant/susceptible bacteremia not reported |
| De Jager51 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Jiao52 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Dimopoulos53 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Lanini54 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Orsi55 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Bastug56 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Boncagni57 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Saravu58 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Burnham59 | 2015 | No data on carbapenem-resistant *Klebsiella pneumoniae* |
| Moghnieh60 | 2015 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Badura61 | 2016 | Mortality for resistant/susceptible bacteremia not reported |
| Hoxha62 | 2016 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Hu63 | 2016 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Fitzpatrick64 | 2016 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Garbati65 | 2016 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Alexopoulou66 | 2016 | No separate data for *Klebsiella pneumoniae* bacteremia |
| Kofteridis67 | 2016 | No separate data for *Klebsiella pneumoniae* bacteremia |

Supplementary Table 3. Description of type and sources of bacteremia in studies included for the quantitative synthesis (n=15).

|  |  |  |
| --- | --- | --- |
| **Author and Year** | **Bacteremia type** | **Bacteremia sources** |
| Daikos 2009 13 | Mono-/polymicrobial, HC-acquired | ***Total:*** CR 7%; PN 27%; UTI 14%; IAI 20% ; SSTI 5%; UNK 28% |
| Mouloudi 2010 68 | First episode, HC-acquired | Not available |
| Ben-David 2011 69 | First episode, monobacterial | Not available |
| Liu 2011 70 | Mono-/polymicrobial, first episode | ***CRKP patients:***CR 16%; PN 40%, UTI 16%, IAI 4%; UNK 24% |
| Qureshi 2012 71 | First episode | Not available |
| Lee 2012 72 | Mono-/polymicrobial, first episode | ***CRKP patients:***CR 7%; PN 34%; UTI 15%, IAI 2%; SSTI 12%***CSKP patients:*** CR 10%; PN 32%; UTI 21%, IAI 3%; SSTI 13% |
| Hussein 2013 73 | Monomicrobial, first episode, HC-acquired | Not available |
| Gallagher 2014 74 | First episode | Not available |
| Girometti 2014 75 | One episode per patient | Not available |
| Alicino 2015 76 | All episodes ≥30 days apart, HC-acquired | Not available |
| Gomez-Simmonds 2015 77 | First episode | ***CRKP patients:***CR 7%; Respiratory 24%; UTI 14%, IAI 21%; SSTI 7%; UNK 24%***CSKP patients:*** CR 13%; Respiratory 8%; UTI 29%, IAI 25%; SSTI 0%; UNK 25% |
| Trecarichi 2015 78 | First episode, monomicrobial (for subgroups) | Not available |
| Vardakas 2015 79 | Patients with SIRS, first episode | ***Total:*** CR 19%; PN 12%; UTI 8%; IAI 3% ; SSTI 5%; Primary 54% |
| Fraenkel-Wandel 2016 80 | One episode per patient | ***CRKP patientsa:***Urine 34%; Sputum 25%; Rectal 25%; Other 19%***CSKP patientsa:*** Urine 40%; Sputum 15%; Rectal 4%; Other 14% |
| Villegas 2016 81 | One episode per patient, monobacterial, SIRS | ***CPE patientsb:***CR 30%; Respiratory 13%; UTI 17%, GI 9%; SSTI 15%; Other 6%; Primary 9%***Non-CPE patientsb:*** CR 11%; Respiratory 18%; UTI 38%, GI 8%; SSTI 8%; Other 8%; Primary 8% |

Abbreviations: SIRS, Systemic Inflammatory Response Syndrome; CRKP, Carbapenem-resistant *Klebsiella pneumoniae;* CSKP, Carbapenem-susceptible *Klebsiella pneumoniae;* CR, Catheter-related; PN, Pneumonia; UTI, Urinary Tract Infection; GI, Gastointestinal; IAI, Intraabdominal Infection; SSTI, Skin and Soft Tissue Infection; UNK, Unknown; CPE, Carbapenemase-producing *Enterobacteriaceae*

a Body sites where bacteria were also cultured from (does not necessarily represent infection)

b Bacteremia sources are not given for patients with specifically CRKP or CSKP

Supplementary Table S4. Risk of bias of cohort and case-control studies, assessed with the Newcastle-Ottawa Assessment Scale.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author** | **SELECTION** | **COMPARABILITY** | **OUTCOME/EXPOSURE** | **RISK** |
|  | Represen-  | Selection | Ascertain- | Outcome | Age | Comorbi- | Assessment | Length of | Adequacy  |  |
|  | tativeness/Case | non- | ment of | not |  | dity | of | FUa/Exposure | of FU/Non- |  |
|  | definition | exposed/ | exposure/ | present |  |  | outcome/ | ascertain- | response |  |
|  |  | Represta- | Community | /Controls |  |  | Ascertain- | ment in | rate |  |
|  |  | tiveness | controls | without |  |  | ment of | controls | between |  |
|  |  |  |  | disease |  |  | exposure |  | groups |  |
| **Cohort studies** |  |  |  |  |  |  |  |  |  |
| Daikos  | \* | \* | \* | \* |   |   | \* |   | \* | Mod |
| Ben-David  | \* | \* | \* | \* | \* |  | \* | \* | \* | Low |
| Lee  | \* | \* | \* | \* | \* |   | \* | \* | \* | Low |
| Girometti  | \* | \* | \* | \* |  |  | \* | \* | \* | Low |
| Gomez-Simmonds  | \* | \* | \* | \* | \* |   | \* | \* | \* | Low |
| Alicino  | \* | \* | \* | \* |  |  | \* | \* | \* | Mod |
| Trecarichi  | \* | \* | \* | \* |   |   | \* | \* | \* | Low |
| Vardakas  | \* | \* | \* | \* | \* |  | \* |  |  | Mod |
| Villegas  | \* | \* | \* | \* | \* |   | \* |   | \* | Mod |
| **Case-control studies** |  |  |  |  |  |  |  |  |  |
| Mouloudi  | \* | \* | \* | \* | \*  | \*  | \* | \* | \* | Low |
| Qureshi  | \* | \* | \* |  |  |  | \* | \* | \* | Mod |
| Liu  | \* | \* | \* | \* | \* |   | \* | \* | \* | Low |
| Hussein  | \* | \* | \* | \* | \* |  | \* | \* |  | Low |
| Gallagher | \* | \* | \* |   | \* |   | \* | \* | \* | Low |
| Fraenkel-Wandel | \* | \* | \* | \* | \* |   | \* | \* | \* | Low |

a FU, Follow Up: adequate if > 14 days; Mod, Moderate

Supplementary Figure S1. Funnel plot of studies evaluating mortality of patients with bacteremia due to carbapenem-resistant compared to carbapenem-susceptible *Klebsiella pneumoniae*.



**Supplementary references (including studies excluded during full text review)**

**1.** Krcmery V, Jr., Spanik S, Krupova I, et al. Bacteremia due to multiresistant gram-negative bacilli in neutropenic cancer patients: a case controlled study. *J Chemother* 1998;10:320-325.

**2.** Blot S, Vandewoude K, De Bacquer D, Colardyn F. Nosocomial bacteremia caused by antibiotic-resistant gram-negative bacteria in critically ill patients: Clinical outcome and length of hospitalization. *Clinical Infectious Diseases* 2002;34:1600-1606.

**3.** Guillemot D, Gasquet I, Vallet O, David MF, Laurent C, Mathieu D. Thirty-day mortality of nosocomial systemic bacterial infections according to antibiotic susceptibility in an 800-bed teaching hospital in France. *Clinical Microbiology and Infection* 2005;11:502-504.

**4.** Kang CI, Kim SH, Wan BP, et al. Bloodstream infections caused by antibiotic-resistant gram-negative bacilli: Risk factors for mortality and impact of inappropriate initial antimicrobial therapy on outcome. *Antimicrobial Agents and Chemotherapy* 2005;49:760-766.

**5.** Giamarellos-Bourboulis EJ, Papadimitriou E, Galanakis N, et al. Multidrug resistance to antimicrobials as a predominant factor influencing patient survival. *Int J Antimicrob Agents* 2006;27:476-481.

**6.** Moreno A, Cervera C, Gavalda J, et al. Bloodstream infections among transplant recipients: Results of a nationwide surveillance in Spain. *American Journal of Transplantation* 2007;7:2579-2586.

**7.** Ressner RA, Murray CK, Griffith ME, Rasnake MS, Hospenthal DR, Wolf SE. Outcomes of bacteremia in burn patients involved in combat operations overseas. *J Am Coll Surg* 2008;206:439-444.

**8.** Patel G, Huprikar S, Factor SH, Jenkins SG, Calfee DP. Outcomes of carbapenem-resistant Klebsiella pneumoniae infection and the impact of antimicrobial and adjunctive therapies. *Infection Control and Hospital Epidemiology* 2008;29:1099-1106.

**9.** Marschall J, Agniel D, Fraser VJ, Doherty J, Warren DK. Gram-negative bacteraemia in non-ICU patients: Factors associated with inadequate antibiotic therapy and impact on outcomes. *Journal of Antimicrobial Chemotherapy* 2008;61:1376-1383.

**10.** Pawar M, Mehta Y, Purohit A, Trehan N, Rosenthal VD. Resistance in gram-negative bacilli in a cardiac intensive care unit in India: risk factors and outcome. *Ann* 2008;11:20-26.

**11.** Schwaber MJ, Klarfeld-Lidji S, Navon-Venezia S, Schwartz D, Leavitt A, Carmeli Y. Predictors of carbapenem-resistant Klebsiella pneumoniae acquisition anions hospitalized adults and effect of acquisition on mortality. *Antimicrobial Agents and Chemotherapy* 2008;52:1028-1033.

**12.** Petrikkos P, Kosmidis C, Psichogiou M, et al. Prospective study of Klebsiella pneumoniae bacteremia: Risk factors and clinical significance of type VIM-1 metallo-beta-lactamases. [Greek]. *Archives of Hellenic Medicine* 2009;26:374-383.

**13.** Daikos GL, Petrikkos P, Psichogiou M, et al. Prospective observational study of the impact of VIM-1 metallo-beta-lactamase on the outcome of patients with Klebsiella pneumoniae bloodstream infections. *Antimicrob Agents Chemother* 2009;53:1868-1873.

**14.** Garnica M, Maiolino A, Nucci M. Factors associated with bacteremia due to multidrug-resistant Gram-negative bacilli in hematopoietic stem cell transplant recipients. *Braz J Med Biol Res* 2009;42:289-293.

**15.** Gasink LB, Edelstein PH, Lautenbach E, Synnestvedt M, Fishman NO. Risk factors and clinical impact of Klebsiella pneumoniae carbapenemase-producing K. pneumoniae. *Infect Control Hosp Epidemiol* 2009;30:1180-1185.

**16.** Tsitsopoulos PP, Iosifidis E, Antachopoulos C, et al. A 5-year epidemiological study of nosocomial bloodstream infections in a Neurosurgery Department. *Infection Control and Hospital Epidemiology* 2010;31:414-417.

**17.** Hyle EP, Ferraro MJ, Silver M, Lee H, Hooper DC. Ertapenem-resistant Enterobacteriaceae: risk factors for acquisition and outcomes. *Infect Control Hosp Epidemiol* 2010;31:1242-1249.

**18.** Pien BC, Sundaram P, Raoof N, et al. The clinical and prognostic importance of positive blood cultures in adults. *Am J Med* 2010;123:819-828.

**19.** Bert F, Larroque B, Paugam-Burtz C, et al. Microbial epidemiology and outcome of bloodstream infections in liver transplant recipients: an analysis of 259 episodes. *Liver Transpl* 2010;16:393-401.

**20.** Khan FY, Elshafie SS, Almaslamani M, et al. Epidemiology of bacteraemia in Hamad general hospital, Qatar: a one year hospital-based study. *Travel Med Infect Dis* 2010;8:377-387.

**21.** Orsi GB, Garcia-Fernandez A, Giordano A, et al. Risk factors and clinical significance of ertapenem-resistant Klebsiella pneumoniae in hospitalised patients. *Journal of Hospital Infection* 2011;78:54-58.

**22.** Tuon FF, Rocha JL, Toledo P, et al. Risk factors for KPC-producing Klebsiella pneumoniae bacteremia. *Braz J Infect Dis* 2012;16:416-419.

**23.** Lee NY, Lee CC, Huang WH, Tsui KC, Hsueh PR, Ko WC. Carbapenem therapy for bacteremia due to extended-spectrum-beta-lactamase-producing Escherichia coli or Klebsiella pneumoniae: implications of ertapenem susceptibility. *Antimicrob Agents Chemother* 2012;56:2888-2893.

**24.** Tabah A, Koulenti D, Laupland K, et al. Characteristics and determinants of outcome of hospital-acquired bloodstream infections in intensive care units: The EUROBACT International Cohort Study. *Intensive Care Medicine* 2012;38:1930-1945.

**25.** Echeverri-Toro LM, Rueda ZV, Maya W, Agudelo Y, Ospina S. [Multidrug-resistant Klebsiella pneumoniae, predisposing factors and associated mortality in a tertiary-care hospital in Colombia]. *Rev* 2012;29:175-182.

**26.** Raz-Pasteur A, Hussein K, Finkelstein R, Ullmann Y, Egozi D. Blood stream infections (BSI) in severe burn patients--early and late BSI: a 9-year study. *Burns* 2013;39:636-642.

**27.** Correa L, Martino MD, Siqueira I, et al. A hospital-based matched case-control study to identify clinical outcome and risk factors associated with carbapenem-resistant Klebsiella pneumoniae infection. *BMC Infect Dis* 2013;13:80.

**28.** Orsi GB, Bencardino A, Vena A, et al. Patient risk factors for outer membrane permeability and KPC-producing carbapenem-resistant Klebsiella pneumoniae isolation: results of a double case-control study. *Infection* 2013;41:61-67.

**29.** Samonis G, Vardakas KZ, Maraki S, et al. A prospective study of characteristics and outcomes of bacteremia in patients with solid organ or hematologic malignancies. *Support Care Cancer* 2013;21:2521-2526.

**30.** Metan G, Demiraslan H, Kaynar LG, Zararsiz G, Alp E, Eser B. Factors influencing the early mortality in haematological malignancy patients with nosocomial Gram negative bacilli bacteraemia: a retrospective analysis of 154 cases. *Braz J Infect Dis* 2013;17:143-149.

**31.** Ortega M, Marco F, Soriano A, et al. Epidemiology and prognostic determinants of bacteraemic catheter-acquired urinary tract infection in a single institution from 1991 to 2010. *Journal of Infection* 2013;67:282-287.

**32.** Mouloudi E, Massa E, Papadopoulos S, et al. Bloodstream infections caused by carbapenemase-producing Klebsiella pneumoniae among intensive care unit patients after orthotopic liver transplantation: risk factors for infection and impact of resistance on outcomes. *Transplant Proc* 2014;46:3216-3218.

**33.** Bartoletti M, Giannella M, Caraceni P, et al. Epidemiology and outcomes of bloodstream infection in patients with cirrhosis. *Journal of Hepatology* 2014;61:51-58.

**34.** Chetcuti Zammit S, Azzopardi N, Sant J. Mortality risk score for Klebsiella pneumoniae bacteraemia. *European Journal of Internal Medicine* 2014;25:571-576.

**35.** Egozi D, Hussein K, Filson S, Mashiach T, Ullmann Y, Raz-Pasteur A. Bloodstream infection as a predictor for mortality in severe burn patients: An 11-year study. *Epidemiology and Infection* 2014;142:2172-2179.

**36.** Rosa RG, Goldani LZ, Dos Santos RP. Risk factors for multidrug-resistant bacteremia in hospitalized cancer patients with febrile neutropenia: A cohort study. *American Journal of Infection Control* 2014;42:74-76.

**37.** Simkins J, Muggia V, Cohen HW, Minamoto GY. Carbapenem-resistant Klebsiella pneumoniae infections in kidney transplant recipients: A case-control study. *Transplant Infectious Disease* 2014;16:775-782.

**38.** Zilberberg MD, Shorr AF, Micek ST, Vazquez-Guillamet C, Kollef MH. Multi-drug resistance, inappropriate initial antibiotic therapy and mortality in Gram-negative severe sepsis and septic shock: A retrospective cohort study. *Critical Care* 2014;18 (6) (no pagination).

**39.** Hajjej Z, Nasri M, Sellami W, Gharsallah H, Labben I, Ferjani M. Incidence, risk factors and microbiology of central vascular catheterrelated bloodstream infection in an intensive care unit. *Journal of Infection and Chemotherapy* 2014;20:163-168.

**40.** Marin M, Gudiol C, Garcia-Vidal C, Ardanuy C, Carratala J. Bloodstream infections in patients with solid tumors: epidemiology, antibiotic therapy, and outcomes in 528 episodes in a single cancer center. *Medicine (Baltimore)* 2014;93:143-149.

**41.** Dizbay M, Guzel Tunccan O, Karasahin O, Aktas F. Emergence of carbapenem-resistant Klebsiella spp. infections in a Turkish university hospital: epidemiology and risk factors. *Journal of Infection in Developing Countries* 2014;8:44-49.

**42.** Chaisathaphol T, Chayakulkeeree M. Epidemiology of infections caused by multidrug-resistant gram-negative bacteria in adult hospitalized patients at Siriraj Hospital. *J Med Assoc Thai* 2014;97 Suppl 3:S35-45.

**43.** Patel SJ, Oliveira AP, Zhou JJ, et al. Risk factors and outcomes of infections caused by extremely drug-resistant gram-negative bacilli in patients hospitalized in intensive care units. *American Journal of Infection Control* 2014;42:626-631.

**44.** Ye QF, Zhao J, Wan QQ, Qiao BB, Zhou JD. Frequency and clinical outcomes of ESKAPE bacteremia in solid organ transplantation and the risk factors for mortality. *Transplant Infectious Disease* 2014;16:767-774.

**45.** Bulut C, Ataman Hatipoglu Ç, Arslan K, Tuncer Ertem G, Adiloglu A, Demiröz AP. Risk factors for acquisition and effect on mortality of carbapenem-resistant K. pneumonia: a case-control study. Abstract eP605, ECCMID conference, Barcelona 2014. Available at: <https://www.escmid.org/escmid_publications/escmid_elibrary/>. Last accessed July 21, 2017. 2014.

**46.** Poulakou G, Routsi C, Moussas N, et al. Multidrug-resistant and extensively drug-resistant Klebsiella pneumoniae bloodstream infections in intensive care unit patients: epidemiology and outcomes. Abstract EV0102, ECCMID conference, Copenhagen 2015. Available at: <https://www.escmid.org/escmid_publications/escmid_elibrary/>. Last accessed July 21, 2017. 2015.

**47.** Candevir Ulu A, Kurtaran B, Inal AS, et al. Risk factors of carbapenem-resistant Klebsiella pneumoniae infection: a serious threat in ICUs. *Med Sci Monit* 2015;21:219-224.

**48.** Wang L, Wang Y, Fan X, Tang W, Hu J. Prevalence of Resistant Gram-Negative Bacilli in Bloodstream Infection in Febrile Neutropenia Patients Undergoing Hematopoietic Stem Cell Transplantation: A Single Center Retrospective Cohort Study. *Medicine (Baltimore)* 2015;94:e1931.

**49.** Biehle LR, Cottreau JM, Thompson DJ, et al. Outcomes and risk factors for mortality among patients treated with carbapenems for klebsiella spp. bacteremia. *PLoS ONE* 2015;10 (11) (no pagination).

**50.** Delle Rose D, Sordillo P, Gini S, et al. Microbiologic characteristics and predictors of mortality in bloodstream infections in intensive care unit patients: A 1-year, large, prospective surveillance study in 5 Italian hospitals. *American Journal of Infection Control* 2015;43:1178-1183.

**51.** de Jager P, Chirwa T, Naidoo S, Perovic O, Thomas J. Nosocomial Outbreak of New Delhi Metallo-beta-Lactamase-1-Producing Gram-Negative Bacteria in South Africa: A Case-Control Study. *PLoS ONE* 2015;10:e0123337.

**52.** Jiao Y, Qin Y, Liu J, et al. Risk factors for carbapenem-resistant Klebsiella pneumoniae infection/colonization and predictors of mortality: a retrospective study. *Pathogens and Global Health* 2015;109:68-74.

**53.** Dimopoulos G, Koulenti D, Tabah A, et al. Bloodstream infections in ICU with increased resistance: Epidemiology and outcomes. *Minerva Anestesiologica* 2015;81:405-418.

**54.** Lanini S, Costa AN, Puro V, et al. Incidence of carbapenem-resistant gram negatives in Italian transplant recipients: a nationwide surveillance study. *PLoS ONE* 2015;10:e0123706.

**55.** Orsi GB, Giuliano S, Franchi C, et al. Changed epidemiology of ICU acquired bloodstream infections over 12 years in an Italian teaching hospital. *Minerva Anestesiologica* 2015;81:980-988.

**56.** Bastug A, Kayaaslan B, Kazancioglu S, et al. Emergence of multidrug resistant isolates and mortality predictors in patients with solid tumors or hematological malignancies. *Journal of Infection in Developing Countries* 2015;9:1100-1107.

**57.** Boncagni F, Francolini R, Nataloni S, et al. Epidemiology and clinical outcome of healthcare-associated Infections: A 4-year experience of an Italian ICU. *Minerva Anestesiologica* 2015;81:765-775.

**58.** Saravu K, Prasad M, Eshwara VK, Mukhopadhyay C. Clinico-microbiological profile and outcomes of nosocomial sepsis in an Indian tertiary care hospital - A prospective cohort study. *Pathogens and Global Health* 2015;109:228-235.

**59.** Burnham JP, Lane MA, Kollef MH. Impact of Sepsis Classification and Multidrug-Resistance Status on Outcome Among Patients Treated With Appropriate Therapy. *Crit Care Med* 2015;43:1580-1586.

**60.** Moghnieh R, Estaitieh N, Mugharbil A, et al. Third generation cephalosporin resistant Enterobacteriaceae and multidrug resistant gram-negative bacteria causing bacteremia in febrile neutropenia adult cancer patients in Lebanon, broad spectrum antibiotics use as a major risk factor, and correlation with poor prognosis. *Front* 2015;5:11.

**61.** Badura A, Pregartner G, Holzer JC, Feierl G, Grisold AJ. Susceptibility of Austrian clinical Klebsiella and enterobacter isolates linked to patient-related data. *Frontiers in Microbiology* 2016;7 (FEB) (no pagination).

**62.** Hoxha A, Kärki T, Giambi C, et al. Attributable mortality of carbapenem-resistant Klebsiella pneumoniae infections in a prospective matched cohort study in Italy, 2012-2013. *Journal of Hospital Infection* 2016;92:61-66 66p.

**63.** Hu Y, Ping Y, Li L, Xu H, Yan X, Dai H. A retrospective study of risk factors for carbapenem-resistant klebsiella pneumoniae acquisition among ICU patients. *Journal of Infection in Developing Countries* 2016;10:208-213.

**64.** Fitzpatrick JM, Biswas JS, Edgeworth JD, et al. Gram-negative bacteraemia; A multi-centre prospective evaluation of empiric antibiotic therapy and outcome in English acute hospitals. *Clinical Microbiology and Infection* 2016;22:244-251.

**65.** Garbati MA, Sakkijha H, Abushaheen A. Infections due to Carbapenem Resistant Enterobacteriaceae among Saudi Arabian Hospitalized Patients: A Matched Case-Control Study. *BioMed Research International* 2016;2016 (no pagination).

**66.** Alexopoulou A, Vasilieva L, Agiasotelli D, et al. Extensively drug-resistant bacteria are an independent predictive factor of mortality in 130 patients with spontaneous bacterial peritonitis or spontaneous bacteremia. *World Journal of Gastroenterology* 2016;22:4049-4056.

**67.** Kofteridis D, Andrianaki A, Plataki M, et al. Multidrug-resistant Klebsiella pneumoniae bacteraemia: a threat in patients with neoplasia. Abstract P1125, ECCMID conference, Amsterdam 2016. Available at: <https://www.escmid.org/escmid_publications/escmid_elibrary/>. Last accessed July 21, 2017. 2016.

**68.** Mouloudi E, Protonotariou E, Zagorianou A, et al. Bloodstream infections caused by metallo-beta-lactamase/Klebsiella pneumoniae carbapenemase-producing K. pneumoniae among intensive care unit patients in Greece: risk factors for infection and impact of type of resistance on outcomes. *Infect Control Hosp Epidemiol* 2010;31:1250-1256.

**69.** Ben-David D, Kordevani R, Keller N, et al. Outcome of carbapenem resistant Klebsiella pneumoniae bloodstream infections. *Clin Microbiol Infect* 2012;18:54-60.

**70.** Liu SW, Chang HJ, Chia JH, Kuo AJ, Wu TL, Lee MH. Outcomes and characteristics of ertapenem-nonsusceptible Klebsiella pneumoniae bacteremia at a university hospital in Northern Taiwan: a matched case-control study. *J Microbiol Immunol Infect* 2012;45:113-119.

**71.** Qureshi ZA, Paterson DL, Peleg AY, et al. Clinical characteristics of bacteraemia caused by extended-spectrum beta-lactamase-producing Enterobacteriaceae in the era of CTX-M-type and KPC-type beta-lactamases. *Clin Microbiol Infect* 2012;18:887-893.

**72.** Lee NY, Wu JJ, Lin SH, Ko WC, Tsai LH, Yan JJ. Characterization of carbapenem-nonsusceptible Klebsiella pneumoniae bloodstream isolates at a Taiwanese hospital: clinical impacts of lowered breakpoints for carbapenems. *Eur J Clin Microbiol Infect Dis* 2012;31:1941-1950.

**73.** Hussein K, Raz-Pasteur A, Finkelstein R, et al. Impact of carbapenem resistance on the outcome of patients' hospital-acquired bacteraemia caused by Klebsiella pneumoniae. *J Hosp Infect* 2013;83:307-313.

**74.** Gallagher JC, Kuriakose S, Haynes K, Axelrod P. Case-case-control study of patients with carbapenem-resistant and third-generation-cephalosporin-resistant Klebsiella pneumoniae bloodstream infections. *Antimicrob Agents Chemother* 2014;58:5732-5735.

**75.** Girometti N, Lewis RE, Giannella M, et al. Klebsiella pneumoniae bloodstream infection: epidemiology and impact of inappropriate empirical therapy. *Medicine (Baltimore)* 2014;93:298-309.

**76.** Alicino C, Giacobbe DR, Orsi A, et al. Trends in the annual incidence of carbapenem-resistant Klebsiella pneumoniae bloodstream infections: a 8-year retrospective study in a large teaching hospital in northern Italy. *BMC Infect Dis* 2015;15:415.

**77.** Gomez-Simmonds A, Greenman M, Sullivan SB, et al. Population Structure of Klebsiella pneumoniae Causing Bloodstream Infections at a New York City Tertiary Care Hospital: Diversification of Multidrug-Resistant Isolates. *J Clin Microbiol* 2015;53:2060-2067.

**78.** Trecarichi EM, Pagano L, Candoni A, et al. Current epidemiology and antimicrobial resistance data for bacterial bloodstream infections in patients with hematologic malignancies: An Italian multicentre prospective survey. *Clinical Microbiology and Infection* 2015;21:337-343.

**79.** Vardakas KZ, Matthaiou DK, Falagas ME, Antypa E, Koteli A, Antoniadou E. Characteristics, risk factors and outcomes of carbapenem-resistant Klebsiella pneumoniae infections in the intensive care unit. *J Infect* 2015;70:592-599.

**80.** Fraenkel-Wandel Y, Raveh-Brawer D, Wiener-Well Y, Yinnon AM, Assous MV. Mortality due to blaKPC Klebsiella pneumoniae bacteraemia. *J Antimicrob Chemother* 2016;71:1083-1087.

**81.** Villegas MV, Pallares CJ, Escandon-Vargas K, et al. Characterization and clinical impact of bloodstream infection caused by carbapenemase-producing enterobacteriaceae in seven Latin American countries. *PLoS ONE* 2016;11:no pagination.