

UpToDate

Parastoo Ehsani
Pasteur Institute of Iran

What is UpToDate ?

An electronic evidence-based clinical decision support tool
designed by expert physicians for clinicians to:

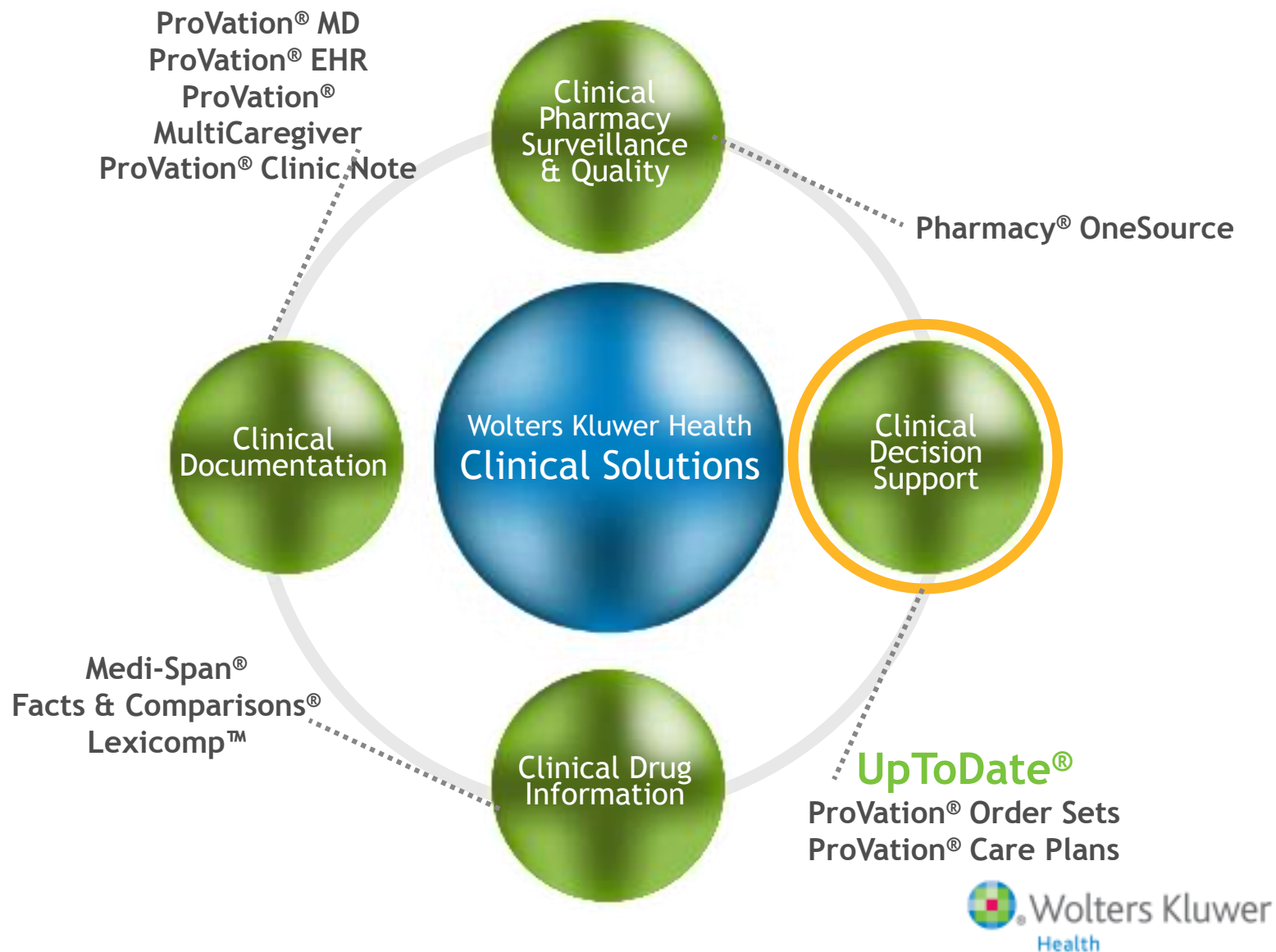
Answer your clinical questions

Increase your clinical knowledge

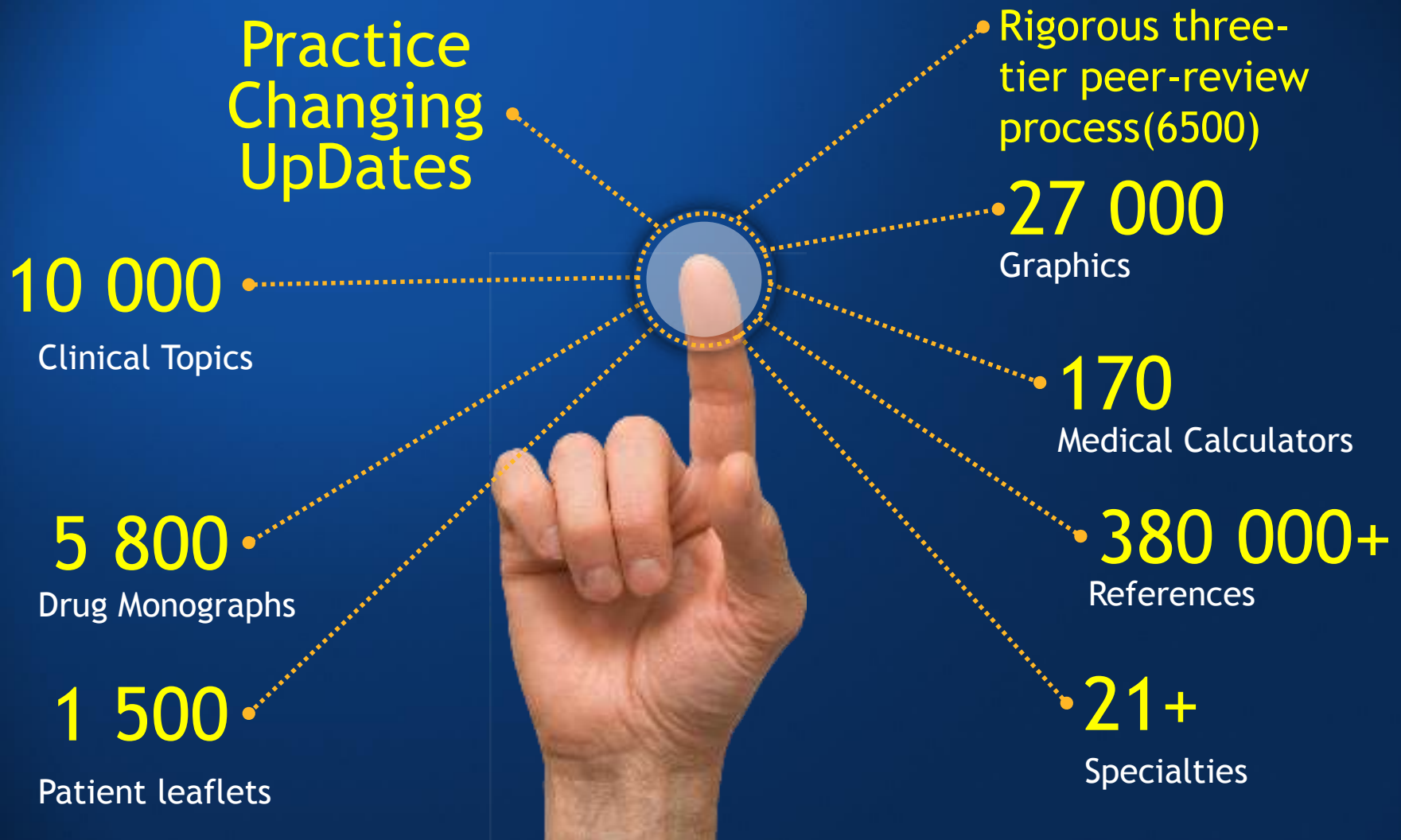
Improve patient care

Evidence-based medicine (EBM) is an approach to medical practice intended to optimize decision-making by **emphasizing the use of evidence from well-designed and well-conducted research**. Although all medicine based on science has some degree of empirical support, EBM goes further, classifying evidence by its epistemologic strength and requiring that only the strongest types (**coming from meta-analyses, systematic reviews, and randomized controlled trials**) can yield strong recommendations; weaker types (such as from **case-control studies**) can yield only weak recommendations.

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- Lower mortality rates (saving 11,500 lives per three year period)

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Doctors Have Clinical Questions

Unanswered clinical questions impact patient management decisions

Approximately 2 out of 3 clinical encounters generate a question

Physicians have approximately 11 clinical questions a day

60%
of questions go
unanswered

Answering all clinical questions could change

5 to 8

patient management decisions each day

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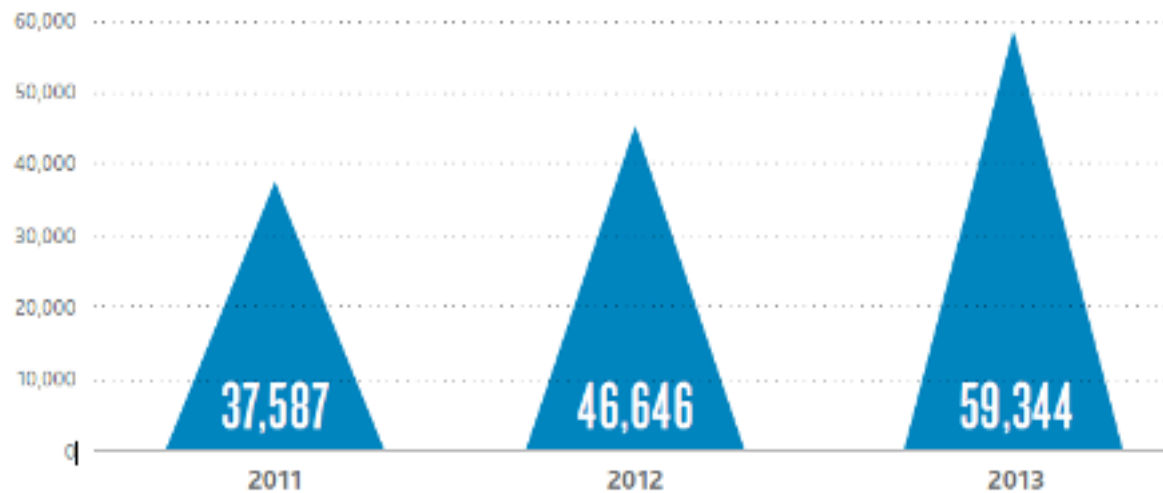
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Clinical manifestations and diagnosis of cholangiocarcinoma

...Approximately 5 to 10 percent of **cholangiocarcinomas** are intrahepatic. **Intrahepatic cholangiocarcinomas** can originate from either small intrahepatic ductules (peripheral **cholangiocarcinomas**) or large intrahepatic ...

Treatment of localized cholangiocarcinoma: Adjuvant and neoadjuvant therapy and prognosis

...resection. Distal **cholangiocarcinomas** have the highest resectability rates while proximal (both intrahepatic and perihilar) tumors have the lowest. Resectability rates for **cholangiocarcinomas** have increased ...

Epidemiology, pathogenesis, and classification of cholangiocarcinoma

...PSC and **cholangiocarcinoma**, especially perihilar disease. Nearly 30 percent of **cholangiocarcinomas** are diagnosed in patients with PSC, with or without UC. The annual incidence of **cholangiocarcinoma** in patients ...

:UpToDate

- 1- ا-ختصارات و مترادف های رایج را تشخیص می دهد. برای مثال کلمه **GERD** نتایج مربوط به **Gastroesophageal** و **(reflux disease)** بیماری رفلاکس مری را بازیابی می کند.
2. در فرایند جستجو استفاده از حروف بزرگ یا کوچک نتایج یکسانی را بازیابی می کند.
3. عبارت جستجو به طور خودکار در تمامی تخصص های موضوعی جستجو می شود.
- 4- عبارت جستجو می تواند نام بیماریها، علائم بیماری، رویکردها و اختلالات آزمایشگاهی، نام داروها و رده های دارویی باشد.
- 5- نام یک نویسنده، عنوان یک مجله و سال انتشار قابل جستجو نمی باشد.

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... **Cystic fibrosis** (CF) is a multisystem disorder caused by mutations in the **cystic fibrosis** transmembrane conductance regulator (CFTR) gene, located on chromosome 7. Pulmonary disease remains the leading ...

[Cystic fibrosis: Hepatobiliary disease](#)

...unresponsive to intensive nutritional support and treatment for **cystic fibrosis**-related diabetes, if present. Given the association of **cystic fibrosis**-related diabetes (CFRD) and advanced CFLD combined, liver-pancreas ...

[Cystic fibrosis: Clinical manifestations and diagnosis](#)

...with CRMS have been published in Europe and in the United States. **Cystic fibrosis** (CF) is caused by mutations in the **cystic fibrosis** transmembrane conductance regulator (CFTR) protein, a complex chloride ...

[Cystic fibrosis: Overview of gastrointestinal disease](#)

... **Cystic fibrosis** (CF) generally is thought of as a lung disease since much of the associated morbidity and mortality is related to pulmonary complications. A discussion of the pulmonary manifestations ...

[Cystic fibrosis: Overview of the treatment of lung disease](#)

... **Cystic fibrosis** (CF) is a multisystem disorder caused by mutations of the **cystic fibrosis** transmembrane conductance regulator (CFTR) gene, located on chromosome 7. Pulmonary disease remains the leading ...

[Cystic fibrosis: Genetics and pathogenesis](#)

...around the world are provided separately. **Cystic fibrosis** (CF) is caused by mutations in a single large gene on chromosome 7 that encodes the **cystic fibrosis** transmembrane conductance regulator (CFTR) ...

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Cystic fibrosis: Antibiotic therapy for chronic pulmonary infection

Topic Outline

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[CONSEQUENCES OF CYSTIC FIBROSIS LUNG INFECTION](#)

[PERIODIC SURVEILLANCE CULTURES](#)

[EARLY ERADICATION](#)

[Pseudomonas aeruginosa](#)

Cystic fibrosis: Antibiotic therapy for chronic pulmonary infection

Author: Richard H Simon, MD

Section Editor: George B Mallory, MD

Deputy Editor: Alison G Hopkin, MD

INTRODUCTION

Cystic fibrosis (CF) is a multisystem disorder caused by mutations in the CF transmembrane conductance regulator (CFTR) gene, located on chromosome 7 [1]. (See "[Cystic fibrosis: Genetics and pathogenesis](#)".)

Pulmonary disease remains the leading cause of morbidity and mortality in patients with CF [2-5]. One of the major drivers of CF lung disease is infection [6,7]. The approach to treating infection in CF is multifaceted, involving antibiotics, chest physiotherapy, inhaled medications to promote secretion clearance, and antiinflammatory agents. Undoubtedly, improved use of antibiotics is responsible for a substantial portion of the increased survival that has occurred in patients with CF ([figure 1](#)) [4,6].

The use of antibiotics to treat chronic pulmonary infections in CF will be reviewed here. Treatment of acute pulmonary exacerbations and other aspects of pulmonary disease in CF are discussed in separate topic reviews:

- (See "[Cystic fibrosis: Treatment of acute pulmonary exacerbations](#)".)
- (See "[Cystic fibrosis: Overview of the treatment of lung disease](#)".)

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TOPIC OUTLINE
SUMMARY & RECOMMENDATIONS
INTRODUCTION
PATHOGENS

- *Pseudomonas aeruginosa*
- *Staphylococcus aureus*
- Methicillin-resistant *Staphylococcus aureus*
- *Burkholderia cepacia* complex
- Other pathogens

CONSEQUENCES OF CF LUNG INFECTION
TREATMENT OF ACUTE PULMONARY EXACERBATIONS
ANTIBIOTIC SELECTION

- General considerations
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 - In vitro antibiotic susceptibility testing
 - Testing bacteria grown as biofilms
 - Antibiotic synergy testing
- Number and choice of antibiotics
- Route of antibiotic administration
 - Oral
 - Inhaled
 - Intravenous
- Dosing
 - Aminoglycosides
 - Once daily
 - Conventional

Cystic fibrosis: Antibiotic therapy for lung disease

Author
Richard H Simon, MD

Section Editor
George S Mallory, MD

Deputy Editor
Alison G Hoppin, MD

Disclosures

All topics are updated as new evidence becomes available and our peer review process is complete.
Literature review current through: Jan 2014 | This topic last updated: Sep 18, 2013

INTRODUCTION — Cystic fibrosis (CF) is a multisystem disorder caused by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene, located on chromosome 7 [1]. (See "[Cystic fibrosis: Genetics and pathogenesis](#)".)

Pulmonary disease remains the leading cause of morbidity and mortality in patients with CF [2-5]. One of the major drivers of CF lung disease is infection [6,7]. The approach to treating infection in CF is multifaceted, involving antibiotics, chest physiotherapy, inhaled medications to promote secretion clearance, and anti-inflammatory agents. Undoubtedly, improved use of antibiotics is responsible for a substantial portion of the increased survival that has occurred in patients with CF (figure 1) [4,6].

The use of antibiotics to treat CF lung disease will be reviewed here. Treatments other than antibiotics for CF lung disease and the diagnosis, clinical manifestations, and investigational therapies for CF are discussed separately. (See "[Cystic fibrosis: Overview of the treatment of lung disease](#)" and "[Cystic fibrosis: Clinical manifestations and diagnosis](#)" and "[Cystic fibrosis: Clinical manifestations of pulmonary disease](#)" and "[Cystic fibrosis: Investigational therapies](#)".)

PATHOGENS — Chronic bacterial infection within the airways occurs in most patients with cystic fibrosis (CF) (table 1); the prevalence of each bacterial type varies with the age of the patient (figure 2).

Pseudomonas aeruginosa — For reasons that are poorly understood, the CF airway is particularly susceptible to *Pseudomonas aeruginosa* (*P. aeruginosa*), with infection occurring as early as the first year of life. The prevalence of *Pseudomonas aeruginosa* (*P. aeruginosa*) increases as patients age, such that more than 73 percent of adults are chronically infected [8]. With prolonged infection, *P. aeruginosa* converts to a mucoid phenotype by the production of alginate. This mucoid phenotype is seen infrequently in populations without CF but is manifested by over 66 percent of patients with CF. The mucoid phenotype is associated with a more aggressive biology, microbiology, and pathogenesis of *Pseudomonas aeruginosa* infection [9,10].

Chronic infection with *P. aeruginosa* is associated with accelerated loss of pulmonary function and decreased survival [9,10].

Quick links to get you to the information you need

Graded recommendations

Based on the body of evidence, and the expertise of the leading specialty experts we make graded recommendations on the next course of action

Cystic fibrosis: Antibiotic therapy for lung disease

TOPIC OUTLINE

SUMMARY & RECOMMENDATIONS

INTRODUCTION

PATHOGENS

- *Pseudomonas aeruginosa*
- *Staphylococcus aureus*
- Meticillin-resistant *Staphylococcus aureus*
- *Burkholderia cepacia* complex
- Other pathogens

CONSEQUENCES OF CF LUNG INFECTION

TREATMENT OF ACUTE PULMONARY EXACERBATIONS

ANTIBIOTIC SELECTION

- General considerations
- Susceptibility testing strategies
 - In vitro antibiotic susceptibility testing
 - Testing bacteria grown as biofilms
 - Antibiotic synergy testing
- Number and choice of antibiotics
- Route of antibiotic administration
 - Oral
 - Inhaled
 - Intravenous
- Dosing
 - Aminoglycosides
 - Once daily
 - Conventional

SUMMARY AND RECOMMENDATIONS

- Cystic fibrosis (CF) lung disease is characterized by persistent infection. *P. aeruginosa* and *S. aureus* are the most prevalent pathogens (Grade 1B).
- The clinical course is frequently complicated by acute pulmonary exacerbations, which can lead to permanent loss of lung function. Exacerbations are treated with antibiotics, given either orally or intravenously, depending on the sensitivities of the infecting bacteria (table 2). Current practice is to culture respiratory secretions, and two antibiotics for *P. aeruginosa* are given: piperacillin-tazobactam, ticarcillin-clavulanate, ceftazidime, imipenem, meropenem, amikacin, or a fluoroquinolone (eg, ciprofloxacin), depending on antibiotic susceptibility test results. (See 'Antibiotic selection' above.)
- The pharmacokinetics of many antibiotics differs in patients with CF as compared with normal individuals. Patients with CF generally require larger and/or more frequent dosing for penicillins, cephalosporins, sulfonamides, and fluoroquinolones. Starting doses of aminoglycosides should also be larger than those recommended for individuals without CF, but dosing must be adjusted based on pharmacokinetic analysis of serum levels because of considerable interindividual variation in clearance rates. (See 'Dosing' above.)
- In the absence of an acute pulmonary exacerbation, we generally suggest not administering chronic or intermittent systemic antibiotics to patients with CF (Grade 2C), EXCEPT for the following:
 - We recommend the chronic use of azithromycin for patients 6 years and older who have clinical evidence of airway inflammation such as chronic cough or any reduction in forced expiratory volume at one minute (FEV1), regardless of the patient's *P. aeruginosa* infection status (Grade 1B). To avoid induction of antibiotic resistance, azithromycin should not be given to patients infected with nontuberculous mycobacteria. (See 'Chronic oral antibiotics' above and 'Cystic fibrosis: Overview of the treatment of lung disease', section on 'Macrolide antibiotics'.)
 - For patients older than six years with persistent *P. aeruginosa* infection and moderate or severe lung disease, we recommend chronic treatment with inhaled tobramycin (Grade 1A). We also suggest this treatment for patients with mild lung disease and persistent *P. aeruginosa* infection (Grade 2B). Inhaled aztreonam lysine is a reasonable alternative. Either inhaled tobramycin or aztreonam lysine are given for one month, on alternate months. (See 'Inhaled antibiotics' above.)
- We suggest not scheduling elective hospitalizations for antibiotics and intensified chest physiotherapy ('clean out') (Grade 2C). (See 'Hospitalizations' above.)



- We recommend the chronic use of [azithromycin](#) for patients 6 years and older who have clinical evidence of airway inflammation such as chronic cough or any reduction in forced expiratory volume at one minute (FEV1), regardless of the patient's *P. aeruginosa* infection status (**Grade 1B**). To avoid induction of antibiotic resistance, azithromycin should not be given to patients infected with nontuberculous mycobacteria. (See '[Chronic oral antibiotics](#)' above and "[Cystic fibrosis: Overview of the treatment of lung disease](#)", section on '[Macrolide antibiotics](#)'.)
- For patients older than six years with persistent *P. aeruginosa* infection and moderate or severe lung disease, we recommend chronic treatment with inhaled [tobramycin](#) (**Grade 1A**). We also suggest this treatment for patients with mild lung disease and persistent *P. aeruginosa* infection (**Grade 2B**). Inhaled [aztreonam](#) lysine is a reasonable alternative. Either inhaled tobramycin or aztreonam lysine are given for one month, on alternate months. (See '[Inhaled antibiotics](#)' above.)

Evidence-based

Grade 1A recommendation

A Grade 1A recommendation is a strong recommendation, and applies to most patients in most circumstances without reservation. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.

Explanation:

A Grade 1 recommendation is a strong recommendation. It means that we believe that if you follow the recommendation, you will be doing more good than harm for most, if not all of your patients.

Grade A means that the best estimates of the critical benefits and risks come from consistent data from well-performed, randomized, controlled trials or overwhelming data of some other form (eg, well-executed observational studies with very large treatment effects). Further research is unlikely to have an impact on our confidence in the estimates of benefit and risk.

Recommendation grades

1. Strong recommendation: Benefits clearly outweigh the risks and burdens (or vice versa) for most, if not all, patients
2. Weak recommendation: Benefits and risks closely balanced and/or uncertain

Evidence grades

- A. High-quality evidence: Consistent evidence from randomized trials, or overwhelming evidence of some other form
- B. Moderate-quality evidence: Evidence from randomized trials with important limitations, or very strong evidence of some other form
- C. Low-quality evidence: Evidence from observational studies, unsystematic clinical observations, or from randomized trials with serious flaws

For a complete description of our use of the GRADE system, please see the UpToDate editorial policy which can be found at www.uptodate.com/home/editorial-policy.

در این پایگاه داروهای متداخل به نسبت میزان خطر به هنگام مصرف هم زمان در طیف A، B، C، D و X تقسیم بندی می شوند:

کد A نشان دهنده نبود تداخل فارماکودینامیک و فارماکوکینتیک در بین دودارو است.

کد B نمایانگر امکان وجود واکنش در بین دودارو است اما نیازی به تغییری از داروها برای بیمار وجود ندارد.

کد C بیانگر نیاز به دخالت در دوز مصرفی بیمار به هنگام مصرف همزمان دودارو است. با توجه به وضعیت بیمار و فواید مصرف هم زمان دودارو، در تعداد اندکی از بیماران و برای کاهش میزان عوارض باید در دوز مصرفی یک یا هر دو دارو هماهنگی برقرار شود.

کد D نشان می دهد که دودارو با یکدیگر تداخل دارویی دارند. به گونه ای که با توجه به وضعیت بیمار، میزان فواید مصرف هم زمان دودارو و خطرهای ناشی از آن مورد ارزیابی قرار می گیرد و نیاز به مشاهده دقیق وضعیت بیمار به هنگام مصرف، تغییر در دوز داروها با توجه به شرایط بالینی بیمار و جایگزینی داروهای معادل وجود دارد.

کد X بیانگر وجود تداخل در بین دودارو است. در این شرایط میزان خطر ناشی از مصرف همزمان دودارو بیشتر از فواید آن است و نباید دودارو را با یکدیگر برای بیمار تجویز کرد.

- We recommend the chronic use of [azithromycin](#) for patients 6 years and older who have clinical evidence of airway inflammation such as chronic cough or any reduction in forced expiratory volume at one minute (FEV1), regardless of the patient's *P. aeruginosa* infection status (**Grade 1B**). To avoid induction of antibiotic resistance, azithromycin should not be given to patients infected with nontuberculous mycobacteria. (See '[Chronic oral antibiotics](#)' above and "[Cystic fibrosis: Overview of the treatment of lung disease](#)", section on '[Macrolide antibiotics](#)'.)
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Drug Information

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cystic fibrosis antibiotics



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Tobramycin: Drug information

cystic fibrosis antibiotics Find Print

DRUG INFORMATION
[by method of administration]

Tobramycin (ophthalmic): Drug information

Tobramycin (oral inhalation): Drug information

Tobramycin (systemic): Drug information

Tobramycin: Drug information Lexicomp®

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Information for this drug is presented separately based upon the following methods of administration:

- [Tobramycin \(ophthalmic\): Drug information](#)
- [Tobramycin \(oral inhalation\): Drug information](#)
- [Tobramycin \(systemic\): Drug information](#)

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Topic 10000 Version 37.0

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Tobramycin (systemic therapy and oral inhalation): Drug information

TOPIC OUTLINE

- ALERT: U.S. Boxed Warning
- Brand Names: U.S.
- Brand Names: Canada
- Pharmacologic Category
- Dosing: Adult
- Dosing: Pediatric
- Dosing: Geriatric
- Dosing: Renal Impairment
- Dosing: Hepatic Impairment
- Dosing: Obesity
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- Breast-Feeding Considerations
- Dietary Considerations
- References: U.S.

Drug Interactions

(For additional information: [Launch Lexi-Interact™ Drug Interactions Program](#)) **Lexicomp®**

AbobotulinumtoxinA: Aminoglycosides may enhance the neuromuscular-blocking effect of AbobotulinumtoxinA. *Risk C: Monitor therapy*

Amphotericin B: May enhance the nephrotoxic effect of Aminoglycosides. *Risk C: Monitor therapy*

BCG: Antibiotics may diminish the therapeutic effect of BCG. *Risk X: Avoid combination*

Bisphosphonate Derivatives: Aminoglycosides may enhance the hypocalcemic effect of Bisphosphonate Derivatives. *Risk C: Monitor therapy*

Capreomycin: May enhance the neuromuscular-blocking effect of Aminoglycosides. *Risk C: Monitor therapy*

CARBOplatin: Aminoglycosides may enhance the ototoxic effect of CARBOplatin. Especially with higher doses of carboplatin. *Risk C: Monitor therapy*

Cephalosporins (2nd Generation): May enhance the nephrotoxic effect of Aminoglycosides. *Risk C: Monitor therapy*

Cephalosporins (3rd Generation): May enhance the nephrotoxic effect of Aminoglycosides. *Risk C: Monitor therapy*

Cephalosporins (4th Generation): May enhance the nephrotoxic effect of Aminoglycosides. *Risk C: Monitor therapy*

CISplatin: May enhance the nephrotoxic effect of Aminoglycosides. *Risk C: Monitor therapy*

Colistimethate: Aminoglycosides may enhance the nephrotoxic effect of Colistimethate. Aminoglycosides may enhance the neuromuscular-blocking effect of Colistimethate. *Risk D: Consider therapy modification*

CycloSPORINE (Systemic): Aminoglycosides may enhance the nephrotoxic effect of CycloSPORINE (Systemic). *Risk C: Monitor therapy*

Gallium Nitrate: Aminoglycosides may enhance the nephrotoxic effect of Gallium Nitrate. *Risk C: Monitor therapy*

Loop Diuretics: May enhance the adverse/toxic effect of Aminoglycosides. *Risk C: Monitor therapy*

Neuromuscular-Blocking Agents: Aminoglycosides may enhance the neuromuscular-blocking effect of Neuromuscular-Blocking Agents. *Risk C: Monitor therapy*


Nonsteroidal Anti-Inflammatory Agents: May decrease the excretion of Aminoglycosides. *Risk C: Monitor therapy*

OnabotulinumtoxinA: Aminoglycosides may enhance the neuromuscular-blocking effect of OnabotulinumtoxinA. *Risk C: Monitor therapy*

Full prescription guidance available + a drug interaction program

Drug Interaction:1

Drug Interaction:1

 Lexicomp® Drug Interactions

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tobram

Tobramycin and Dexamethasone

Tobramycin For Injection (CAN)

Tobramycin For Injection, USP (CAN)

Tobramycin Injection (CAN)

Tobramycin Injection, USP (CAN)

Drug Interaction:1



Lexicomp® Drug Interactions

Item List



Tobramycin For Injection (CAN)

NOTE: This tool does not address chemical compatibility related to I.V. drug preparation or administration.

Drug Interaction:1

Item List


Tobramycin For Injection (CAN)

Typhoid Vaccine

NOTE: This tool does not address chemical compatibility related to I.V. drug preparation or administration.

Analyze


Drug Interaction:1



Lexicomp® Drug Interactions

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1 Result



Filter Results by Item ▼

D

Typhoid Vaccine


Tobramycin For Injection (CAN) (Antibiotics)

>

DISCLAIMER: Readers are advised that decisions regarding drug therapy must be based on the independent judgment of the clinician, changing information about a drug (eg, as reflected in the literature and manufacturer's most current product information), and changing medical practices.

NOTE: This tool does not address chemical compatibility related to I.V. drug preparation or administration.

Drug Interaction:1

 Lexicomp® Drug Interactions

Item List

Tobramycin For Injection (CAN)

Typhoid Vaccine

Vitamin A

NOTE: This tool does not address chemical compatibility related to I.V. drug preparation or administration.

Analyze

Drug Interaction:1



Lexicomp® Drug Interactions

[Back](#)

1 Result



Filter Results by Item ▼

D

Typhoid Vaccine


Tobramycin For Injection (CAN) (Antibiotics)



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Drug Interaction:1

 Lexicomp® Drug Interactions

Item List

+

Tobramycin For Injection (CAN)

>

Typhoid Vaccine

>



Vitamin A

>

NOTE: This tool does not address chemical compatibility related to I.V. drug preparation or administration.

Analyze

Drug Interaction:1

 Lexicomp® Drug Interactions	
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X	Typhoid Vaccine (Vaccines (Live)) Ocrelizumab
X	Typhoid Vaccine (Vaccines (Live)) Venetoclax
D	Typhoid Vaccine (Vaccines) Acetaminophen
D	Typhoid Vaccine Antibiotics

Drug interaction 2

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Tobramycin: Drug information cystic fibrosis antibiotics Find Print

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کد A نشان دهنده نبود تداخل فارماکودینامیک و فارماکوکینتیک در بین دودارو است.

کد B نمایانگر امکان وجود واکنش در بین دودارو است اما نیازی به تغییری از داروها برای بیمار وجود ندارد.

کد C بیانگر نیاز به دخالت در دوز مصرفی بیمار به هنگام مصرف همزمان دودارو است. با توجه به وضعیت بیمار و فواید مصرف هم زمان دودارو، در تعداد اندکی از بیماران و برای کاهش میزان عوارض باید در دوز مصرفی یک یا هر دو دارو هماهنگی برقرار شود.

کد D نشان می دهد که دودارو با یکدیگر تداخل دارویی دارند. به گونه ای که با توجه به وضعیت بیمار، میزان فواید مصرف هم زمان دودارو و خطرهای ناشی از آن مورد ارزیابی قرار می گیرد و نیاز به مشاهده دقیق وضعیت بیمار به هنگام مصرف، تغییر در دوز داروها با توجه به شرایط بالینی بیمار و جایگزینی داروهای معادل وجود دارد.

کد X بیانگر وجود تداخل در بین دودارو است. در این شرایط میزان خطر ناشی از مصرف همزمان دودارو بیشتر از فواید آن است و نباید دودارو را با یکدیگر برای بیمار تجویز کرد.

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Cystic fibrosis: Antibiotic therapy for lung disease

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Cystic fibrosis: Antibiotic therapy for lung disease

Author Richard H Simon, MD	Section Editor George B Mallory, MD	Deputy Editor Allison G Hopkin, MD
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Disclosures

All topics are updated as new evidence becomes available and our [peer review process](#) is complete.
Literature review current through: Jan 2014. | **This topic last updated:** Sep 18, 2013.

INTRODUCTION — Cystic fibrosis (CF) is a multisystem disorder caused by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene, located on chromosome 7 [1] (See "[Cystic fibrosis: Genetics and pathogenesis](#)").

Pulmonary disease remains the leading cause of morbidity and mortality in patients with CF [2-5]. One of the major drivers of CF lung disease is infection [6,7]. The approach to treating infection in CF is multifaceted, involving antibiotics, chest physiotherapy, inhaled medications to promote secretion clearance, and anti-inflammatory agents. Undoubtedly, improved use of antibiotics is responsible for a substantial portion of the increased survival that has occurred in patients with CF (figure 1) [4,6].

The use of antibiotics to treat CF lung disease will be reviewed here. Treatments other than antibiotics for CF lung disease and the diagnosis, clinical manifestations, and investigational therapies for CF are discussed separately. (See "[Cystic fibrosis: Overview of the treatment of lung disease](#)" and "[Cystic fibrosis: Clinical manifestations and diagnosis](#)" and "[Cystic fibrosis: Clinical manifestations of pulmonary disease](#)" and "[Cystic fibrosis: Investigational therapies](#)".)

PATHOGENS — Chronic bacterial infection within the airways occurs in most patients with cystic fibrosis (CF) (table 1); the prevalence of each bacterial lung infection varies with the age of the patient (figure 2).

For reasons that are poorly understood, the CF airway is particularly susceptible to *Pseudomonas aeruginosa* (P. aeruginosa), often appearing as early as the first year of life. The prevalence of *Pseudomonas aeruginosa* (P. aeruginosa) increases as the patient's age increases, and over 73 percent of adults are chronically infected [8]. With prolonged infection, P. aeruginosa converts to a mucoid phenotype. This mucoid phenotype is seen infrequently in populations without CF but is manifested by over 66 percent of patients with CF. (See "[Epidemiology, microbiology, and pathogenesis of Pseudomonas aeruginosa](#)".)

Feedback

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How uptodate is UpToDate?

The screenshot displays the UpToDate web interface. At the top, a search bar contains the text 'cystic fibrosis children'. Navigation links include 'All Topics', 'Languages', 'About Us', 'Contact Us', and 'Help'. A secondary navigation bar offers options like 'New Search', 'Patient Info', 'What's New', 'Calculators', 'CME 2015', 'My Account', and a 'Log Out' button. Below this, a 'Back to Search Results' button is visible. The main heading of the page is 'Cystic fibrosis: Antibiotic therapy for lung disease'. On the right side of this heading are icons for 'Find', 'Patient', 'Print', and 'Email'. A left-hand sidebar titled 'TOPIC OUTLINE' lists various sections: 'SUMMARY & RECOMMENDATIONS' (highlighted with a green arrow), 'INTRODUCTION', 'PATHOGENS', 'CONSEQUENCES OF CF LUNG INFECTION', 'TREATMENT OF ACUTE PULMONARY EXACERBATIONS', and 'ANTIBIOTIC SELECTION'. The 'ANTIBIOTIC SELECTION' section is further detailed with a list of topics: 'General considerations', 'Susceptibility testing strategies' (including 'In vitro antibiotic susceptibility testing' and 'Testing bacteria grown as biofilms'), 'Antibiotic synergy testing', 'Number and choice of antibiotics', 'Route of antibiotic administration' (including 'Oral', 'Inhaled', and 'Intravenous'), and 'Dosing' (including 'Aminoglycosides'). The main content area on the right features a yellow header box with the title 'Cystic fibrosis: Antibiotic therapy for lung disease' and the names of the 'Author' (Richard H Simon, MD), 'Section Editor' (George B Mallory, MD), and 'Deputy Editor' (Allison G Hopkin, MD). Below this, a 'Disclosures' section is present. The main text begins with a statement: 'All topics are updated as new evidence becomes available and our peer review process is complete. Literature review current through: Jan 2014. | This topic last updated: Sep 18, 2013.' This is followed by an 'INTRODUCTION' paragraph explaining that Cystic fibrosis (CF) is a multisystem disorder caused by mutations in the CFTR gene. It notes that pulmonary disease is the leading cause of morbidity and mortality in CF patients, and that improved use of antibiotics has contributed to increased survival. A paragraph then discusses the use of antibiotics to treat CF lung disease, mentioning that treatments other than antibiotics for CF lung disease and the diagnosis, clinical manifestations, and investigational therapies for CF are discussed separately. The 'PATHOGENS' section states that chronic bacterial infection within the airways occurs in most patients with CF, with the prevalence of each bacterial type varying with the patient's age. Finally, the 'Pseudomonas aeruginosa' section explains that for reasons not fully understood, the CF airway is particularly susceptible to this bacterium, with infection occurring as early as the first year of life. The prevalence of *P. aeruginosa* increases with age, such that more than 73 percent of adults are chronically infected. With prolonged infection, *P. aeruginosa* converts to a mucoid phenotype by the production of alginate. This mucoid phenotype is seen infrequently in populations without CF but is manifested by over 66 percent of the *P. aeruginosa* isolated from patients with CF. (See 'Epidemiology, microbiology, and pathogenesis of Pseudomonas aeruginosa infection'.)

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Cystic fibrosis: Antibiotic therapy for lung disease

TOPIC OUTLINE

SUMMARY & RECOMMENDATIONS

INTRODUCTION

PATHOGENS

- *Pseudomonas aeruginosa*
- *Staphylococcus aureus*
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- *Burkholderia cepacia* complex
- Other pathogens

CONSEQUENCES OF CF LUNG INFECTION

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Medline ® Abstracts for References 4,6 of 'Cystic fibrosis: Antibiotic therapy for lung disease'

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4 Update on cystic fibrosis epidemiology.
Goss CH, Rosenfeld M
Curr Opin Pulm Med. 2004;10(5):510.

Disc PURPOSE OF REVIEW: With the improving survival of cystic fibrosis (CF) patients, the clinical spectrum of this complex, multisystem disease continues to evolve. Epidemiologic studies have provided important insight into the disease course, prognosis, and complications. This review summarizes recent advances in our understanding of predictors of survival and outcome and modifiers of disease in CF. This review is not meant to be comprehensive, but highlights selected studies, many of which have particular relevance to the growing number of older CF patients.

All to RECENT FINDINGS: Survival rates of US CF patients improved remarkably over the past 15 years, but most of the improvement was limited to patients 2 to 15 years of age. Both median household income and ambient air pollutants were found to be important modifiers of disease, echoing research reported in other chronic lung diseases. Genotype classified according to functional mutation class was highly associated with outcome (class I, II, and III mutations were associated with the highest mortality). Of the emerging pathogens, *B. cepacia* complex and *B. gladioli* are the most prominent. A small but significant percentage of patients have been shown to acquire new *B. cepacia* complex or *B. gladioli* strains with time.

Liter SUMMARY: Epidemiologic research in cystic fibrosis continues to inform patient care and clinical research, and to generate new hypotheses regarding pathophysiology. Survival and outcomes continue to improve in this multisystem disease. With continued improving survival, epidemiologic studies will be critical to tracking changes in prognosis and outcome.

INTR AD Department of Medicine, University of Washington Medical Center, Seattle, Washington 98195, USA. goss@u.washington.edu

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8 Pathophysiology and management of pulmonary infections in cystic fibrosis.
Gibson RL, Burns JL, Ramsey BW
Am J Respir Crit Care Med. 2003;168(8):918.

This comprehensive State of the Art review summarizes the current published knowledge base regarding the pathophysiology and microbiology of pulmonary disease in cystic fibrosis (CF). The molecular basis of CF lung disease including the impact of defective cystic fibrosis transmembrane conductance regulator (CFTR) protein function on airway physiology, mucociliary clearance, and establishment of *Pseudomonas aeruginosa* infection is described. An overview of the microbiology of CF lung disease with particular reference to infection with *P. aeruginosa* is provided. Other pathogens commonly associated with CF lung disease including *Staphylococcus aureus*, *Burkholderia cepacia*, *Stenotrophomonas maltophilia*, *Achromobacter xylosoxidans*, and *Mycobacterium abscessus* are also described. Clinical presentation and assessment of CF lung disease including diagnostic microbiology and other laboratory tests are reviewed. Current recommendations for management of CF lung disease are provided. An extensive review of treatment options in the settings of treatment for early *P. aeruginosa* infection, maintenance for patients with chronic *P. aeruginosa* infection, exacerbation in pulmonary symptoms, as well as antibiotic therapies for other CF respiratory pathogens, are included. In addition, the review discusses infection control policies, therapies to optimize airway clearance and reduce inflammation, and potential future therapies.

ics, University of Washington School of Medicine, Children's Hospital, Seattle, WA 98125, USA.

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...with CRMS have been published in Europe and in the United States. **Cystic fibrosis** (CF) is caused by mutations in the **cystic fibrosis** transmembrane conductance regulator (CFTR) protein, a complex chloride ...

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Defects in the CFTR gene in cystic fibrosis

The diagram illustrates the biosynthesis and function of the CFTR protein in an epithelial cell. It shows the protein being synthesized in the ER, processed in the Golgi, and then moving to the cell membrane. The protein is shown in two states: a functional state (Class I) and a defective state (Class II). The defective state is shown with a mutation in the CFTR gene, leading to a defective protein that cannot function properly. The diagram also shows the role of ATP and PKA in the regulation of the protein.

Schematic representation of the biosynthesis and function of CFTR in an epithelial cell and of mechanisms of dysfunction associated with different cystic fibrosis mutations. CFTR, cystic fibrosis transmembrane conductance regulator; ER, endoplasmic reticulum; PKA, phosphatase A; NBD1 and NBD2, nuclear binding folds.

Adapted from Welsh, M.P., Tsui, L.-C., Boat, T., Beaudet, A.L. Cystic Fibrosis. In: The Metabolic and Molecular Basis of Inherited Disease, Scriver, C.R., Beaudet, A.L., Sly, W.S., et al (Eds), McGraw-Hill, New York, 1995, p. 3801

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cystic fibrosis



Patient Education

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Lung disease

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What's new in pulmonary and critical care medicine 


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 - Tiotropium and minimally symptomatic COPD with low exacerbation risk (October 2017)
 - Mepolizumab and COPD (October 2017)
 - Chemical constituents released by heat-not-burn (HNB) tobacco cigarettes (August 2017)

What's new in pulmonary and critical care medicine

Authors: Helen Hollingsworth, MD, April F Eichler, MD, MPH, Geraldine Finlay, MD


Contributor Disclosures

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ASTHMA

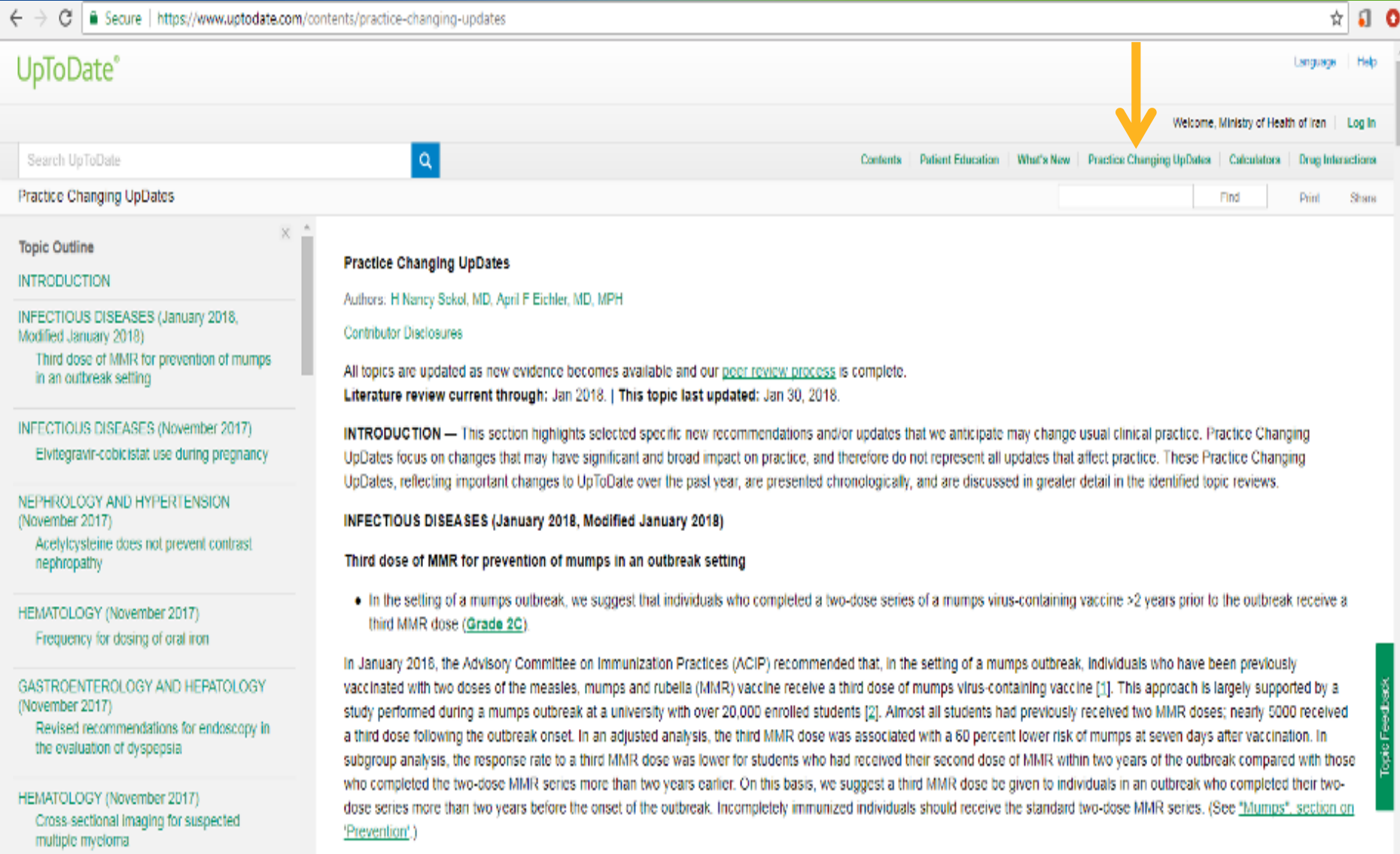
Benralizumab for severe eosinophilic asthma (January 2018)

[Benralizumab](#) is a monoclonal antibody against interleukin (IL)-5 receptor alpha that has been approved by the US Food and Drug Administration as add-on therapy in patients (≥12 years) with severe asthma and an eosinophilic phenotype [1]. In two earlier trials, benralizumab reduced exacerbations in patients with severe asthma and peripheral blood eosinophils ≥300/microL. A more recent trial in patients with peripheral blood eosinophils ≥150/microL found that benralizumab allowed tapering of oral glucocorticoids and reduced exacerbations compared with placebo [2]. Benralizumab is administered subcutaneously every four weeks for the first three doses, then every eight weeks. (See ["Treatment of severe asthma in adolescents and adults"](#), section on ["Benralizumab"](#).) 

Long-acting beta agonist-glucocorticoid combination inhalers: FDA boxed warning removed (January 2018)

In 2017, the US Food and Drug Administration (FDA) reviewed four large clinical safety trials and concluded that long-acting beta agonist (LABA)-inhaled glucocorticoid combination inhalers do **not** significantly increase the risk of serious asthma related side effects compared with inhaled glucocorticoids [3]. Based on the review, the FDA removed the "boxed warning" on combination LABA-inhaled glucocorticoid medications. The FDA continues to warn that monotherapy with a LABA (ie, without the concomitant use of an inhaled glucocorticoid) is contraindicated in the treatment of asthma. (See ["Beta agonists in asthma: Controversy regarding chronic use"](#).)

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 - Third dose of MMR for prevention of mumps in an outbreak setting
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Practice Changing UpDates

Authors: H Nancy Sokol, MD, April F Eichler, MD, MPH

Contributor Disclosures

All topics are updated as new evidence becomes available and our [peer review process](#) is complete.

Literature review current through: Jan 2018. | This topic last updated: Jan 30, 2018.

INTRODUCTION — This section highlights selected specific new recommendations and/or updates that we anticipate may change usual clinical practice. Practice Changing UpDates focus on changes that may have significant and broad impact on practice, and therefore do not represent all updates that affect practice. These Practice Changing UpDates, reflecting important changes to UpToDate over the past year, are presented chronologically, and are discussed in greater detail in the identified topic reviews.

INFECTIOUS DISEASES (January 2018, Modified January 2018)

Third dose of MMR for prevention of mumps in an outbreak setting

- In the setting of a mumps outbreak, we suggest that individuals who completed a two-dose series of a mumps virus-containing vaccine >2 years prior to the outbreak receive a third MMR dose ([Grade 2C](#)).

In January 2016, the Advisory Committee on Immunization Practices (ACIP) recommended that, in the setting of a mumps outbreak, individuals who have been previously vaccinated with two doses of the measles, mumps and rubella (MMR) vaccine receive a third dose of mumps virus-containing vaccine [1]. This approach is largely supported by a study performed during a mumps outbreak at a university with over 20,000 enrolled students [2]. Almost all students had previously received two MMR doses; nearly 5000 received a third dose following the outbreak onset. In an adjusted analysis, the third MMR dose was associated with a 60 percent lower risk of mumps at seven days after vaccination. In subgroup analysis, the response rate to a third MMR dose was lower for students who had received their second dose of MMR within two years of the outbreak compared with those who completed the two-dose MMR series more than two years earlier. On this basis, we suggest a third MMR dose be given to individuals in an outbreak who completed their two-dose series more than two years before the onset of the outbreak. Incompletely immunized individuals should receive the standard two-dose MMR series. (See ["Mumps" section on 'Prevention'](#).)

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Calculators

Contents > Calculators

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Patient Information

What's New

Calculators

Authors and Editors

Calculator: Peak Expiratory Flow Prediction

$$PEF_{\text{Female}} = 0.375 \times \text{Age} + 0.107 \times \text{Age} + 55.9 \times \text{Height} + 15.0$$

$$PEF_{\text{Male}} = 0.375 \times \text{Age} + 0.107 \times \text{Age} + 55.9 \times \text{Height} + 15.0$$

Input:

Height cm
Age yr

Results:

PEF Female L/min
PEF Male L/min

References

1. Nunn AJ, Gregg I. New regression equations for predicting peak expiratory flow in adults. *BMJ*. 1989 Apr 22;298(6680):1068-70.
2. Radeos MS, Camargo CA. Predicted peak expiratory flow: differences across formulae in the literature. *Am J Emerg Med*. 2004 Nov;22(7):516-21.

Critical Care, and Sleep

val prediction

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monoxide (DLCO) correction of predicted value for

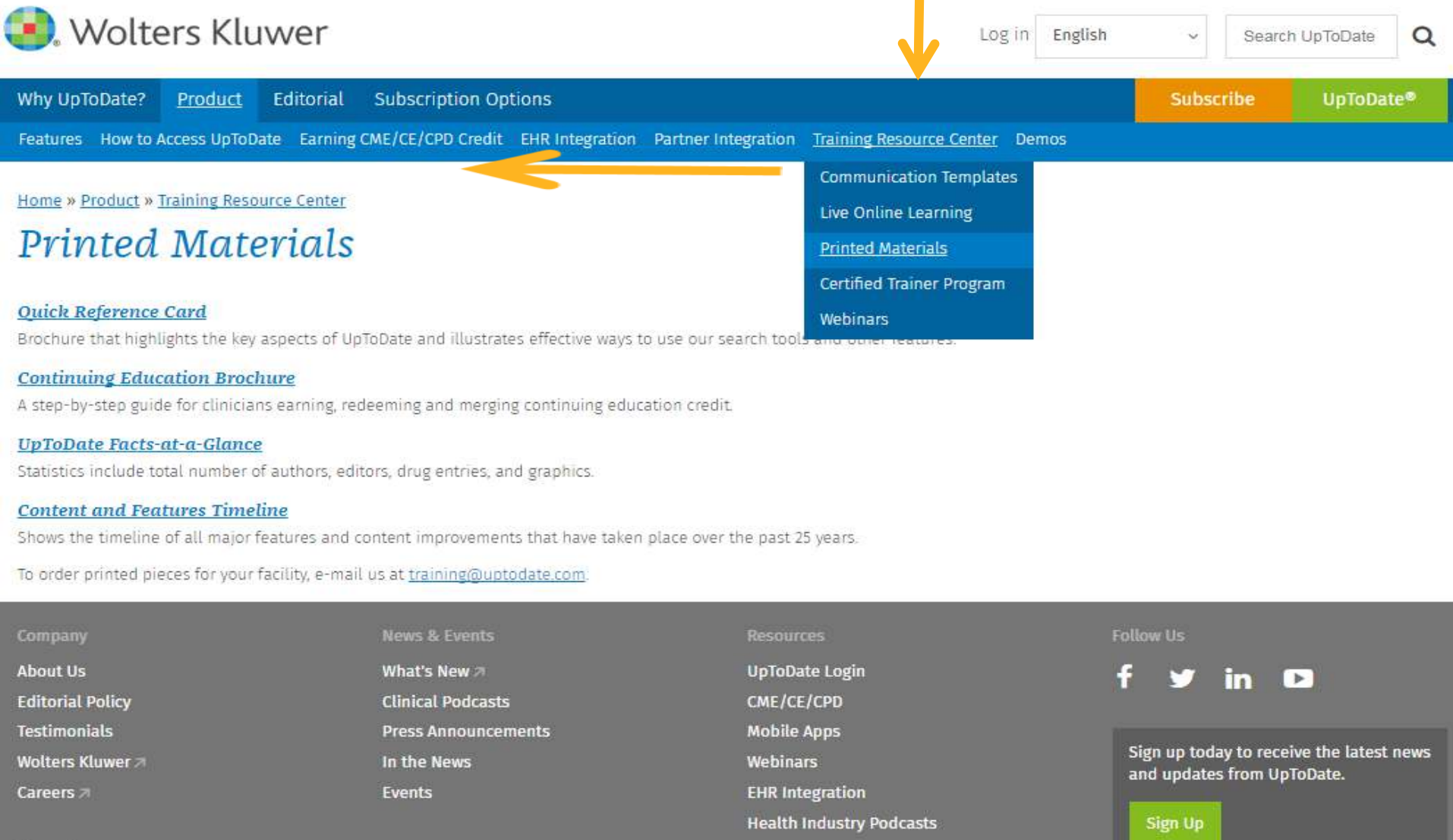
Calculator: Lunging Capacity: Arterial monoxide (DLCO) correction of predicted value for anemia (SI units)

- Calculator: In-Flight PaO2 Estimation
- Calculator: In-Flight PaO2 Estimation (using PFT's)
- Calculator: Nasal Canula Oxygen Fractional Inspired O2 (FIO2) Estimate
- Calculator: Oxygenation Index
- Calculator: Peak Expiratory Flow Prediction

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Do a quick check on
medical calculations

Training resource centre:



The screenshot displays the Wolters Kluwer UpToDate website. At the top, the Wolters Kluwer logo is on the left, and navigation links for 'Log in', 'English', and 'Search UpToDate' are on the right. Below this is a blue navigation bar with links: 'Why UpToDate?', 'Product', 'Editorial', 'Subscription Options', 'Features', 'How to Access UpToDate', 'Earning CME/CE/CPD Credit', 'EHR Integration', 'Partner Integration', 'Training Resource Center', and 'Demos'. An orange arrow points to the 'Training Resource Center' link. A dropdown menu is open under 'Training Resource Center', listing: 'Communication Templates', 'Live Online Learning', 'Printed Materials' (highlighted), 'Certified Trainer Program', and 'Webinars'. Another orange arrow points to the 'Printed Materials' link in the dropdown. The main content area shows the breadcrumb 'Home » Product » Training Resource Center' followed by the heading 'Printed Materials'. Below this are links to 'Quick Reference Card', 'Continuing Education Brochure', 'UpToDate Facts-at-a-Glance', and 'Content and Features Timeline', each with a brief description. At the bottom, there is a footer with four columns: 'Company' (About Us, Editorial Policy, Testimonials, Wolters Kluwer, Careers), 'News & Events' (What's New, Clinical Podcasts, Press Announcements, In the News, Events), 'Resources' (UpToDate Login, CME/CE/CPD, Mobile Apps, Webinars, EHR Integration, Health Industry Podcasts), and 'Follow Us' (Facebook, Twitter, LinkedIn, YouTube). A sign-up box on the right of the footer encourages users to sign up for the latest news and updates.

Wolters Kluwer

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Brochure that highlights the key aspects of UpToDate and illustrates effective ways to use our search tools and other features.

[Continuing Education Brochure](#)

A step-by-step guide for clinicians earning, redeeming and merging continuing education credit.

[UpToDate Facts-at-a-Glance](#)

Statistics include total number of authors, editors, drug entries, and graphics.

[Content and Features Timeline](#)

Shows the timeline of all major features and content improvements that have taken place over the past 25 years.

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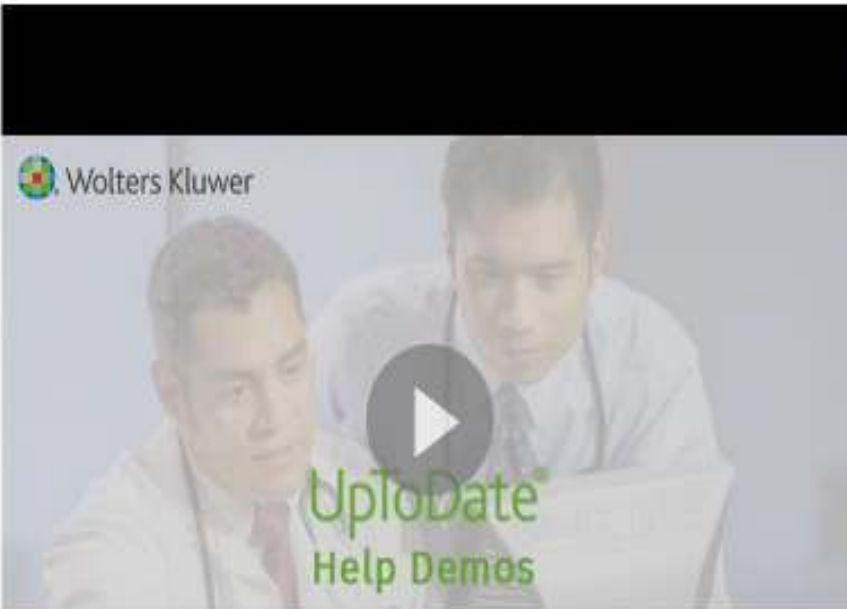
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UpToDate Mini-logo - Users can quickly identify a link to UpToDate when you place the UpToDate icon on a page or menu.

Desktop Icon - Placing an icon on the desktop enables all clinicians within a facility to access UpToDate.

Direct Link to UpToDate - Add a direct link to www.uptodate.com/contents/search to a page or menu within your intranet, portal, or HIS.

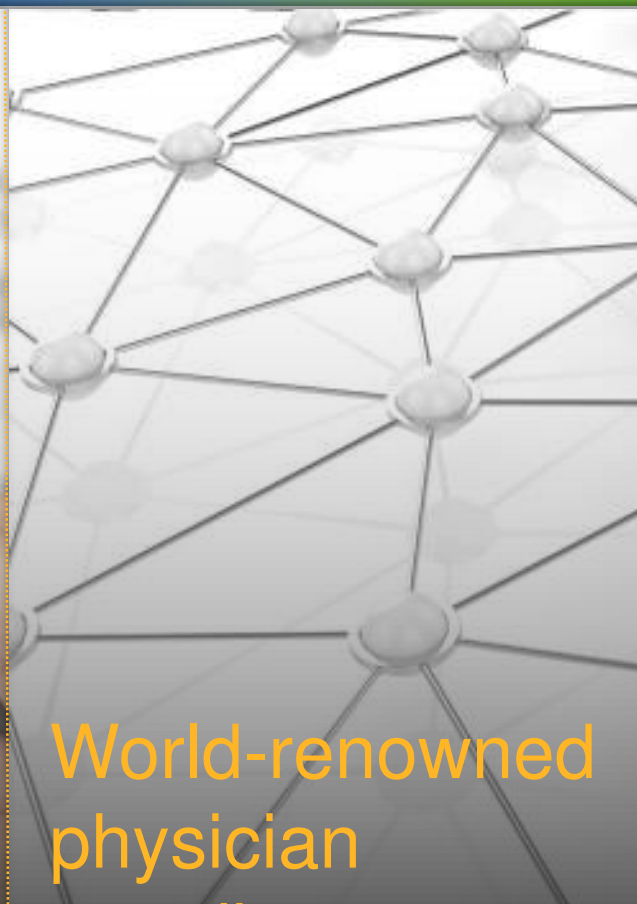
موفق باشيد

Why is it Important to Optimize Access?

What Differentiates UpToDate?



Rigorous
editorial
process



World-renowned
physician
contributors



Advanced
Technology

Uptodate and mobile

<https://www.uptodate.com/home/how-access-uptodate>

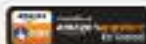
Your experience will be optimized, whether accessing UpToDate from a desktop computer, tablet, or mobile device. Read more about access options in the tabs below.

UpToDate Mobile

OPTIMIZED ACCESS ACROSS MOBILE DEVICES AND BROWSERS

Installed Apps

Individual subscribers and registered UpToDate Anywhere users may install the UpToDate Mobile Apps on up to two devices free of charge. UpToDate Mobile Apps are available in most countries.



The UpToDate Mobile App for Android™ works with Android devices running Android OS version 4.0.3 or higher that have at least 50 MB of free phone memory. SD card installation is supported. The UpToDate Mobile App for iOS® works with any iPhone® or iPad® running iOS 8 or higher.

Mobile Web – Nothing to Install

The user-friendly website is designed to responsively adapt to mobile devices, such as smartphones and tablets. Simply open the browser on your mobile device, go to www.uptodate.com and click **Log in** from the upper right corner. You will find a consistent experience across all mobile platforms that is optimized for smaller screens and tablets and easy to navigate.

BENEFITS OF MOBILE APPS

UPTODATE MOBILECOMPLETE™

PROMOTE ACCESS AT YOUR ORGANIZATION

What's the best mobile option for me?

My Priority	Best Option
My connection speed is often slow (e.g., 2G).	All UpToDate Mobile options are designed to accommodate slower connection speeds.
I often have limited or unpredictable connectivity.	UpToDate MobileComplete downloads the full content of UpToDate to your device for use offline.
I want to take advantage of features like persistent login, bookmarks, history, and Search in Your Own Language.	UpToDate Mobile Apps (iOS®, Android™, and MobileComplete) offer an experience most similar to the desktop interface.
I don't want to download anything to my mobile device.	Access UpToDate Mobile Web by going to www.uptodate.com from your mobile browser.

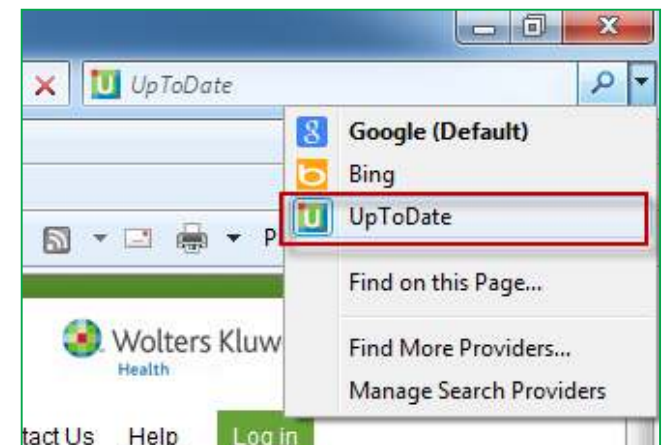
Access Options

Professional Search Box - Allows users to search UpToDate directly from an institution's intranet



UpToDate for Patients Search Box - Enables patients and their families find current, in-depth and unbiased information about a specific condition

Browser Search - Helps you find clinical answers more quickly by bringing you directly to the search results page



Optimization results in an increase in Usage

Announcement of Access with links to widget

Link on main intranet page under popular links

38% increase in usage within the first month

The screenshot shows the NHS intranet home page with the following sections:

- Home** (Navigation: Departments, Forms, Policies, Resources, Directory, Applications, Trainnet, Ask)
- Announcements**: A large graphic with a stethoscope and a tablet displaying a DNA helix, with the text "STAYING UP TO DATE". Below it, a blue banner reads "UpToDate Widget Now Live Announcement for the UpToDate widget".
- Events**: A list of upcoming events including "Paediatric Teaching...", "Matalan NHS Discount W...", "Division of Medicine...", "Volunteering needed - X...", "Opera House Panto 2013...", "IT Courses...", "Lifestyle Fitness Symp...", "New Revised Health and...", "Crash Manchester Swim...", and "Emergency First Aid AT...".
- Classifieds**: A list of classifieds including "Large medical Centre for...", "ZUMBA Tuesdays - RMCH...", "Rock of Ages Musical T...", "Bookcase...", "Wedding Dress £250...", "House Clearance", "TOYOTA AL...", "Samsung galaxy S5630...", "Royal Exchange Theatre...", and "Set of 4 more cassette...".
- System Status**: A section with a "CMFT Shared System" status and a link to "All Other Systems".
- System Links**: A list of links including "Central Intelligence Central Portal", "Clinical Clinical Links Clinical Handbook - Adults", "Email Web Access Change your password", "Incident Reporting Incident Investigation", "RACS All CMFT RACS Images", and "staffnet".
- Popular Links**: A list of links including "New Trust Appraisal Process", "Security Services", "Annual Leave Calculator", "eLearning", "PayScale Information", "Safeguarding", "Interpretation (IFS)", "Team Brief", "Mandatory Training", "EWS", "UpToDate", "Central Island Site Map", "DOBT", "NHS Professionals", "Preceptorship", "Major Incident Plan", "NHS Evidence", "Vacancies", "Occupational Health", and "Pharmacy".
- staffnet Poll**: A poll titled "We have given insight (staff newsletter) a new look, if you have seen it what is your view?" with options "I like better", "I like better", and "No better".
- UpToDate**: A section titled "Access UpToDate® here at Central Manchester University Hospitals NHS Foundation Trust" with the subtitle "Smarter Decisions. Better Care." It describes UpToDate as an evidence-based clinical decision support resource and lists its features, including over 10,000 topics, 21 specialties, and a powerful graphics search. It also mentions remote access and continuing professional development.

Customisable PPT's, posters and local language user guides

The collage features several UpToDate resources:

- Manual del usuario institucional**: A booklet titled "Manual del usuario institucional" with the subtitle "Encuentre respuestas clínicas de manera rápida y fácil para tomar decisiones correctas en el lugar de la atención". It includes an image of hands typing on a laptop.
- UpToDate® Decisions inteligentes. Una mejor atención.**: A poster titled "Acceder a UpToDate en el Hospital Virgen de la Salud de Toledo". It lists features like "Más de 10000 tópicos en más de 21 especialidades" and "Más de 350.000 resúmenes de Medline".
- Biblioteca Virtual**: A screenshot of the UpToDate website interface showing a search bar and various navigation links.
- UpToDate® Busque en su propio idioma**: A poster titled "UpToDate® Busque en su propio idioma" with the subtitle "Los resultados de búsqueda, diagnóstico y tratamiento de UpToDate® están disponibles en múltiples idiomas". It features an image of two healthcare professionals.
- Centro de recursos**: A screenshot of the UpToDate website showing a "Centro de recursos" section with links to "Plan de estudio" and "Materiales de estudio".
- Certified Trainer**: A certificate titled "CERTIFIED TRAINER" issued by UpToDate, signed by a representative.

Yellow callout boxes highlight specific elements:

- Customised training slides**: A yellow box pointing to the "UpToDate® Busque en su propio idioma" poster.
- documentation**: A yellow box pointing to the "CERTIFIED TRAINER" certificate.
- Train the trainer program**: A yellow box pointing to the "CERTIFIED TRAINER" certificate.

The UpToDate logo and the text "Wolters Kluwer Health" are visible in the bottom right corner of the collage.

Thank you!



What are your next steps?

1. Following the suggested links in the Interface toolkit
2. Put us in contact with your IT department, or persons responsible





UpToDate®

Things to present during your demo

- Be able to say what UpToDate is and what it is designed to do (3 points)
- Describe the editorial team - their expertise, what they review and the three tier peer review process
- Conduct a search from the home page outlining the different options
- Show how the results are listed by relevancy and provide topic outlines if you hover over them
- Within a topic, indicate and clearly explain (as part of your presentation) the following elements:
 1. Graded recommendations
 2. Links to drug formulary **and** interactions program
 3. Links to the editorial team
 4. Updates (when and how? Where can you see them?)
 5. References
 6. Graphics (and how you can use them)
 7. Patient leaflets
 8. Calculators and the What's New section

The following slides will outline some of the facts and figures to mention in your demo

[FEATURES](#)[HOW TO ACCESS UPTODATE](#)[EARNING CME/CE/CPD
CREDIT](#)[EHR INTEGRATION](#)[PARTNER INTEGRATION](#)[CONTENT](#)**TRAINING RESOURCE CENTER**[COMMUNICATION TEMPLATES](#)[ONLINE TUTORIALS](#)[PRINTED MATERIALS](#)[WEBINARS](#)[CERTIFIED TRAINER PROGRAM](#)[DEMOS](#)

Training Resource Center

Research has shown that the more that UpToDate® is consistently used, the greater the reduction of adverse events and hospital length of stay.

In an effort to help customers see the same impact at their institutions, UpToDate has developed a comprehensive training and awareness program that includes a number of resources — both print and electronic — to help drive utilization.



Communication Templates

Send customized messages about UpToDate to Clinicians

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Printed Materials

Order or print posters, handouts, brochures and more

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Certified Trainer Program

Become the 'UpToDate expert' at your facility

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Interface Toolkit

Put UpToDate deeper into the clinical workflow with these tools

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Webinars

View our schedule of free webinars

[Learn More »](#)

Review a full list of interacting properties

Lexicomp® Lexi-Interact™

Lookup

Enter item name to lookup.

Analyze

New List

☒ Tobramycin (Systemic, Oral Inhalation)

☒ Typhoid Vaccine

☒ Vitamin A

•Display complete list of interactions for an individual item by clicking item name.

•Add another item(s) [Lookup] to Analyze for potential interactions between items in the list.

•Remove item from the list by clicking the check mark next to the item name.

Customize Analysis

Only interactions

View interaction

Tobramycin (Sy

[D] Typhoid V

Typhoid Vaccin

[D] Tobramycin

Vitamin A

No interaction

Date February 1

Disclaimer Rea

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Lexicomp® Copyr

Lexi-Comp Online™ Interaction Analysis

Lexi-Comp Online™ Interaction Monograph

Title Typhoid Vaccine / Antibiotics

Dependencies:

• Route (oral): Only t

Risk Rating D: Consider

Summary Antibiotics me

Severity Major Reliabilit

Patient Management V

systemic antibacterial ag

Antibiotics Interacting

Cefaclor; Cefadroxil; CeF

Ceftaroline Fosamil; CeF

(Systemic); Clarithromycin

Demeclocycline; Dicloxac

Acid (Systemic); Gemiflo

Lincomycin; Lomefloxacin

Mupirocin; Nafcillin; Nalid

Penicillin G Benzathine; f

Spiramycin; Streptomycin

Telithromycin; Tetracyclin

Acid; Aluminum Acetate;

(Topical); Dapsone (Topi

Acid (Topical); Gatifloxacin

MetroNIDAZOLE (Topica

Sulfadiazine; Sulfacetami

Discussion The prescri

to individuals who are be

oral typhoid vaccine shou

concern regarding the po

the live bacterial strain us

Footnotes

1. Prescribing informatio

2. http://www.cdc.gov/var

August 16, 2010.

3. Wolfe MS, "Precautions with Oral Live Typhoid (Ty 21a) Vaccine," *Lancet*, 1990; 336:631-2. [PubMed 1975401]

Only interactions at or above the selected risk rating will be displayed. [A: ▼]

View interaction detail by clicking on link.

Lexi-Comp Online™ Interaction Lookup

Tobramycin (Systemic, Oral Inhalation)

Interacting Categories

[C] AbobotulinumtoxinA

[C] Amphotericin B

[B] Antifungal Agents (Azole Derivatives, Systemic)

[X] BCG

[C] Bisphosphonate Derivatives

[C] Capreomycin

[C] CARBOplatin

[C] Cephalosporins (2nd Generation)

[C] Cephalosporins (3rd Generation)

[C] Cephalosporins (4th Generation)

[C] CISplatin

[B] Clindamycin (Systemic)

[D] Colistimethate

[C] CycloSPORINE (Systemic)

[B] Fluconazole

[X] Gallium Nitrate

[C] Loop Diuretics

[C] Magnesium Salts

[C] Neuromuscular-Blocking Agents

[C] Nonsteroidal Anti-Inflammatory Agents

[C] OnabotulinumtoxinA

[D] Penicillins

[C] RimabotulinumtoxinB

[D] Sodium Picosulfate

[C] Tenofovir

[D] Typhoid Vaccine

[C] Vancomycin

Date February 17, 2014

X	Avoid combination	C	Monitor therapy	A	No known interaction
D	Consider therapy modification	B	No action needed	<i>More about Risk Ratings</i>	▼

Lexicomp® Drug Interactions

Add items to your list by searching below.

Enter item name

ITEM LIST

Clear List

Analyze

Typhoid Vaccine

Vitamin A

Display complete list of interactions for an individual item by clicking item name.

NOTE: This tool does not address chemical compatibility related to I.V. drug preparation or administration.

X Avoid combination	C Monitor therapy	A No known interaction
D Consider therapy modification	B No action needed	More about Risk Ratings ▼

26 Results

X	Typhoid Vaccine Belimumab	X	Avoid Combination Data demonstrate that the specified agents may interact with each other in a clinically significant manner. The risks associated with concomitant use of these agents usually outweigh the benefits. These agents are generally considered contraindicated.
X	Typhoid Vaccine Dacizumab	D	Consider Therapy Modification Data demonstrate that the two medications may interact with each other in a clinically significant manner. A patient-specific assessment must be conducted to determine whether the benefits of concomitant therapy outweigh the risks. Specific actions must be taken in order to realize the benefits and/or minimize the toxicity resulting from concomitant use of the agents. These actions may include aggressive monitoring, empiric dosage changes, choosing alternative agents.
X	Typhoid Vaccine Dupilumab	C	Monitor Therapy Data demonstrate that the specified agents may interact with each other in a clinically significant manner. The benefits of concomitant use of these two medications usually outweigh the risks. An appropriate monitoring plan should be implemented to identify potential negative effects. Dosage adjustments of one or both agents may be needed in a minority of patients.
X	Typhoid Vaccine Fingolimod	B	No Action Needed Data demonstrate that the specified agents may interact with each other, but there is little to no evidence of clinical concern resulting from their concomitant use.
X	Typhoid Vaccine Immunosuppress		
X	Typhoid Vaccine Ocrelizumab		

[Print](#)

Check for

Lexicomp® Lexi-Interact™

Lookup

Enter item name to lookup.

Analyze New List

☒ Tobramycin (Systemic, Oral Inhalation)

☒ Tdap Vaccine

☒ Vitamin A

•Display complete list of interactions for an individual item by clicking item name.

•Add another item(s) [Lookup] to Analyze for potential interactions between items in the list.

•Remove item from the list by clicking the check mark next to the item name.

Risk Rating	Action	Description
A	No Known Interaction	Data have not demonstrated either pharmacodynamic or pharmacokinetic interactions between the specified agents
B	No Action Needed	Data demonstrate that the specified agents may interact with each other, but there is little to no evidence of clinical concern resulting from their concomitant use.
C	Monitor Therapy	Data demonstrate that the specified agents may interact with each other in a clinically significant manner. The benefits of concomitant use of these two medications usually outweigh the risks. An appropriate monitoring plan should be implemented to identify potential negative effects. Dosage adjustments of one or both agents may be needed in a minority of patients.
D	Consider Therapy Modification	Data demonstrate that the two medications may interact with each other in a clinically significant manner. A patient-specific assessment must be conducted to determine whether the benefits of concomitant therapy outweigh the risks. Specific actions must be taken in order to realize the benefits and/or minimize the toxicity resulting from concomitant use of the agents. These actions may include aggressive monitoring, empiric dosage changes, choosing alternative agents.
X	Avoid Combination	Data demonstrate that the specified agents may interact with each other in a clinically significant manner. The risks associated with concomitant use of these agents usually outweigh the benefits. These agents are generally considered contraindicated.

is

dependent judgment of the most current product information),

Drug Interactions

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cystic fibrosis children

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Tobramycin (ophthalmic): Drug information

cystic fibrosis children Find Print

- Medication Safety Issues
- Adverse Reactions
- Contraindications
- Warnings/Precautions
- Metabolism/Transport Effects
- Drug Interactions**
- Pregnancy Risk Factor
- Pregnancy Implications
- Breast-Feeding Considerations

Tobramycin (ophthalmic): Drug information Lexicomp®

[Access Lexicomp Online here.](#)

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(For additional information [see "Tobramycin \(ophthalmic\): Patient drug information "](#) and [see "Tobramycin \(ophthalmic\): Pediatric drug information"](#))

For abbreviations and symbols that may be used in Lexicomp ([show table](#))

Brand Names: US Tobrex

Brand Names: Canada PMS-Tobramycin; Sandoz-Tobramycin; Tobrex; Tobrexan

Pharmacologic Category Antibiotic, Aminoglycoside; Antibiotic, Ophthalmic

Launch Drug Interactions Program

Medication Safety Issues
Adverse Reactions
Contraindications
Warnings/Precautions
Metabolism/Transport Effects
Drug Interactions
Pregnancy Risk Factor
Pregnancy Implications
Breast-Feeding Considerations
Mechanism of Action
Pharmacodynamics/Kinetics
Pricing: US

Drug Interactions

(For additional information: [Launch drug interactions program](#)) Lexicomp®

There are no known significant interactions.

Pregnancy Risk Factor B ([show table](#))

Pregnancy Implications Adverse events have not been observed in animal reproduction studies. The amount of tobramycin available systemically following topical application of the ophthalmic drops is undetectable (<0.2 mcg/mL) (Filatov 1994). If ophthalmic agents are needed during pregnancy, the minimum effective dose should be used in combination with punctal occlusion to decrease systemic absorption (Samples 1988).

Breast-Feeding Considerations The amount of tobramycin available systemically following topical application of the ophthalmic drops is undetectable (<0.2 mcg/mL) (Filatov 1994). If ophthalmic agents are needed in lactating women, the minimum effective dose should be used in combination with punctal occlusion to decrease systemic absorption (Samples 1988).