IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

BG RCI
Berufsgenossenschaft
Rohstoffe und chemische Industrie

Bundesministerium
für Arbeit und Soziales

Klebsiella pneumoniae subsp. pneumoniae

General information | Occupational and health protection | Morphology and physiology | Occurrence/natural habitat | Pathogenicity/pathogenic properties | Disease | Epidemiology | Resistance/Tenacity | Legal basics | Links | References

GENERAL INFORMATION

Klebsiella pneumoniae subsp. pneumoniae
Klebsiella pneumoniae

For further information on the current nomenclature of the species see
List of Prokaryotic names with Standing in Nomenclature

Document Number: 823147
Processing status: This information was compiled on 19.11.2016.

Category: Bacteria
Strain type: *Klebsiella pneumoniae* subsp. *pneumoniae* (Schroeter) Trevisan
ATCC-Nr.: 13883
DSM-Nr.: 30104
IAM-Nr.: 14200,
JCM-Nr.: 1662
NCTC-Nr.: 9633
WDCM-Nr.: 00097

Klebsiella pneumoniae subsp. *pneumoniae* (Schroeter) Trevisan
ATCC-Nr.: 33259
NCPPB*-Nr.: 439
*National Collection of Plant Pathogenic Bacteria

Further information:
BacDive - The Bacterial Diversity Metadatabase (DSMZ)

Risk group: **2**
Biological agents that can cause human disease and might be a hazard to employees; they are unlikely to spread to the comunity; there is usually effective prophylaxis or treatment available.

References:
Note TA:
Types of which strains are known which have been handled safely over many years in technical applications. These proven strains can therefore be assigned to risk group 1 according to the classification criteria. The "TA" tag lays no claim of completeness, however. Strains with the features of "TA" may therefore also arise in species not bearing this tag.
Note ht:
Pathogenic for humans and vertebrates, but normally no transmission between the two host groups.

Consultant / Reference laboratory:
National Reference Centre for Gram Negative Hospital Pathogens
[Nationales Referenzzentrum für gramnegative Krankenhauserreger]
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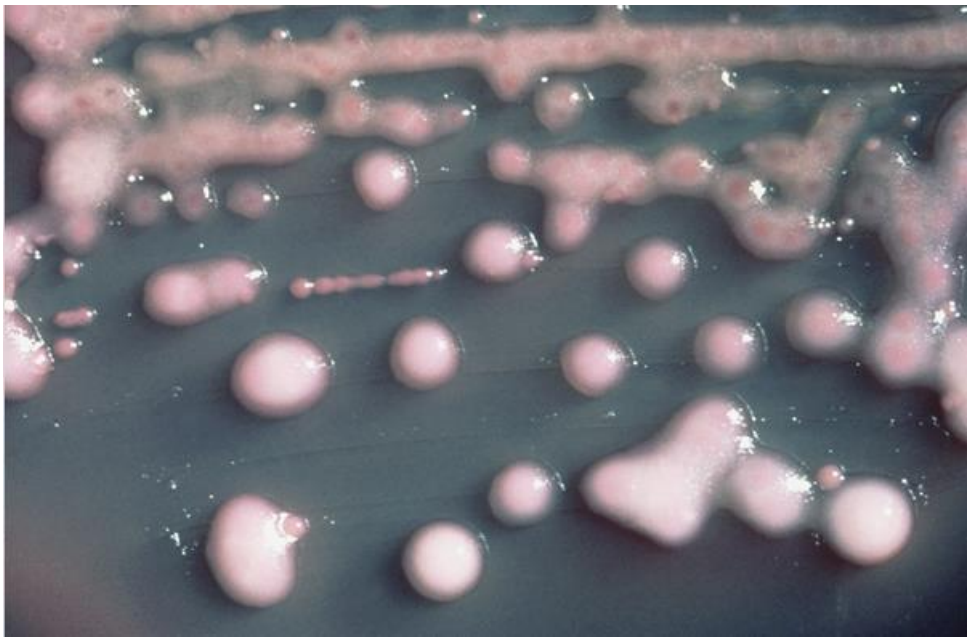

In some strains of *Klebsiella pneumoniae*, the bacteria form large capsules of acidic polysaccharides. This causes the slimy growth of colonies on culture media. Photo: CDC, Public Health Image Library (PHIL)

Medical significance

Klebsiella pneumoniae is among the Enterobacteria and is regarded as a normal organism in the intestine of humans and animals. *Klebsiella pneumoniae* enters the environment with excretions, and is found there and on plants.
When it is equipped with appropriate virulence factors and the patient is suitably predisposed, *Klebsiella pneumoniae* may also trigger a variety of infections. For example, urinary tract infections are commonly caused by Klebsiella. Apart from this, Klebsiella pneumoniae is often a causative agent of pneumonia, wound and soft tissue infections, or sepsis. Artificial respiration, traumata, immunosuppression, diabetes mellitus, old age etc. may predispose patients to develop infections with *Klebsiella pneumoniae*. Therefore, hospital patients with relevant primary diseases are at special risk. In individuals with the tissue type HLA B27, infections due to *Klebsiella pneumoniae* may cause autoimmune disorders due to antigen similarity and resulting cross-immunity.
Klebsiella pneumoniae is therefore an opportunistic infectious pathogen, which triggers infections only in individuals weakened by their predisposition.
Since *Klebsiella pneumoniae* is able to exchange plasmids with other bacteria, including resistance plasmids, strains isolated from hospital patients are often extremely resistant to antibiotics. This qualifies Klebsiella pneumoniae as a feared hospital pathogen, which can also be transmitted by healthy individuals such as personnel. This antibiotic resistance may involve penicillins, cephalosporins, but also carbapenems.

Reference: 02015 03068 03072

Transmission routes

Admission over the respiratory tract.
Microbial contaminated aerosols (bioaerosols) are inhalable due to their size and can thus get in the lung.
Admission over the mouth.
The transmission takes place due to contaminated water.
The transmission takes place due to food.
A transmission takes place by touching the mouth with dirty hands or gloves or smoking without prior thorough cleaning of the hands (smear infection).
Splash in the eyes or mucous membranes of the mouth must be considered as portal of entry.
Transmission via penetration in the deep tissues (muscle, subcutaneous fatty tissue) in the case of injury e.g. due to stab and cutting injuries with contaminated equipment.

Reference: 99999

For further information on transmission routes see chapter EPIDEMIOLOGY.

OCCUPATIONAL SAFETY AND HEALTH

Sector | Activity | Protective measures | Inactivation/Decontamination | Immediate measures/First aid | Occupational health care

SECTORS

- Stationary Health Care
- Health care

Reference: 99999

ACTIVITIES

Care of patients infected with *Klebsiella pneumoniae*, care of patients with immunodeficiency, with long term artificial respiration, with intensive care and of neonates.

Reference: 04350 04352 04355

PROTECTIVE MEASURES

General protective measures

The general protective measures correspond to those of infectious disease wards or laboratories with biosafety level S2.
Hand disinfection before and after patient contact. Hand disinfection must also be performed after wearing protective gloves.
When directly caring for patients with multiresistant strains of *Klebsiella pneumoniae*, face masks are required when splashes of blood, secretions or excretions must be expected.

The following protective measures apply to specific activities in laboratories, the husbandry of laboratory animals and biotechnological activities. For further information see TRBA 100, TRBA 120, TRBA 500.

Technical measures

Where tasks intentionally involve biomaterials, their identity must be verified and documented routinely.
Areas in which the biomaterial is processed must be isolated from other areas and labelled with the 'Biohazard' warning symbol and protection level **2**.
The doors of the area within which the protection level applies must open in the direction of the escape route and be equipped with an inspection window.
Where a health hazard posed by bioaerosols cannot be eliminated, the relevant activities must be performed in a microbiological safety cabinet (MSC). For detailed information on activities in MSCs, see leaflet B 011 of the BG RCI (German Social Accident Insurance Institution for the raw materials and chemical industry).
Wash basins, disinfectant dispensers, disposable towels and hand detergents must be available.
Water faucets and disinfectant dispensers must be operable without the use of the hands.
Laboratories must offer suitable eyewash facilities.
All surfaces and areas that could come into contact with biological agents must be easy to clean, liquid-tight and resistant to detergents and disinfectants. A seamless wall-floor joint must be effected.
Windows and doors must be kept closed while work is in progress.
Work areas are to be maintained in a clean and tidy state. Only tools and devices that are actually needed may remain on the benches.
Pipettors must be provided and used. Mouth pipetting is not permitted.
If the use of pointed or sharp instruments cannot be avoided, they must be disposed of in suitable containers after use.
The release of biological agents must be minimised during the opening of technical equipment.
Catch basins must be in place to ensure that open sample containers are prevented from turning over during work operations.
The biomaterial must not be stored under conditions that favour its reproduction.
Clearly labelled, closed, rigid, liquid-tight and unbreakable vessels that can be disinfected from the outside must be provided and used for the in-house transport of biological agents.
Transport of biological agents outside the plant is subject to the regulations governing hazardous goods (class 6.2).
Suitable containers must be available for the collection of waste that constitutes biological agents.

Organisational measures

The number of staff must be limited to the actual requirements, and access to the area in which the protection level applies must be restricted to authorized persons.
An instruction manual must be prepared. Prior to beginning their activity and subsequently at least once a year, verbal and work-related instruction must be provided to staff members to familiarise them with the hazards and protective measures as laid down in the instruction manual. DGUV Informative Publication 213-016 (BGI/GUV-I 853) contains a prototype instruction manual on 'activities involving biological agents of Risk Group 2' in accordance with the German Ordinance on Biological Substances.
The instruction process must also include advice in occupational medicine and safety.
Restrictions of employment for expectant and nursing mothers must be observed in accordance with the German Maternity Protection Act.
Injuries must be reported immediately to the person in charge.

Personal protection - body protection

Suitable protective clothing must be worn (at least lab coats).
Hygiene wear.
Durind the processing of infectious tissues, the protective clothing must be complemented by disposable aprons.
Remove protective clothing when leaving the area in which the protection level applies.
Keep protective clothing separate from normal clothing.

Personal protection - hand protection

Depending on the results of the risk assessment, the use of protective gloves may be mandatory for certain activities.
The skin protection plan must be observed.

Personal protection – eye and face protection

Generally not required.

Personal protection - respiratory protection

Generally not required.

Occupational hygiene

The consumption and storage of food and alcohol/tobacco in the protection level area is forbidden.
The wearing of jewellery, watches and rings on the hands and the forearms is not permitted.
Fingernails are to be kept short.
Following completion of work and prior to leaving the work area, hands are to be disinfected, washed and remoisturised according to the skin protection plan.
Skin protection and skin care agents must be made available in contamination-proof containers.
Contaminated protective clothing and shoes are to be collected safely and decontaminated, cleaned and disposed of centrally.
Work clothing must not be cleaned at home.
The cleaning regulations for employees, equipment and workplaces must be defined in a hygiene plan.
Insects and pests in the working area must be regularly controlled.

Vaccination

A vaccine is not available.

Reference: 00001 04025 04164 99999

INACTIVATION / DECONTAMINATION

Disinfection measures must be carried out by proven means and procedures. For detailed information see the following lists: DVG - Animal Husbandry (German Association for Veterinary Medicine, Accommodation and Husbandry of Animals), DVG - Food Area, VAH and RKI. Officially ordered disinfection measures (decontamination) required by the authorities may be carried out only with disinfection agents included in the RKI list.
Furthermore, the Industrie Association Hyhiene and Surface Protection (IHO) supplies lists of statements of companies on the efficacy of different products. The information in this register is based on statments of the respective companies.
Klebsiella pneumoniae can be inactivated with all licensed disinfectants when used as specified in the applicable dilution for use. Furthermore, all approved sterilisation processes are effective against *Klebsiella pneumoniae*.
A suitable autoclave must be available in the same building.
Externally contaminated test vessels must be disinfected before opening.
Work areas and working equipment must be decontaminated before the performance of maintenance measures. For further information see TRBA 100 (‘Technical Rules for Biological Agents’).
Contaminated solid wastes, liquid cultures and suspensions containing pathogens are to be collected in appropriate containers and deactivated.

Reference: 00001

IMMEDIATE MEASURES / FIRST AID / POST-EXPOSURE PROPHYLAXIS

Accidental release measures

Surface disinfection can be considered.

First aid: eyes and mucous membranes

Wash the eyes with water or preferably with an eyewash bottle.

First aid: skin

Skin disinfection.

First aid: respiratory tract

None.

First aid: swallowing

None.

Information for physicians

Klebsiella pneumoniae is unlikely to be pathogenic to healthy individuals. Nonetheless, even healthy individuals may be colonised by *Klebsiella pneumoniae*. Therefore, personnel must also be taken into account when identifying and interrupting infection chains of multiresistant strains. However, the KRINKO (Kommission für Krankenhaushygiene und Infektionsprävention [Committee for Hospital Hygiene and Prevention of Infections] does not explicitly recommend personnel screening; rather, it suggests that patients in whom a multiresistant strain of *Klebsiella pneumoniae* was isolated should receive care from specifically selected personnel.
Once multiresistant strains of Klebsiella pneumoniae with resistance to carbapenems have been detected (infection or colonisation), a report to the responsible health authority for the hospital is mandatory.

Reference: 02015 02018 99999

OCCUPATIONAL HEALTH CARE according to ArbMedVV

Optional health care:
In the case of tasks specifically involving contact and tasks involving incidental contact with biological agents classed as Risk Group 2 under the Biological Agents Ordinance (Biostoffverordnung, BioStoffV) or which involve a comparable risk, the employer must offer an optional health care. This does not apply when on account of the risk assessment and on account of the protective measures taken it can be assumed that there is no risk of infection.
An optional health care must also be offered if as a result of the exposure to biological agents
- a serious infectious illness is to be expected and post-exposure prophylatic measures are possible, or
- an infection has resulted.

MORPHOLOGY AND PHYSIOLOGY

MORPHOLOGY

Klebsiella pneumoniae is a Gram-negative rod-shaped bacillus measuring up to 1 µm in diameter with a length of up to 3 µm. It possesses no flagella and is therefore immotile. Many strains form a capsule of acidic polysaccharides which surround the bacterial cell, appearing as a colourless areola in the original specimen. *Klebsiella pneumoniae* forms fimbria and adhesins which are used when colonising mucous membranes.

Reference: 03068 03072

PHYSIOLOGY

Klebsiella pneumoniae reproduces under both aerobic and anaerobic conditions. The bacterium does not form indole from tryptophan, shows a positive Voges-Proskauer reaction, cleaves malonate and ONPG, and shows no reproduction at 10°C, but does reproduce at 44°C. Some strains produce slimy growth on solid nutrient media due to capsule formation.
Klebsiella pneumoniae is able to accept and donate plasmids from/to other enterobacteria by conjugation and therefore, contribute to the spread of antibiotic resistances.
Apart from their natural resistance to ampicillin and carbenicillin, strains of *Klebsiella pneumoniae* may express extended spectrum betalactamases (ESBL), and thereby show resistance to penicillins and cephalosporins. There are also strains capable of inactivating carbapenemes. Commonly found carbapenemases in *Klebsiella pneumoniae* include OXA-48, NDM-1, KPC-2, KPC-3 and VIM-1.

Reference: 03068 03070 03072 04351

INFORMATION ON MOLECULAR BIOLOGY

Genome
The fully sequenced genomes of nearly 80 strains are available for *Klebsiella pneumoniae*. However, this does not include the aforementioned type strains. The genome has a size of 5.37 - 6.08 mega base pairs and generally contains several plasmids. Its GC content lies between 56.88 and 58.0%.
In clinical-epidemiological terms, molecular biological confirmation of the aforementioned extended spectrum betalactamases (ESBL) is significant.

Reference: 10177 20970

OCCURRENCE / NATURAL HABITAT

FREE-LIVING / HOST BOUND

This biological agent is free-living.
This biological agent is host-dependent parasitical.
This biological agent is host dependent-commensalic.
Reference: 99999

HOSTS

Humans, animals, plants.
Reference: 99999

VECTORS

Humans, (animals, plants).
Reference: 99999

GEOGRAPHIC DISTRIBUTION

Worldwide.
Reference: 99999

PATHOGENICITY / PATHOGENIC PROPERTIES

CHARACTERISTIC OF PATHOGENICITY

Facultative human-pathogenic (it does not necessarily cause diseases in humans).
Facultative animal-pathogenic (it does not necessarily cause diseases in animals).

Reference: 99999

MINIMUM INFECTIOUS DOSE (MID)

Unknown.
Reference: 99999

CARCINOGENICITY / MUTAGENICITY / REPRODUCTIVE TOXICITY

None.
Reference: 99999

ALLERGENICITY / SENSITISING EFFECT

An allergic / sensitising potential is not known.

Reference: 99999

TOXIGENICITY / TOXIN FORMATION

Aside from the lipopolysaccharide of the cell wall of *Klebsiella pneumoniae*, which acts as an endotoxin, any further and specific toxins of these bacteria are not yet known.
Reference: 99999

DISEASE

DESCRIPTION

Klebsiella pneumoniae may trigger various respiratory tract and urinary tract infections and sepsis in predisposed individuals. This bacterium may also cause wound infections.
A specific, but less commonly occurring disease is Friedländer pneumonia due to *Klebsiella pneumoniae*, which may also be found in immunocompetent individuals.
Reference: 99999

ZOONOSIS

Zoonosis (transmission between animals and humans): Yes

Even though Klebsiella pneumoniae can also be transmitted from animals to humans, such infections have previously not been classified as zoonosis.
Reference: 99999

INFECTIOUS STAGES

The course of the infection depends on its location, and has no specific stages.
Reference: 99999

INCUBATION PERIOD

The incubation period depends on the predisposing underlying disease.
Reference: 99999

PATENCY

Klebsiella is always (facultatively) pathogenic.
Reference: 99999

SYMPTOMS AND COURSE OF DISEASE

The symptoms and course of disease depend on the location of the infection.
Coughing slimy foamy sputum mingled with blood is typical for Friedländer pneumonia.
Reference: 99999

LETHALITY

The fatality rate of hospital-acquired infections with *Klebsiella pneumoniae* is stated as 1.3%
Reference: 04299

THERAPY

Alongside treatment of the predisposing underlying illness, the results of resistance testing of the isolated strain are a significant basis of antibiotic treatment.
Treatment with piperacillin-tazobactam, meropenem, gentamycin or ciprofloxacin can be attempted, until the relevant microbiological findings are obtained.
Reference: 04351 10176

PROPHYLAXIS

Since a vaccine is not available, a key factor for the prevention of the spread of hospital infection is that patients who are infected with Klebsiella pneumoniae are handled in compliance with hygiene standards.
The KRINKO (Kommission für Krankenhaushygiene und Infektionsprävention [Committee for Hospital Hygiene and Prevention of Infections]), which is appointed by the Robert Koch Institute [Robert-Koch-Institut] has issued detailed recommendations for this; and we would like to refer you to them.
Reference: 02015 02017

EPIDEMIOLOGY

TRANSMISSION ROUTES / PORTALS OF ENTRY

Transmission takes place percutaneously (through the skin).
Transmission takes place via inhalation (by breathe).
Transmission takes place orally (by ingestion).

Reference: 99999

PATHOGEN RESERVOIR

Humans.
Detection of a carbapenemase OXA-48 bearing strain of *Klebsiella pneumoniae* in small animals and its spread in an animal clinic suggest that transmission of such strains may also be possible between animals and humans, or at least, a reservoir of corresponding resistance genes must be sought in domestic animals and pets.
Reference: 04351

INCIDENCE

No reliable figures available.
In 2015, a total of 143 outbreaks of bacterial nosocomial infections were reported to the Robert Koch Institute. 14 of these were caused by *Klebsiella*, with 156 affected individuals; two of them died from the infection.
Reference: 04299

RESISTANCE / TENACITY

SPORULATION

Does not form spores.

Reference: 99999

CONIDIA FORMATION

Does not form conidia.

Reference: 99999

RESISTANCES

Klebsiella pneumoniae exhibits environmental resistance, which allows it to survive for longer periods on vegetables, in refrigerated foods, on surfaces, on the skin and in other locations. However, the ability of *Klebsiella pneumoniae* to pick up resistances to antibiotics is of greater significance. Apart from its natural resistance to ampicillin and carbenicillin, resistances to many other penicillins and to cephalosporins may be acquired with the aid of various expanded spectrum betalactamases (ESBL). The circumstance that *Klebsiella pneumoniae* may also form resistances to carbapenems with the aid of special carbapenemases is a threat. If an appropriately equipped strain triggers an infection, there are scarcely any options available for an intervention with antibiotics.
Reference: 04354

LEGAL PRINCIPLES / REGULATIONS

LAWS AND ORDINANCES

Ordinance on Safety and Health Protection at Workplaces Involving Biological Agents (Biological Agents Ordinance - BioStoffV)

Law for the regulation of genetic engineering (Genetic Engineering Act -GenTG) and associated regulations (only in German).

Public notice of the list risk-rated donor organisms and recipient organisms for genetic engineering of 5. July 2013

Law on the prevention and control of infectious diseases in humans (Infection Protection Act -IfSG) (only in German)

Ordinance on Occupational Health Care (ArbMedVV)

Law for the protection of working mothers (MuSchG)
(only in German)

Rules for transportation of dangerous goods:
- European Convention on the carriage of dangerous goods by road (ADR)
- Order concerning the International Carriage of Dangerous Goods by Rail (RID)
- International Air Transport Association (IATA), dangerous goods regulation, 54th edition 2013
- the law on the transport of dangerous goods (Gefahrgutbeförderungsgesetz". -GGBefG)
- Regulation on the national and international transport of dangerous goods by road, rail and inland waterway services (Dangerous Goods Regulations, road, rail and inland waterways - GGVSEB)
- Regulation on the International Maritime Dangerous Goods (Dangerous Goods Regulations lake - GGVSee)
- Regulation on the order of advisor and the training of the persons in businesses and enterprises (Dangerous Goods Advisor Ordinance - GBV) (only in German)

TECHNICAL RULES AND OTHER REGULATIONS

TRBA 100
Protective measures for activities involving biological agents in laboratories

TRBA 250
Biological agents in health care and welfare facilities

TRBA 400
Guideline for risk assessment and for the instruction of employees in relation to activities with biological agents

TRBA 450
Criteria for the classification of biological agents

TRBA 466
Classification of prokaryotes (bacteria and archaea) into risk groups (only in German)

TRBA 468
List of cell lines and activities with cell cultures (only in German)

TRBA 500
Basic measures to be taken for activities involving biological agents

LINKS

Public Health Agency of Canada (PHAC)

Information provided by the Public Health Agency of Canada to this pathogen

Centers for Disease Control and Prevention (CDC)

Information provided by the Centers for Disease Control and Prevention for this pathogen

German Federal Institute for Occupational Safety and Health (BAuA)

Epidemiology of work-related infectious diseases (only in German)

European Association of Zoo and Wildlife Veterinarians (EAZWV)

Information provided by the EAZWV (European Association of Zoo and Wildlife Veterinarians) for this pathogen

Further Links:

Bad Bug Book

REFERENCES

General information | Occupational and health protection | Morphology and physiology | Occurrence/natural habitat | Pathogenicity/pathogenic properties | Disease | Epidemiology | Resistance/Tenacity | Legal basics | Links | References

Quelle: 00001
Informationen aus den Technischen Regeln für Biologische Arbeitsstoffe, insbesondere aus:
Information from the technical rules for biological substances, in particular from:
- TRBA 100
Schutzmaßnahmen für Tätigkeiten mit biologischen Arbeitsstoffen in Laboratorien; Ausgabe: Oktober 2013, zuletzt geändert 2018
Protective measures for activities involving biological agents in laboratories; Edition: October 2013, last amended 2018
- TRBA 120
Versuchstierhaltung; Ausgabe: Juli 2012, zuletzt geändert 2017
Experimental animal husbandry; Edition July 2012, last amended 2017
- TRBA 500
Grundlegende Maßnahmen bei Tätigkeiten mit biologischen Arbeitsstoffen; Ausgabe: April 2012
Basic measures to be taken for activities involving biological agents; Edition April 2012

Quelle: 01466
TRBA 466
Einstufung von Prokaryonten (Bacteria und Archaea) in Risikogruppen; August 2015, zuletzt geändert August 2019

Classification of prokaryotes (bacteria and archaea) in risk groups; August 2015, last amended August 2019

Quelle: 02014
Verordnung zur arbeitsmedizinischen Vorsorge (ArbMedVV)
Ordinance on Occupational Health Care (ArbMedVV)

Quelle: 02015
Hygienemaßnahmen bei Infektionen oder Besiedlung mit multiresistenten gramnegativen Stäbchen; Empfehlung der Kommission für Krankenhaushygiene und Infektionsprävention (KRINKO) beim Robert Koch-Institut (RKI) Bundesgesundheitsbl. 2012 · 55:1311–1354

Quelle: 02017
Infektionsprävention im Rahmen der Pflege und Behandlung von Patienten mit übertragbaren Krankheiten: Empfehlung der Kommission für Krankenhaushygiene und Infektionsprävention (KRINKO) beim Robert Koch-Institut, Bundesgesundheitsbl 2015 · 58:1151–1170

Quelle: 02018
Verordnung zur Anpassung der Meldepflichten nach dem Infektionsschutzgesetz an die epidemische Lage (Infektionsschutzgesetz-Meldepflicht-Anpassungsverordnung – IfSGMeldAnpV) vom 1. Mai 2016

Quelle: 03068
James H. Jorgensen, Michael A. Pfaller, Karen C. Carroll, Guido Funke, Marie Louise Landry, Sandra S. Richter, David W. Warnock, Manual of Clinical Microbiology, Eleventh Edition, ASM Press, Washington 2015

Quelle: 03070
Mikrobiologische Diagnostik, Editoren: Neumeister, B., Geiss H.K., Braun R., Kimmig, P.; Georg Thime Verlag, Stuttgart, New York, 2009

Quelle: 03072
Suerbaum, S., Burchardt G.-D., Kaufmann, S.H.E.; Schulz, Th.F. ((Herausgeber) Medizinische Mikrobiologie und Infektiologie, 8. Aufl., Springer Verlag, Heidelberg, New York 2016

Quelle: 04025
Bekanntmachung des Robert Koch-Institutes: „Liste der vom Robert Koch-Institut geprüften und anerkannten Desinfektionsmittel und -verfahren“, Stand: 31. August 2013
Bundesgesundheitsbl. 2013 • 56:1706–1728

Quelle: 04164
Desinfektionsmittel-Liste des VAH, Stand 1. April 2015

Quelle: 04299
Robert-Koch-Institut: Infektionsepidemiologisches Jahrbuch meldepflichtiger Krankheiten für 2015, Datenstand: 1. März 2016

Quelle: 04350
Agodi A, Barchitta M, Valenti G, Romeo MA, Giaquinta L, Santangelo C, Castiglione G, Tsakris A.: Cross-transmission of Klebsiella pneumoniae in two intensive care units: intra- and inter-hospital spread. J Hosp Infect. 2011 Mar;77(3):279-80.

Quelle: 04351
GERMAP 2015, Antibiotika-Resistenz und –Verbrauch, Herausgeber: Bundesamt für Verbraucherschutz und Lebensmittelsicherheit, Paul-Ehrlich-Gesellschaft für Chemotherapie e.V., Oktober 2016

Quelle: 04352
Morgan, M.E., Hart, C.A., Cooke, R.W.: Klebsiella infection in a neonatal intensive care unit: role of bacteriological surveillance. J Hosp Infect 1984 Dec. 5 (4): 377-385

Quelle: 04354
Robert-Koch-Institut, Epidemiologisches Bulletin vom 27. Juni 2016, Nr. 25: Bericht des Nationalen Referenzzentrums (NRZ) für gramnegative Krankenhauserreger Zeitraum 1. Januar 2015 bis 31. Dezember 2015

Quelle: 04355
Robert_Koch-Institut: Epidemoplpgisches Bulletin vom 30. Mai 2008 Nr. 22: Klebsiella-pneumoniae-Carbapenemase in Deutschland nachgewiesen!

Quelle: 10176
Public Health Agency of Canada (PHAC)
Pathogen Safety Datasheet - Infectious substances
Klebsiella spp.
http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/klebsiella-eng.php

Quelle: 10177
National Center for Biotechnology Information (NCBI)
Genome Assembly and Annotation report
Klebsiella pneumoniae
https://www.ncbi.nlm.nih.gov/genome/genomes/815?

Quelle: 20970

Singh K, Mangold KA, Wyant K, Schora DM, Voss B, Kaul KL, Hayden MK, Chundi V, Peterson LR.: Rectal screening for Klebsiella pneumoniae carbapenemases: comparison of real-time PCR and culture using two selective screening agar plates. J Clin Microbiol. 2012 Aug;50(8):2596-600.

Quelle: *99999*
Angabe des Bearbeiters
Indication of the author

General information | Occupational and health protection | Morphology and physiology | Occurrence/natural habitat | Pathogenicity/pathogenic properties | Disease | Epidemiology | Resistance/Tenacity | Legal basics | Links | References