



UK Health
Security
Agency

Hydration Health Summit

The burden and challenge of urinary tract infections and related blood stream infections.

Senate House, Malet Street, London WC1E 7HU
Thursday 14th November 2024 9.00am – 16.45pm

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Consultant Medical Microbiologist – London
Science Group
UK Health Security Agency

UTI & blood stream infection

1. The patients - how do they feel
2. The morbidity and mortality?
3. Precautions – what can we all do
4. The environment
5. The antimicrobials

Hydration Health Summit

Enhancing knowledge and understanding
of hydration in health and social care



Thursday 14 November 2024



09:00 AM - 16:45 PM



Senate House, Malet Street,
London WC1E 7HU

Hear from internationally renowned experts on the importance and challenges of maintaining health and wellbeing through good hydration, and innovations currently being tested across England.

Topics include:

- Importance of Fluids in Health
- Water Safety
- Hydration and the Older Person
- Urinary Tract Infections and Gram-negative bloodstream infections
- Importance of Fluid Management and Fluid Balance
- Innovation initiatives such as #ButFirstADrink

Limitations

- The views portrayed are my personal views - Not UKHSA or DHSC policy

Individual ownership, individual responsibility, individual accountability

Patient safety – Quality in healthcare delivery – Zero tolerance

Effective prevention & management

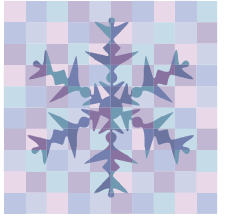
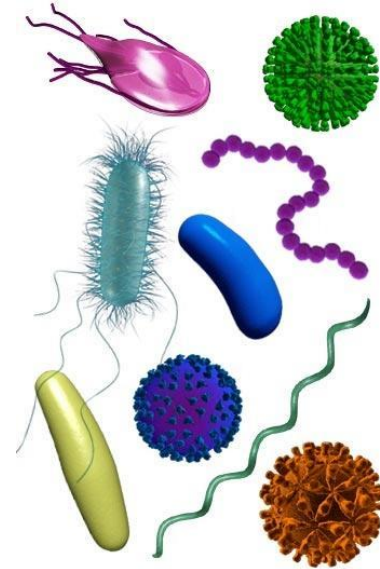
Gram negative organisms

Enterobacterales

E. coli, Klebsiella, Serratia, Enterobacter, Citrobacter

Non Enterobacteriaceae

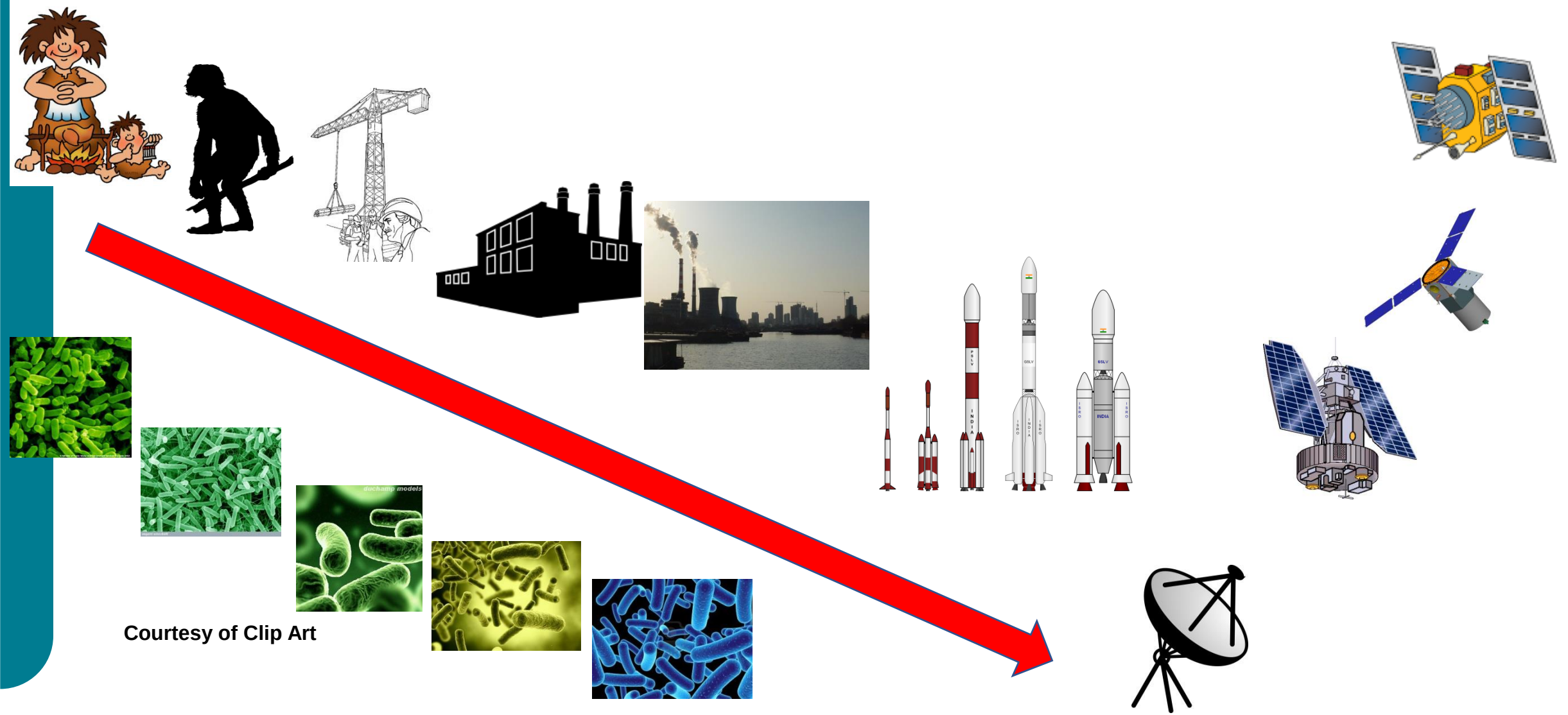
Pseudomonas, Acinetobacter, Stenotrophomonas



Courtesy CDC Public Health Image Library - Jennifer Oosthuizen & Alissa Eckert & National Institute of Allergy and Infectious Diseases (NIAID) AND Images from Clip Art

Evolution – survival of the fittest

Evolution and adaptation

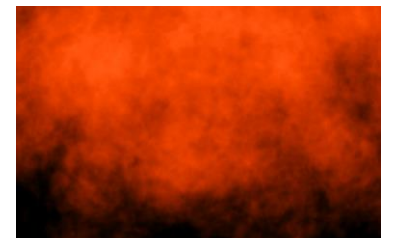
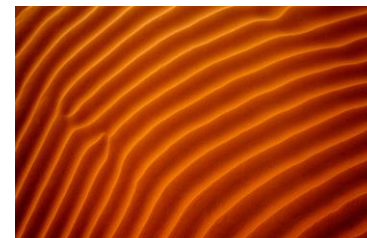
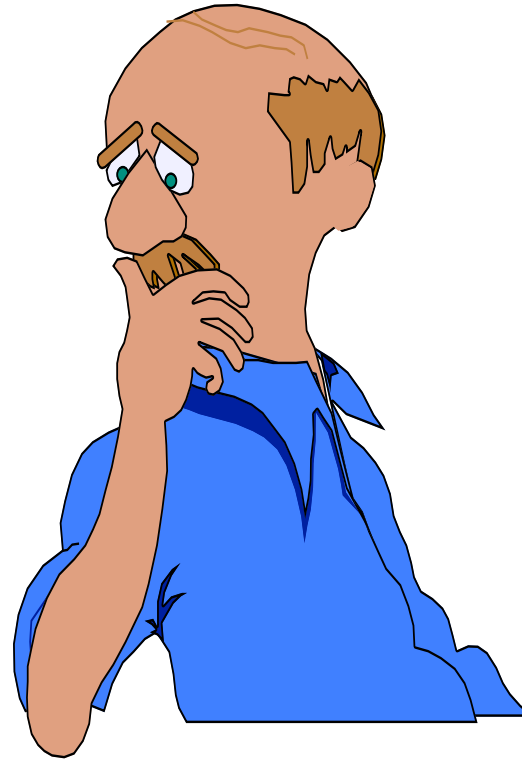


Multiply every 20 mins

What are you expecting from today?

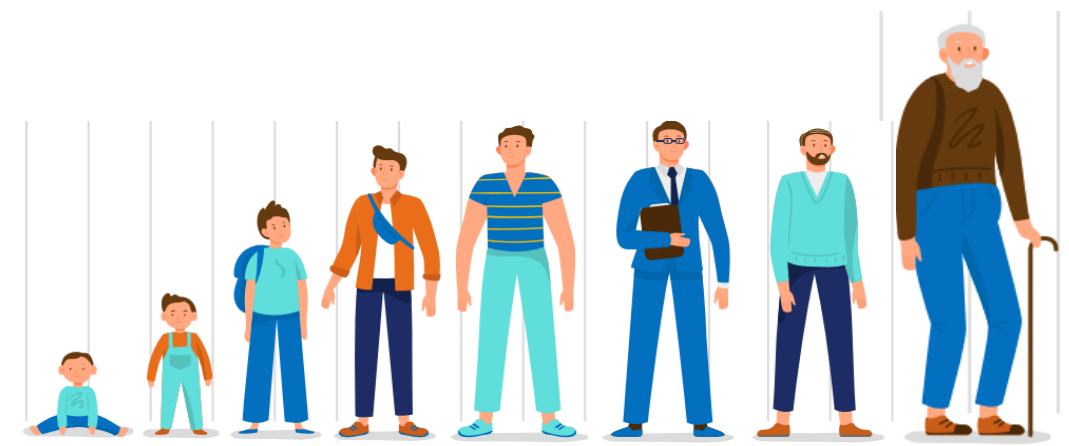
Are you
ready for
the next
decade?

Is the
healthcare
system
ready for
the next
decade?



Overall the elderly population is increasing

- Over the 15 years between mid-2021 and mid-2036, the UK population is projected to grow by 6.6 million people (9.9%) from an estimated 67.0 million to 73.7 million; this includes 541,000 more births than deaths, and net international migration of 6.1 million people.
- The UK population is projected to reach 70 million by mid-2026; this growth is faster than in the 2020-based projections released in January 2023 with the projected increase mainly resulting from international migration.
- There will be an increasing number of older people; over the next 15 years the size of the UK population aged 85 years and over is projected to increase from 1.6 million (2.5% of the total population) to 2.6 million (3.5%).
- Dementia patients projected to rise over the next decade (not part of ONS)



Population by age groups, EU-27, 2001-2070

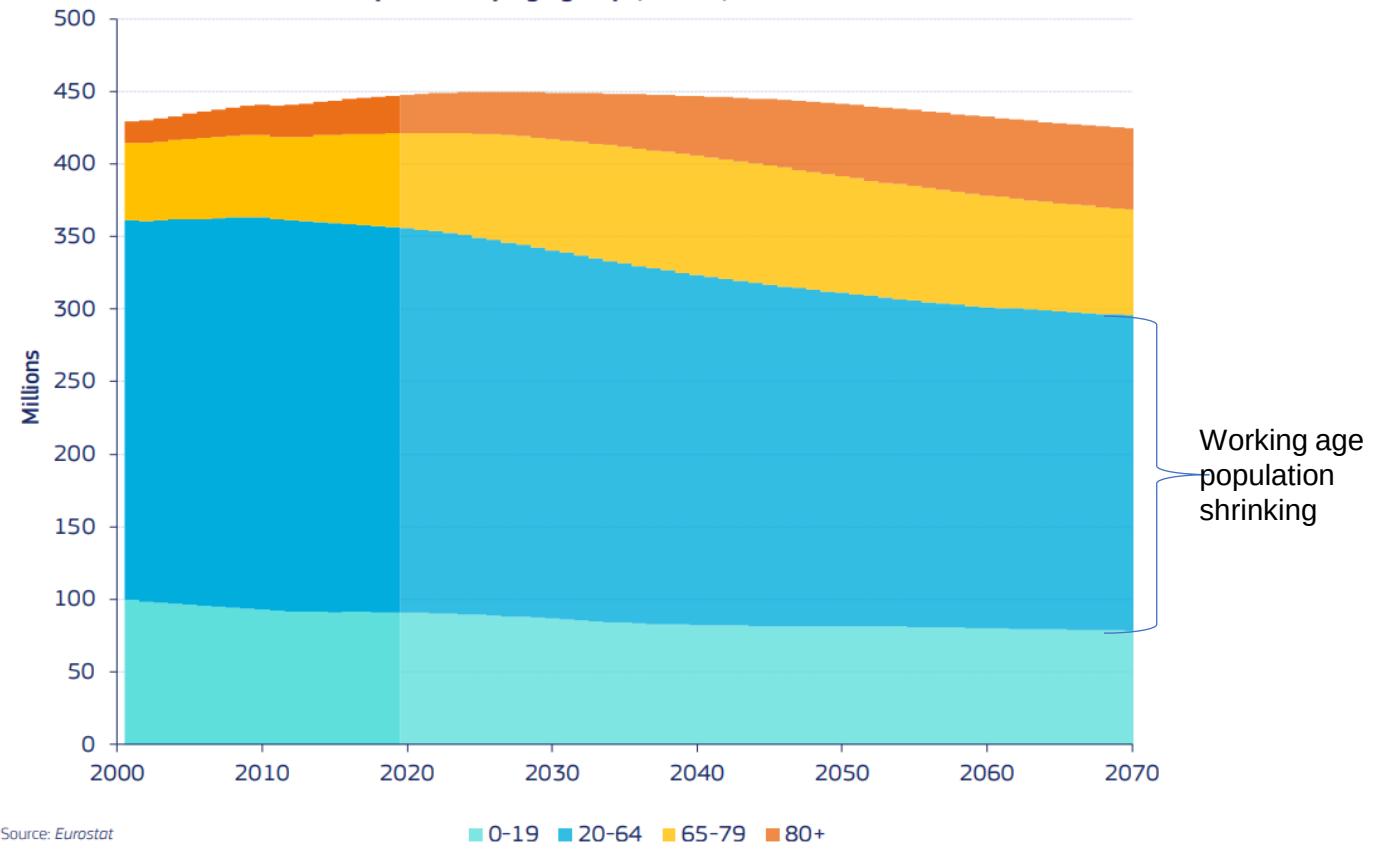
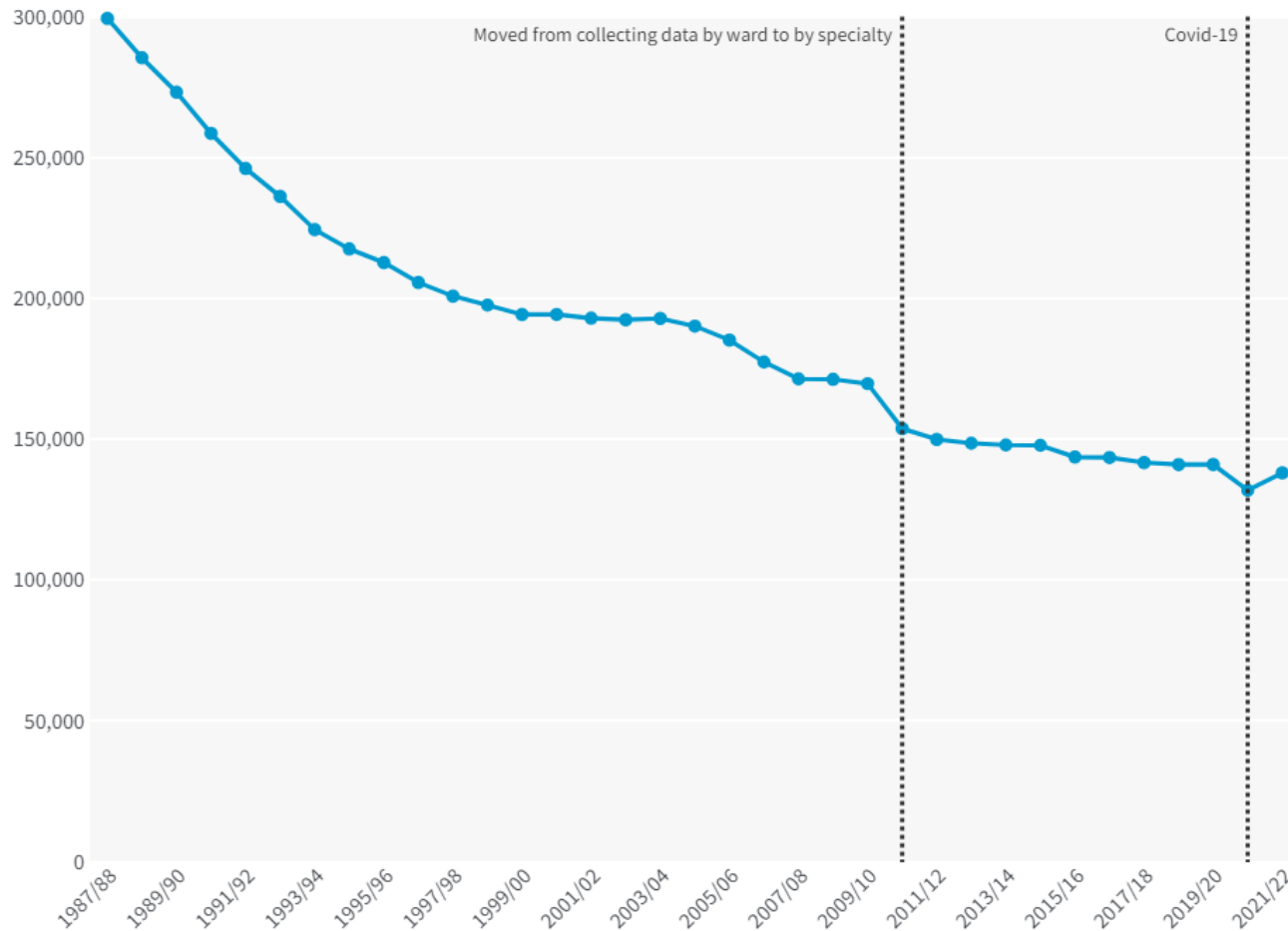


Image courtesy of Eurostat and the text is from the ONS projection report

The number of hospital beds in England has halved over the past 30 years

Average number of hospital beds (overnight and day only)



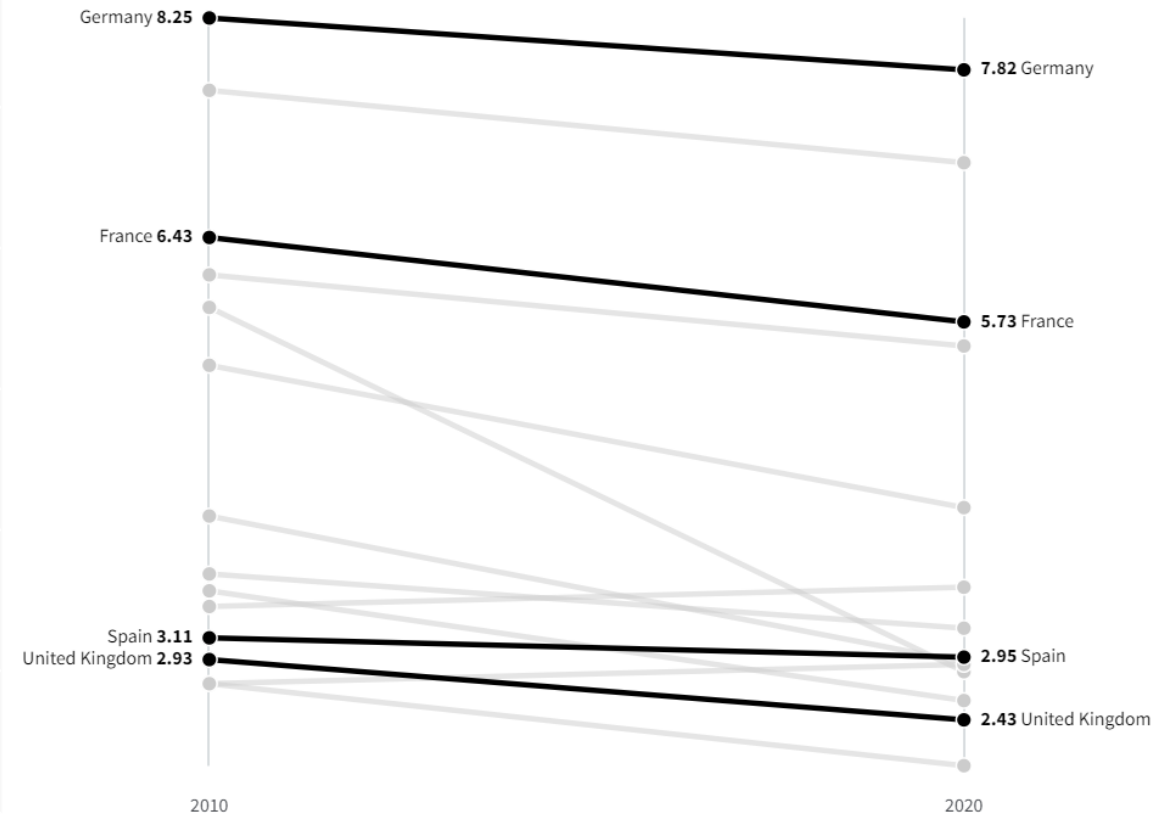
Source: [NHS England \(1987/88 - 2009/10\)](#), [NHS England \(2010/11 onwards\)](#)

The fall in bed numbers in 2020/21 reflects the impact of the Covid-19 pandemic, for example infection control measures meaning few beds can be accommodated in the same space.

TheKingsFund

Over the past 10 years hospital bed numbers have fallen in many countries

Number of hospital beds per 1,000 population



Source: [OECD](#)

Data for all EU15 countries, except Greece as 2020 data is not available. 2020 used as the most recent comparator as 2021 and 2022 data not yet widely available.

TheKingsFund

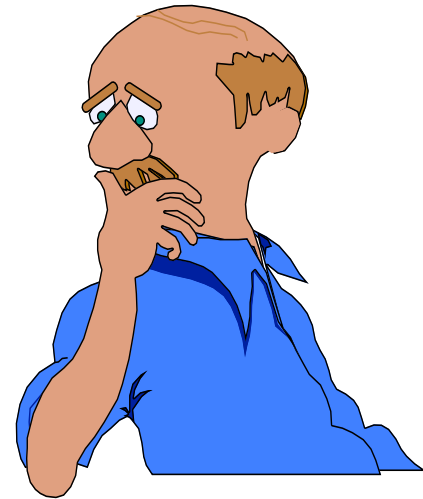
What does the term UTI mean?

The patients

- Infant
- Child
- Young woman
- Older woman
- Older man
- Catheterised person

The professionals

- Carer
- Healthcare Worker
- Care Worker
- Nurse
- Pharmacist
- Doctor



- **Urinary tract infections (UTIs) affect your urinary tract, including your bladder (cystitis), urethra (urethritis) or kidneys (kidney infection). UTIs may be treated with antibiotics, but they're not always needed.**

Symptoms of a urinary tract infection (UTI) may include:

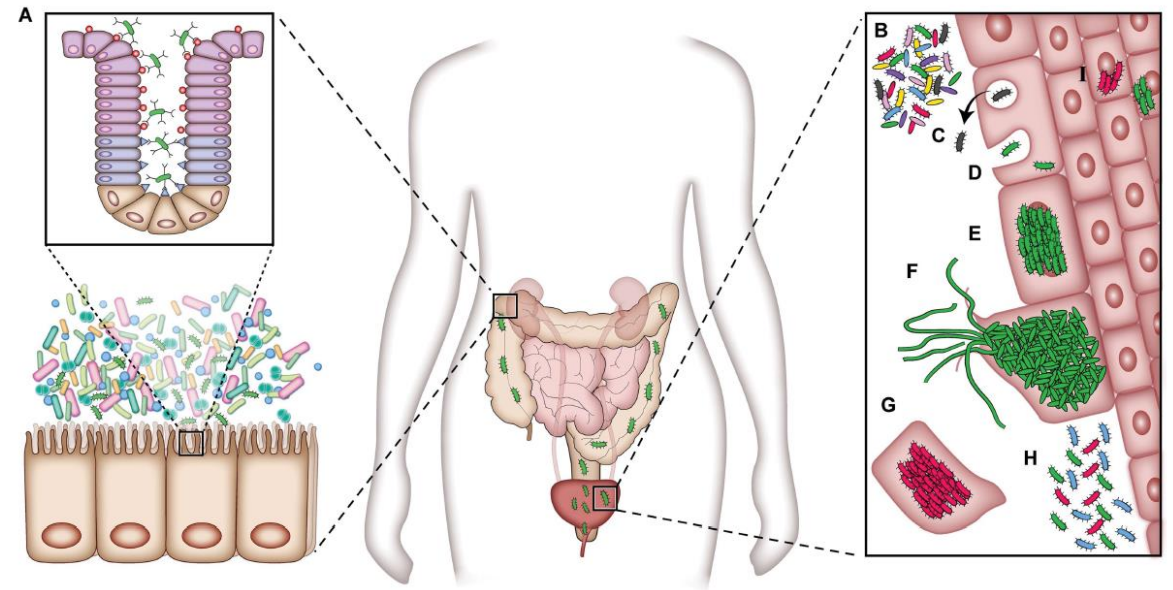
- pain or a burning sensation when peeing (dysuria)
- needing to pee more often than usual
- needing to pee more often than usual during the night (nocturia)
- needing to pee suddenly or more urgently than usual
- pee that looks cloudy
- [blood in your pee](#) (infection or bladder or prostate cancer)
- lower tummy pain or pain in your back, just under the ribs
- a high temperature, or feeling hot and shivery
- a very low temperature below 36C

Your pee may also be dark or smell. If this is your only symptom, it might be because you've not been drinking enough water.

Simple Medical Definition

- UTIs are classified as either:
 - lower (confined to the bladder)
 - or upper (pyelonephritis),
- and as either:
 - uncomplicated or
 - complicated.
- an uncomplicated UTI is one occurring in a normal host who has no structural or functional abnormalities, is not pregnant, or who has not been instrumented (for example, with a catheter or -scoped).
- all other UTIs are considered complicated.

Foxman, B. *Nat. Rev. Urol.* 7, 653–660 (2010);



Tamaddonfar KO, Omattage NS, Spaulding CN, Hultgren SJ. 2019. Reaching the end of the line: urinary tract infections. *Microbiol Spectrum* 7(3):BAI-0014-2019.

Complicated UTI carries more significant morbidity, carry a higher risk of treatment failure, and typically require longer antibiotic courses, and further investigations

What does the term UTI mean?

Covers a wide clinical context

Male

- Neonatal UTI
- Childhood UTI
- Uncomplicated UTI
- Complicated UTI
- Adult UTI
- Recurrent UTI
- UTI associated with Prostatic Disease

Female

- Neonatal UTI
- Childhood UTI
- Uncomplicated UTI
- Complicated UTI
- Adult UTI
- Recurrent UTI
- Pregnancy UTI

Age

Diabetes

Dementia

projected – 1m by 2025

Long Term Catheter

- urethral

- suprapubic

Bladder Cancer

Immunocompromised

Nephrostomy

Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- The NHS and UK Health Security Agency (UKHSA) are raising awareness of urinary tract infections (UTIs), as [new data shows](#) they have led to more than 800,000 admissions to hospitals across the country over the past five years.
- While UTIs are a year-round concern, ahead of what is expected to be another busy winter in the NHS, clinical leaders are reminding people – **particularly those aged 65 and older, and carers – of the steps they can take to reduce their risk of getting a harmful infection.**
- Some of the symptoms of UTI include needing to pee more frequently or urgently than usual, pain or a burning sensation when peeing, new pain in the lower tummy, kidney pain or pain in the lower back, blood in the pee, and for older people can include changes in behaviour such as acting agitated or confused.

[NHS England » New awareness campaign to help reduce hospital admissions for urinary tract infections](#)

<https://www.england.nhs.uk/2023/10/new-awareness-campaign-to-help-reduce-hospital-admissions-for-urinary-tract-infections/>

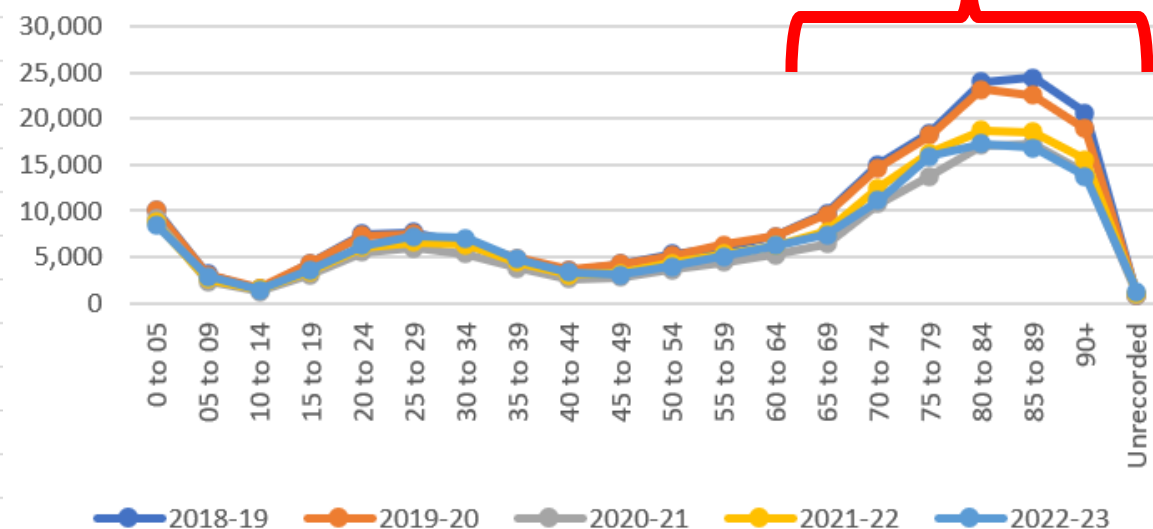
A count of Finished Admission Episodes (FAEs), with a primary diagnosis of Urinary Tract Infection (UTI), broken down by patient age, for the period 2018-19 - 2022-23.

Activity in English NHS Hospitals and English NHS commissioned activity in the independent sector

Age group	2018-19	2019-20	2020-21	2021-22	2022-23
0 to 05	10,108	10,009	9,147	8,791	8,535
05 to 09	3,169	3,065	2,397	2,637	2,886
10 to 14	1,554	1,627	1,280	1,511	1,496
15 to 19	4,392	4,376	3,076	3,479	3,639
20 to 24	7,526	7,346	5,516	6,047	6,239
25 to 29	7,654	7,493	6,003	6,622	7,261
30 to 34	6,369	6,377	5,325	6,300	7,079
35 to 39	4,515	4,862	3,782	4,477	4,776
40 to 44	3,525	3,651	2,594	3,092	3,345
45 to 49	4,274	4,261	2,822	3,297	3,107
50 to 54	5,361	5,185	3,602	4,309	3,955
55 to 59	6,079	6,379	4,460	5,361	5,101
60 to 64	7,200	7,266	5,243	6,252	6,210
65 to 69	9,779	9,560	6,463	7,762	7,458
70 to 74	15,020	14,614	10,729	12,526	11,092
75 to 79	18,460	18,189	13,713	16,287	15,964
80 to 84	23,923	23,159	17,124	18,759	17,280
85 to 89	24,419	22,509	17,281	18,506	16,858
90+	20,604	18,940	14,091	15,546	13,740
Unrecorded	863	917	946	1,134	1,264
All	184,794	179,785	135,594	152,695	147,285

Source: Hospital Episode Statistics (HES), NHS England

A count of finished admission Episodes - primary diagnosis of UTI



3. Diagnosis codes used

N39.0 Urinary tract infection, site not specified

O23.4 Unspecified infection of urinary tract in pregnancy

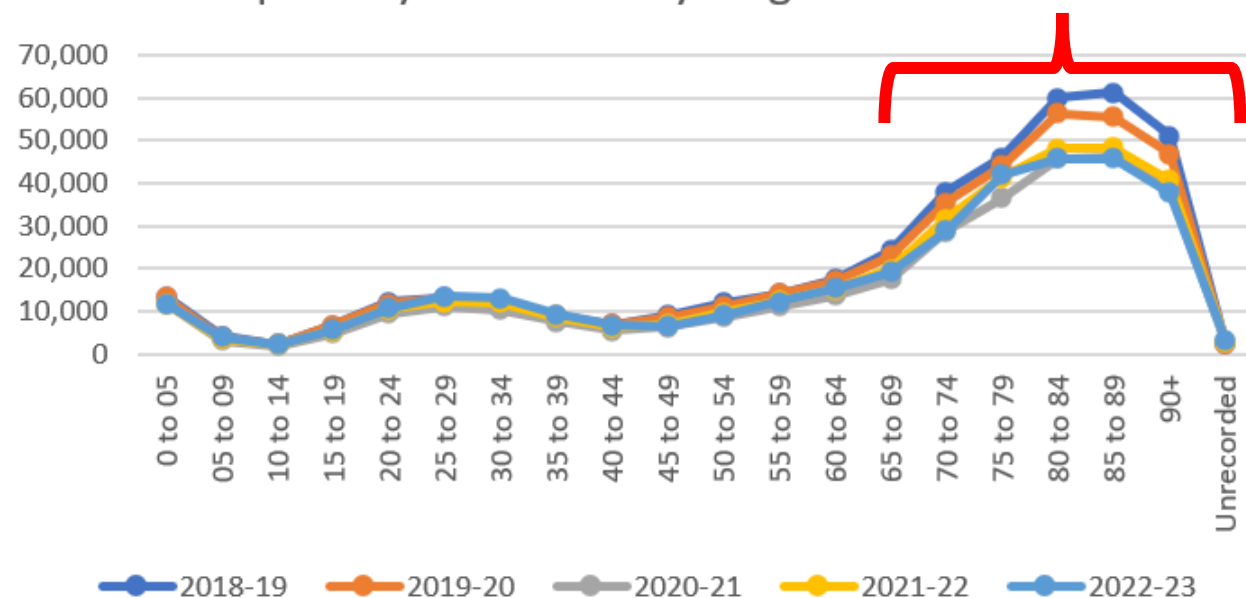
O86.2 Urinary tract infection following delivery

P39.3 Neonatal urinary tract infection

A count of Finished Admission Episodes (FAEs), with a primary or secondary diagnosis of Urinary Tract Infection (UTI), broken down by patient age, for the period 2018-19 - 2022-23.

Age group	2018-19	2019-20	2020-21	2021-22	2022-23
0 to 05	13,548	13,257	11,927	11,863	11,874
05 to 09	4,293	4,111	3,115	3,569	4,002
10 to 14	2,332	2,434	1,975	2,290	2,266
15 to 19	6,854	6,675	4,838	5,415	5,813
20 to 24	12,245	11,880	9,480	10,494	10,734
25 to 29	13,258	13,026	11,149	12,235	13,428
30 to 34	11,634	11,436	10,355	11,973	13,142
35 to 39	8,861	9,111	7,670	8,732	9,356
40 to 44	7,007	6,950	5,549	6,440	6,822
45 to 49	9,163	8,631	6,348	6,962	6,490
50 to 54	11,951	11,280	8,698	9,690	9,115
55 to 59	14,258	14,126	11,114	12,564	12,322
60 to 64	17,525	17,016	13,747	15,304	15,463
65 to 69	24,317	23,012	17,462	19,757	19,261
70 to 74	37,928	35,534	28,796	31,766	28,865
75 to 79	46,027	44,111	36,531	41,373	41,936
80 to 84	59,914	56,328	45,843	48,166	45,885
85 to 89	61,215	55,451	46,139	48,268	45,734
90+	51,146	46,841	38,595	40,703	37,773
Unrecorded	2,384	2,244	2,725	2,981	3,208
All	415,860	393,454	322,056	350,545	343,489
Source: Hospital Episode Statistics (HES), NHS England					

A count of Finished Admission Episodes with a primary or secondary diagnosis of UTI



3. Diagnosis codes used

N39.0 Urinary tract infection, site not specified

O23.4 Unspecified infection of urinary tract in pregnancy

O86.2 Urinary tract infection following delivery

P39.3 Neonatal urinary tract infection

Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- A range of resources, including posters, have been developed for local NHS areas to share with all their services, including GP practices. They will also be shared with charities, royal colleges, care homes, and other relevant groups in the health and care sector to ensure as many older people and their carers have access to the information as possible.
- The campaign also highlights **the importance of keeping hydrated by regularly drinking enough fluids, going to the toilet as soon as possible when you need to, and washing or showering regularly to make sure the genital area is kept clean and dry.**
- Older adults are more prone to UTIs – making up almost three fifths of admissions for UTIs over the past five years.

[NHS England » New awareness campaign to help reduce hospital admissions for urinary tract infections](https://www.england.nhs.uk/2023/10/new-awareness-campaign-to-help-reduce-hospital-admissions-for-urinary-tract-infections/)

<https://www.england.nhs.uk/2023/10/new-awareness-campaign-to-help-reduce-hospital-admissions-for-urinary-tract-infections/>

Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- New data, published today, shows there were over 1.8 million hospital admissions involving UTIs between 2018-19 and 2022-23 – the majority of which involved patients aged 65 and older. This includes admissions because of UTIs as well as those for another reason where the patient also had a UTI.
- **Last year (2022/23), of the 147,285 admissions with a primary diagnosis of UTI, 56% (82,392) were people over 65 years old, with the highest number in the 80-84 age group (17,280 admissions).**
- Additionally, UTIs are one of the leading causes of life-threatening E. coli bloodstream infections in England, and are a major contributor to the burden of antibiotic resistant infections in this country. A quarter of urine samples analysed in the first half of 2023 had bacteria resistant to a common type of antibiotic used in treatment.
- If left **unmanaged UTIs can lead to severe infection, sepsis, and in the most serious cases death.**

[NHS England » New awareness campaign to help reduce hospital admissions for urinary tract infections](https://www.england.nhs.uk/2023/10/new-awareness-campaign-to-help-reduce-hospital-admissions-for-urinary-tract-infections/)

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Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- **Professor Sir Stephen Powis, NHS national medical director, said:** “As we get closer to what is likely to be another challenging winter in the health service, it is a good opportunity to remind people of the range of services available in the NHS and the best way to get the right care for their needs, which can help avoid unnecessary trips to A&E – these include using NHS 111, speaking to a pharmacist or GP, or visiting an urgent care walk-in centre.
- “And this joint campaign with UKHSA is a **timely reminder for older people and carers of the importance of keeping hydrated year-round – not just during warmer months – going to the toilet when you need to, and regular washing, which can all help avoid preventable infections like UTIs, that if left untreated can become serious infections and can lead to admission to hospital.**
- “So if you or someone you care for has any symptoms like pain when peeing, a high temperature, lower tummy pain, or changes in behaviour, please seek advice as soon as possible from your **GP, a walk-in centre, community pharmacist, or by calling NHS 111, as the quicker a UTI is detected, the faster and easier it is to treat.**”

[NHS England » New awareness campaign to help reduce hospital admissions for urinary tract infections](https://www.england.nhs.uk/2023/10/new-awareness-campaign-to-help-reduce-hospital-admissions-for-urinary-tract-infections/)

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Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- The campaign comes ahead of Infection Prevention Control week, and as the NHS has been busy preparing for what is expected to be another winter of pressure in the health service, following **last winter's record demand for emergency care, the significant number of people being treated in hospital for respiratory illnesses like flu and covid, and high bed occupancy.**
- A key aim of the **urgent and emergency care recovery plan**, published earlier this year, is the **expansion of out-of-hospital care so patients can be treated and recover in the comfort of their own homes.**
- One of the plan's initiatives has been to increase referrals into **urgent community response teams**, which respond to calls normally requiring an ambulance crew, and allow people to get care and treatment at home within two hours, **avoiding a trip to A&E when clinically appropriate.** Since April last year, these have been available across England.

Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- Patients who would require inpatient care can **also receive hospital-level treatment through a virtual ward, and UCR teams – and other healthcare professionals, including GPs – can refer a patient to a virtual ward if a longer period of treatment is needed to manage their condition.**
- **Virtual wards – or “hospital at home” services – mean patients with acute medical problems including UTIs and dehydration can be seen by clinical teams, who deliver the same level of high-quality patient care and have access to the same investigations and treatment they would receive in hospital.** Patients are closely monitored which enables clinicians to recognise early deterioration and adjust treatment if needed.

Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- **Dr Colin Brown, Deputy Director for Antimicrobial Resistance at UKHSA, said:**
“Urinary Tract Infections are incredibly common and while most people can manage their infection at home with painkillers and plenty of fluids, some do go on to develop much more serious complications, such as kidney or bloodstream infections that need hospital treatment.
- “These more serious consequences are more common in people over the age of 65 so we are reminding this group in particular to be aware of the ways they can help reduce their risk of getting poorly. Drinking enough fluids is so important, as well as avoiding holding onto pee. Regular washing and keeping dry can also help reduce the risk of infections.”

[NHS England » New awareness campaign to help reduce hospital admissions for urinary tract infections](https://www.england.nhs.uk/2023/10/new-awareness-campaign-to-help-reduce-hospital-admissions-for-urinary-tract-infections/)

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Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- **Professor Adam Gordon, President of the British Geriatrics Society, said:** “Most urinary tract infections can be managed at home if they’re spotted in time. But they can be serious, and lead to hospitalisation, if they continue without treatment. We would encourage people to be vigilant for signs of urinary infection, and to seek help if they’re worried about this. People with dementia may not be able to report symptoms, and so it’s important that carers are on the lookout for sudden changes in toileting habits, or other behaviours, that might indicate infection. We support the NHS and UKHSA in raising awareness about this important issue”.
- **To prevent getting a UTI, the NHS and UKHSA are reminding older adults to:**
 - **drink enough fluids regularly**
 - **avoid holding pee - instead, go to the toilet as soon as possible when you need to**
 - **wash, or shower daily where possible especially if you suffer from incontinence**
 - **keep the genital area clean and dry and check and change leakage of urine pads often**
 - **wash genitals before and after sex.**

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Why are UTIs so important?

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- **Older adults, particularly people 65 years and older are more prone to UTIs** and while both sexes can get a UTI, **UTIs are more common in women than men.** Women have a shorter urethra than men and bacteria are therefore more likely to reach the bladder or kidneys and cause an infection.
- Symptoms of UTIs can include:
 - pain or a burning sensation when peeing (dysuria)
 - needing to pee more often than usual
 - needing to pee more often than usual during the night (nocturia)
 - needing to pee suddenly or more urgently than usual
 - pee that looks cloudy
 - blood in your pee (infection, bladder cancer, prostate cancer)
 - lower tummy pain or pain in your back, just under the ribs
 - a high temperature, or feeling hot and shivery
 - a very low temperature below 36C.

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Why are UTIs so important?

Especially, in certain groups

New awareness campaign to help reduce hospital admissions for urinary tract infections 12 October 2023

- In older, **frail people who have problems with memory, learning and concentration (such as dementia), and people with a urinary catheter, symptoms** of a UTI may also include:
 - **changes in behaviour, such as acting agitated or confused (delirium)**
 - **wetting themselves (incontinence) that is worse than usual**
 - **new shivering or shaking (rigors).**
- More information can be found at www.nhs.uk/conditions/urinary-tract-infections-utis

Quality & Improvement Work

– what can be achieved with a little effort and focus

March 2018

A single care home in ENHertsCCG in a 7 month period:

Antibiotic UTI Rx fell 78%

Acute admissions fell 67%

Acute admissions due to falls reduced 67%

Acknowledging colleagues
who presented at a NHS
initiative a few years ago

- Initial results Jul-Dec 2015 NHS Bath and North East Somerset
- 56% reduction in the proportion of residents who had an antibiotic for a UTI
- 143 / 690 residents had at least one antibiotic for a UTI in 6 month period Jul-Dec 2015 after implementation
- 67% reduction in the number of antibiotic prescriptions
- 153 fewer in 6 month period in 8 nursing homes with pre and post data
- 82% reduction in the number of residents prescribed antibiotic prophylaxis
- 13 / 690 residents had antibiotic prophylaxis in 6 month period Jul-Dec 2015 after implementation
- Unplanned hospital admissions for UTI, urosepsis and AKI reduced in the nursing home population following implementation

Other matters

UTI Diagnostics

- Dipstick of limited use in elderly – see NICE guidelines
- MSU
- CSU – only in limited cases
- Suprapubic catheter samples or aspiration in the younger age groups

Therapeutics

- Prevention
- Informed choice of antimicrobials
- Phage treatment

General principals

- **Do not perform urine dipsticks**
- Dipsticks become more unreliable with increasing age over 65 years.
- By 80 years half of older adults, and **most** with a urinary catheter, will have bacteria present in the bladder/urine without an infection.
- This “asymptomatic bacteriuria” is not harmful, and although it causes a positive urine dipstick, antibiotics are not beneficial and may cause harm
- Dark or foul smelling urine alone does not mean infection, and **may be a sign of dehydration.**

Suspected sepsis alert

UTI symptom

Action advised

Other advice

- Multiple studies have shown a direct association between antibiotic use and the selection and spread of antimicrobial resistance at the population level, including total antibiotic prescribing and proportion of broad spectrum antibiotics prescribed.
- Most antibiotics (80-90%) are prescribed outside of hospitals in high income countries. The pattern of antibiotic prescribing in primary care is therefore an important and modifiable driver of antimicrobial resistance.
- Quinolones have been used extensively for treating uncomplicated UTIs in some countries. This group of antibiotics is a key driver of resistance and associated with substantial adverse effects on nerves, muscles, and tendons. (UK – MHRA alerts)

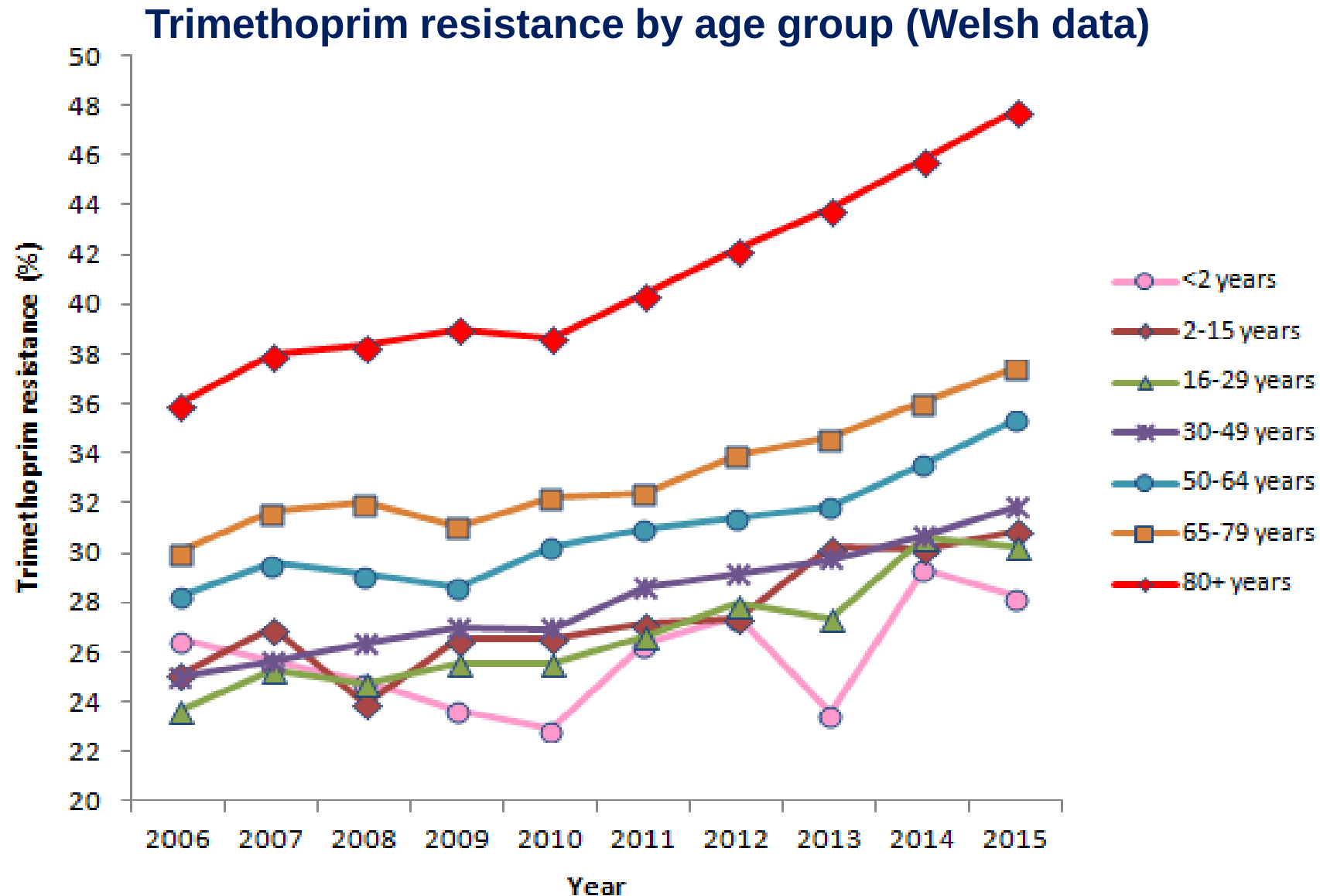
- In a linked The BMJ paper (doi:10.1136/bmj-2023- 076305), Schmiemann and colleagues report a large, cluster randomised, controlled trial targeting the use of second line antibiotics for women with uncomplicated UTIs attending general practices in Germany.
- The authors evaluated a multimodal intervention **in each practice**, consisting of guideline recommendations, **quarterly feedback on antibiotic prescribing**, benchmarking, telephone counselling, and **provision of local resistance data for the most common uropathogens**.
- The trial found that **intervention practices prescribed a significantly lower proportion of second line antibiotics for UTIs than did control practices** (after adjustment for preintervention proportions, mean difference was -0.13 ((95% confidence interval -0.21 to -0.06), $P < 0.001$).
- Additionally, **these practices prescribed antibiotics for a significantly lower proportion of UTIs after one year** (mean difference was -0.08 (95% confidence interval -0.15 to -0.02), $P < 0.029$).
- Complication rates were similar in both groups. The benefits of the intervention were found to be **sustained over the one year period and were most effective among high prescribing practices**.

- This study has important implications for the management of UTIs in primary care, and shows that antibiotic prescribing behaviour at the practice level can change. Pragmatic audit and feedback interventions seem to be the most efficient way of changing practice behaviour, as previously shown for respiratory tract infections.
- Schmiemann and colleagues' trial also confirms that patients with mild to moderate symptoms can be treated safely without antibiotics, in line with previous studies.
- **Another important arena in primary care is management of UTIs in nursing home residents.**
- **Asymptomatic bacteriuria, which are highly prevalent in this setting, need no antibiotic treatment.**
- Audit and feedback have also been important in reducing antibiotic prescribing for UTIs in nursing homes.
- Overall, open discussions among peers and formal comparison with other GPs seem essential in any successful intervention related to infections in primary care.

- Prevention of recurrent UTIs is another important topic, including whether to use low dose antibiotics or other drugs. Among the alternative options, **methenamine** is still used and more studies are needed to clarify the possible effect of this drug on recurrent UTIs.
- Prudent use of antibiotics and antimicrobial resistance should be a **compulsory topic in postgraduate education** for primary care prescribers, including dentists.
- Use of local antimicrobial susceptibility data was an important and novel component of Schmiemann and colleagues' trial. Resistance rates are essential to the choice of antibiotic for UTIs. Local data also show important differences in resistance rates between women with single and with recurrent UTIs, which have implications for prescribing practice. **Local resistance to first line antibiotics (except trimethoprim) was significantly less common than resistance to second line antibiotics in non-recurrent UTIs, suggesting a lower propensity for first line drugs to develop resistance.**
- Overall, these findings call for enhanced cooperation between microbiology services and primary care clinicians. Yearly local resistance rates should be made available to GPs, alongside professional discussions. This approach has been successful in Norway where the surveillance system for antimicrobial resistance in human pathogens reports annual national and regional data for antibiotic use and resistance rates for the clinically most important bacterial species.

Evidence:

Antibiotic resistance is increasing Age specific resistance



Routine laboratory data generated by the Welsh
Antimicrobial Resistance Programme, Public Health Wales

Courtesy
Dr Clodna McNulty

Evidence:

Antibiotic resistance affects your patients with UTI

Clinical outcomes of UTIs in English general practice treated with empirical trimethoprim

Prospective study of 497 women (18–70 years) with ≥ 2 UTI symptoms

	Patients with		<i>p</i> -value
	Resistant UTI	Susceptible UTI	
Median time to symptom resolution (207)	7 days	4 days	0.0002
Re-consultation in first week or less (317)	17/44, 39%	17/273, 6%	<0.0001
Further antibiotic in first week (317)	16/44, 36%	11/273, 4%	<0.0001
Still had bacteriuria at 1 month (132)	8/19 42%	23/113, 20%	0.04

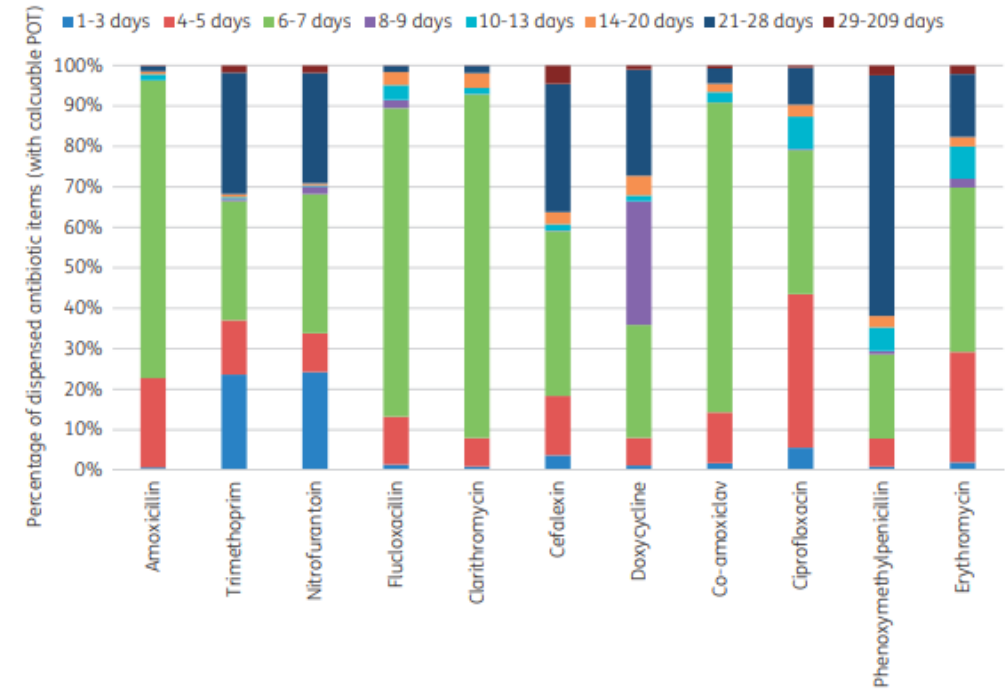
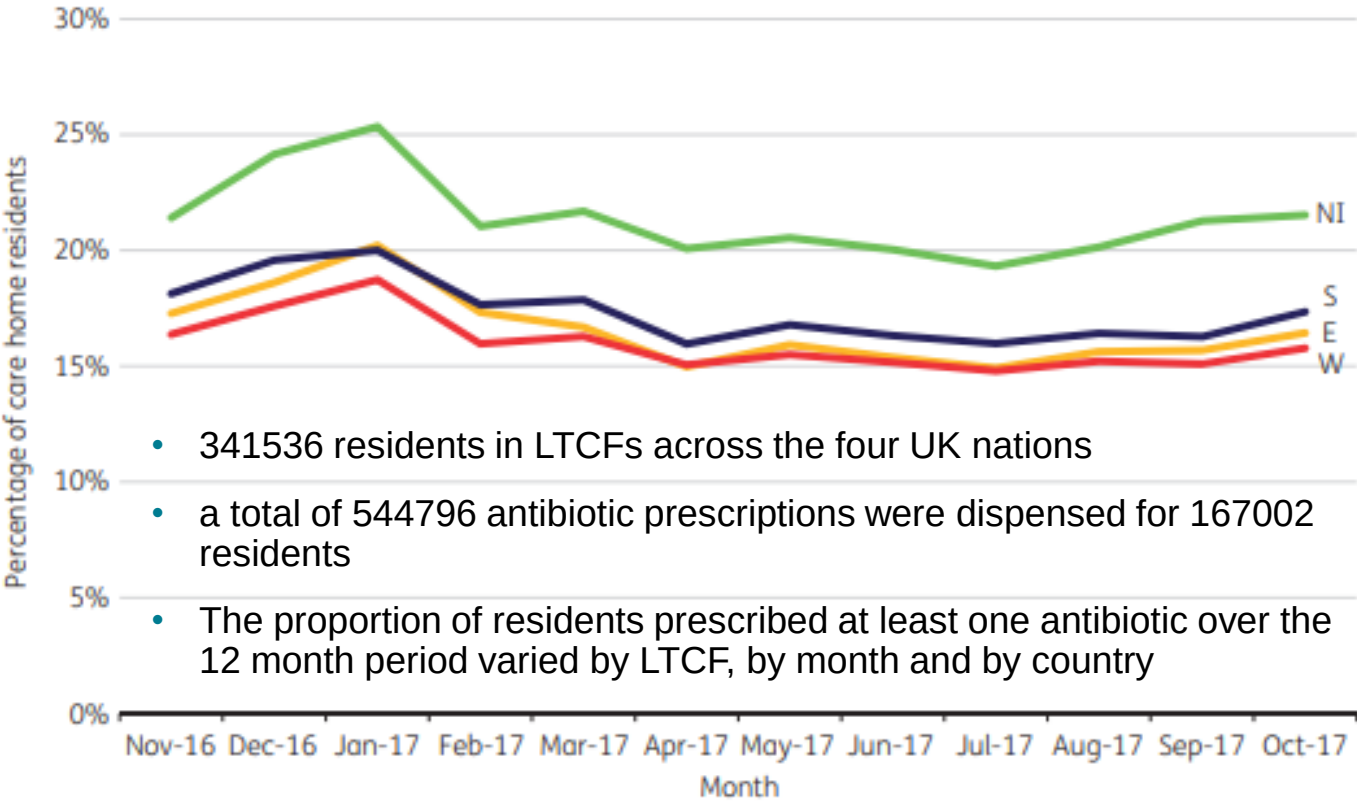
Urine antimicrobial susceptibility Laboratory Data from London North West University Healthcare NHS Trust 2016-2022

%Resistance	1 Jan 16-30 Dec 17		2018		2019		2020		2021		
	All urines		GP MSU		GP MSU		GP MSU		MSU & CCU		
Antibiotic	<i>E coli</i> n= apprx 15,700	<i>Klebsiella pneumoniae</i> n = apprx 215	E coli	Klebsiella sp	E coli	Klebsiella sp	E coli	Klebsiella sp	C n=5202	E C n=17971	KP n=858
Ampicillin/ Amoxicillin	58.4	100	51	N/A	49	100	51	100	94.8	54.1	98.6
Coamoxiclav	7.7	23	15	50	15	49	16	49	16.7	17	65.8
Trimethoprim	36.7	53.3	33	72	31	71	31	80	13.3	31.5	79.5
Cephalexin	16.4	45.6	14	85	13	83	14	88	13.2	17.6	82
Ciprofloxacin	15.8	38	14	40	14	49	16	60	4.8	18.8	70.5
Nitrofurantoin	1.3	23.2	1	30	0	29	1	38	14.6	1.8	31.5
Fosfomycin	0.3*	10.3*							0.2	0.2	8.7
Gentamicin	7.3								1.6	6.5	41
Amikacin									0.4	0.9	8.2
Cefpodoxime (ESBL)	11.4	26	12	72	12	79	12	72	2.7	16.1	78.7
Mecillinam											

- Limitations
These are laboratory submitted urines
- Klebsiella are biased towards resistance
- Note increase in ESBL Rate
- Cephalexin, Co-amoxiclav and ciprofloxacin resistance appears to have increased

Antibiotic prescribing for residents in long-term-care facilities across the UK Tracey Thornley et al J Antimicrob Chemother 2019 May; 74(5): 1447–1451 doi: 10.1093/jac/dkz008

Mean percentage of LTCF residents prescribed antibiotics by month and country. NI, Northern Ireland; S, Scotland; E, England; W, Wales.



Percentage of antibiotic items	22.1%	21.8%	17.9%	11.1%	5.1%	5.0%	3.7%	3.4%	1.7%	1.4%	1.2%
N	91155	89993	73564	45610	20997	20529	15147	14093	7131	5890	4942

Antibiotic prescribing for residents in long-term-care facilities across the UK Tracey Thornley et al J Antimicrob Chemother 2019 May; 74(5): 1447–1451 doi: 10.1093/jac/dkz008

- The percentage of residents receiving at least one antibiotic prescription during the 12 month period November 2016–October 2017 was: 56.6% in Northern Ireland, 53.2% in Scotland, 48.5% in England and 45.0% in Wales. The mean percentage of residents prescribed antibiotics each month by country (Figure 1) was 21.4% in Northern Ireland, 17.4% in Scotland, 16.6% in England and 16.0% in Wales
- **Half of the residents (52.1%) were dispensed one antibiotic drug over the 12 month period, a quarter (27.5%) were dispensed two different antibiotics, 12.9% were dispensed three and 5.1% were dispensed four (the remaining 2.4% were dispensed between 5 and 10 different antibiotics).** If a resident only had amoxicillin over the 12 months then this would be classed as one drug, even if they had several prescriptions for it.
- The distribution of the number of antibiotic prescriptions per resident over the 12 month period is positively skewed, with a median of 2 (IQR 1–4). Of those residents taking antibiotics over the 12 month period, **38.4% had one antibiotic prescription, 21.3% had two, 12.5% had three, 7.9% had four and 19.9% had five or more antibiotic prescriptions.** In total, 10561 residents (6.3%) had 10 antibiotic prescriptions during the 12 month period. Here, the definition of prescription would include the same antibiotic being dispensed more than once over the 12 month period (e.g. a resident having three prescriptions for amoxicillin and a further two for trimethoprim over the 12 months would be classed as having five prescriptions).
- Four antibiotics (amoxicillin, trimethoprim, nitrofurantoin and flucloxacillin) accounted for 66.4% of all antibiotic prescribing. The 11 antibiotics shown in Figure 2 accounted for 92.8% of all antibiotic prescribing, of which it was possible to calculate days of therapy for 77.0% of them. Figure 2 shows the days of therapy variation for each of these antibiotics; for example, amoxicillin accounted for 22.1% of antibiotics dispensed with a calculable value for days of therapy, of which 73.6% were for 6–7 days and 22.0% for 4–5 days. **Trimethoprim accounted for 21.8% of antibiotics, of which 30.0% were for 21–28 days, 29.5% for 6–7 days, 23.6% for 1–3 days and 13.4% for 4–5 days.**

Escherichia coli

UTI (urinary tract infection)

Bacteraemia (Blood stream infection - BSI)

Cholangitis/Cholecystitis

Acute bacterial meningitis

Intra-abdominal infections

Enteric infections

Septic arthritis

Endophthalmitis

Osteomyelitis

Endocarditis

Klebsiella pneumoniae

- UTI (urinary tract infection),

- Bacteraemia (Blood stream infection - BSI)

- Lower respiratory tract,

- Cholangitis/Cholecystitis

- Surgical wound sites,

- Pneumonia,

- Osteomyelitis,

- Meningitis

Pseudomonas aeruginosa

- UTI (urinary tract infection),

- Respiratory tract (eg, pneumonia)

- Bacteraemia (Blood stream infection - BSI)

- Heart (endocarditis)

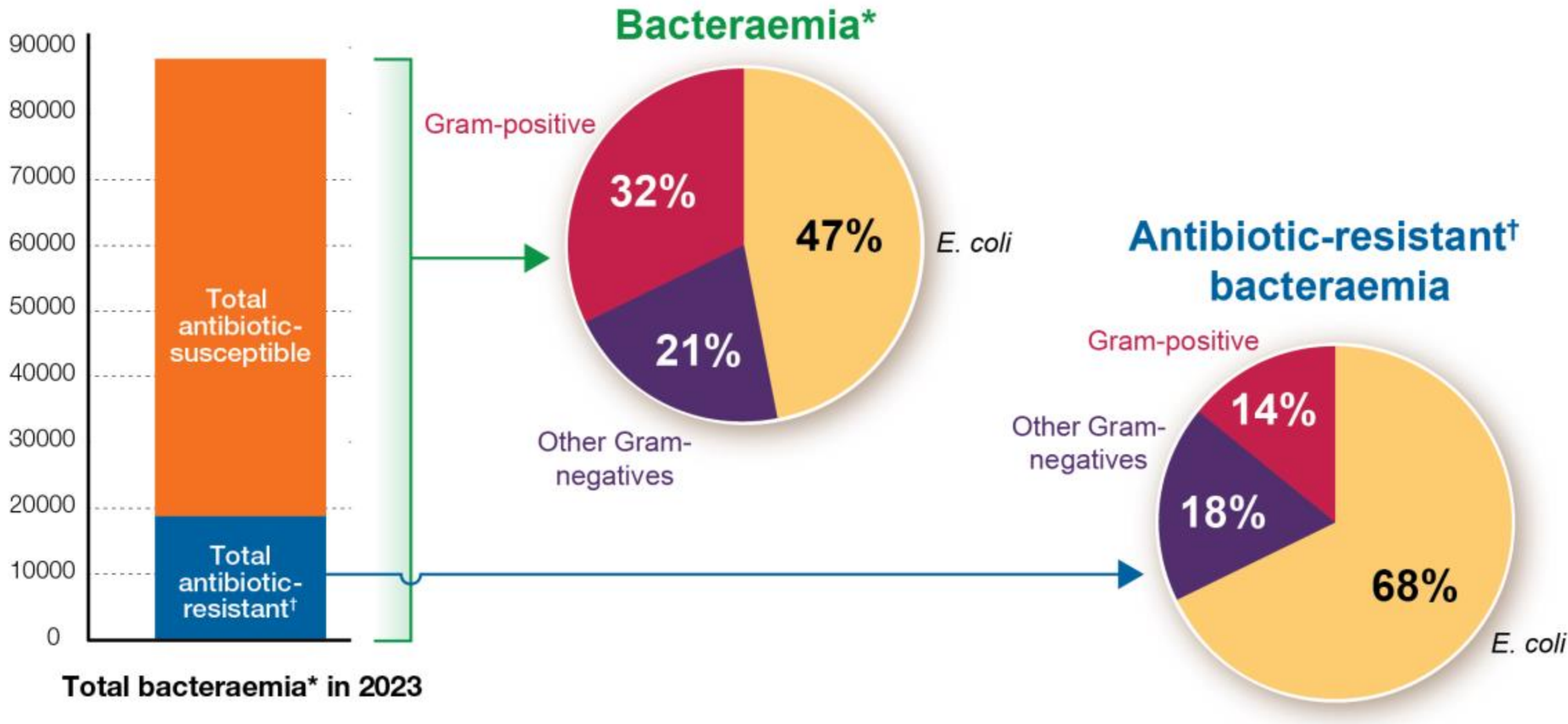
- CNS (eg, meningitis, brain abscess)

- Ear (eg, otitis externa and media)

- Eye (eg, bacterial keratitis, endophthalmitis)

- Bones and joints (eg, osteomyelitis)

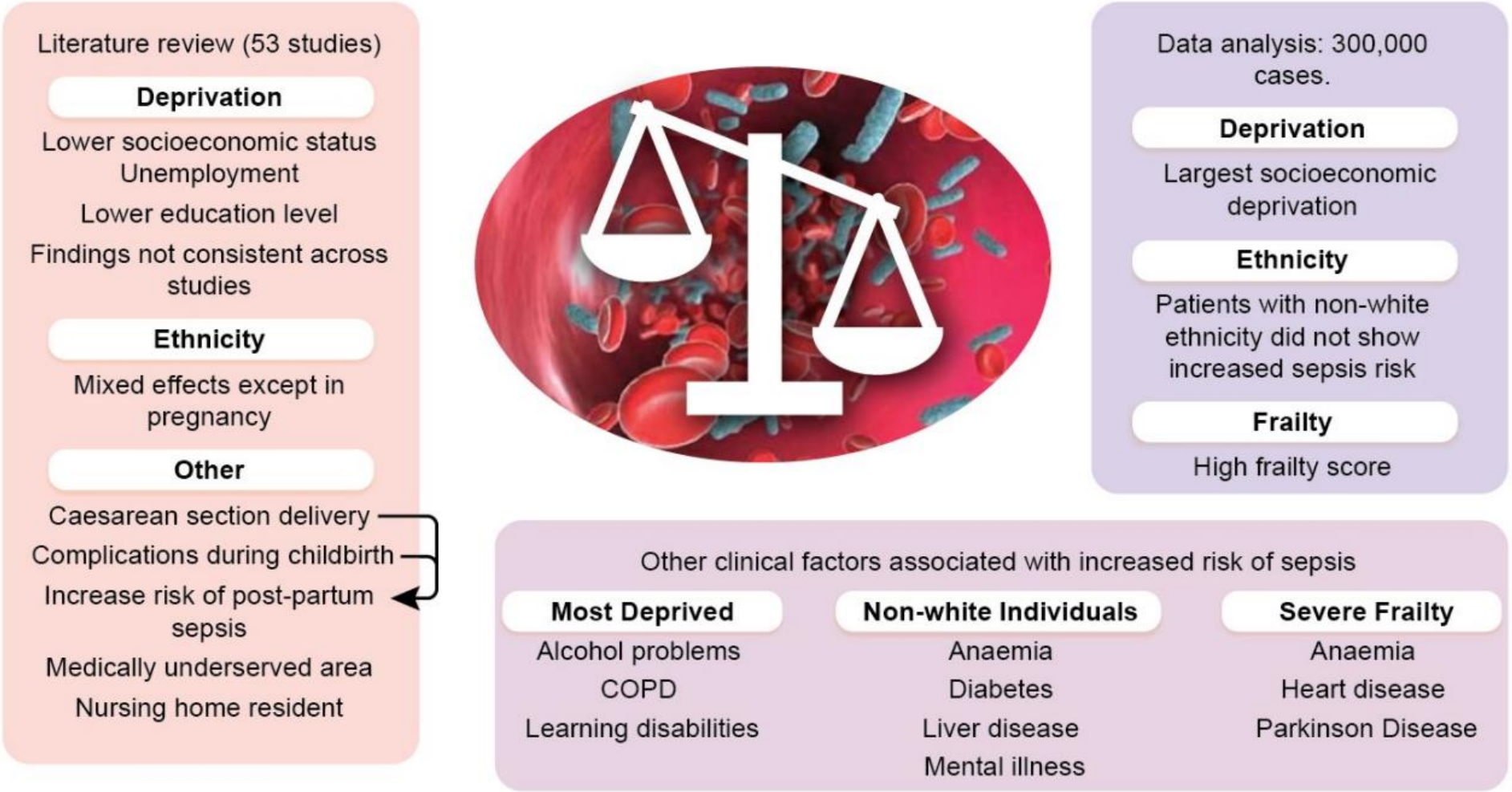
- Skin (ulcers)



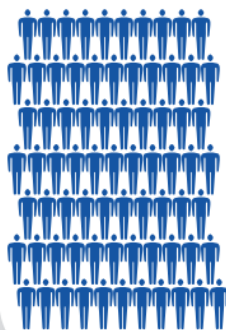
[ESPAUR report infographics 2023 to 2024](#)

* Pathogens include: *E. coli*, *K. pneumoniae*, *K. oxytoca*, *Acinetobacter* spp. *Pseudomonas* spp., *Enterococcus* spp., *S. aureus* and *S. pneumoniae*.
† *E. coli*, *K. pneumoniae* and *K. oxytoca*: resistant to any of: carbapenems, third-generation cephalosporin, aminoglycosides or fluoroquinolones; *Acinetobacter* spp: resistant to aminoglycosides and fluoroquinolones, or carbapenems; *Pseudomonas* spp. resistant to three or more antimicrobial groups, or carbapenems; *Enterococcus* spp. resistant to glycopeptides; *S. aureus* resistant to methicillin; *S. pneumoniae* resistant to penicillin and macrolides, or penicillin.

Assessing the interplay between factors commonly associated with health inequalities, clinical factors, and sepsis incidence and outcomes

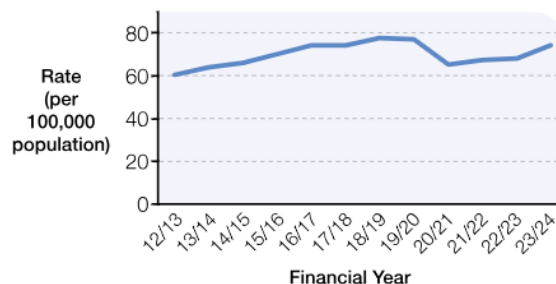


Overall rate



74 people out of every **100,000** will acquire a *E. coli* bacteraemia

Trends in rates of *E.coli* bacteraemia



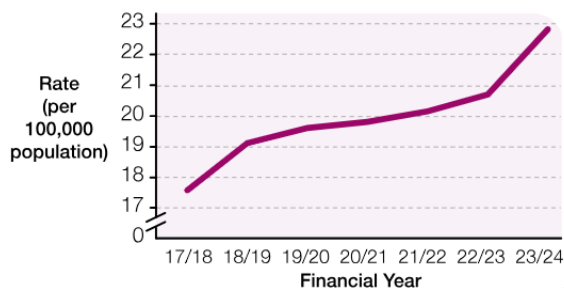
E coli

Overall rate



23 people out of every **100,000** will acquire a *Klebsiella* spp. infection

Trends in rates of *Klebsiella* spp. bacteraemia



Klebsiella spp

Overall rate

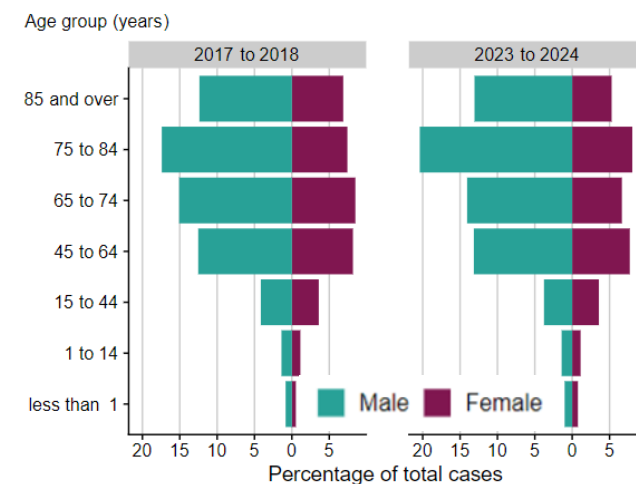
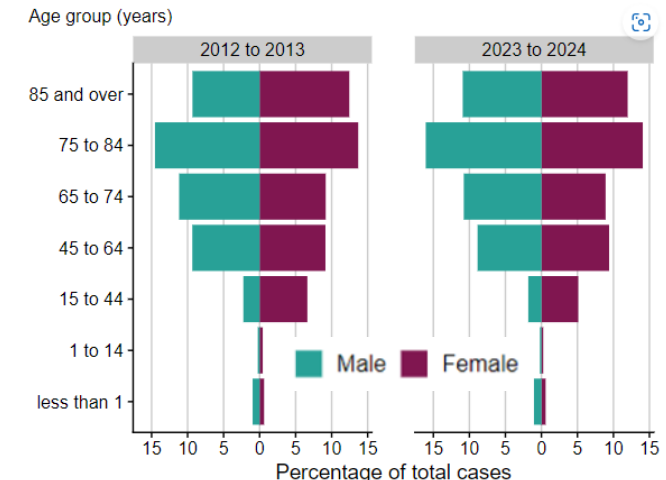


8 people out of every **100,000** will acquire a *P. aeruginosa* bacteraemia

Trends in rates of *P. aeruginosa* bacteraemia

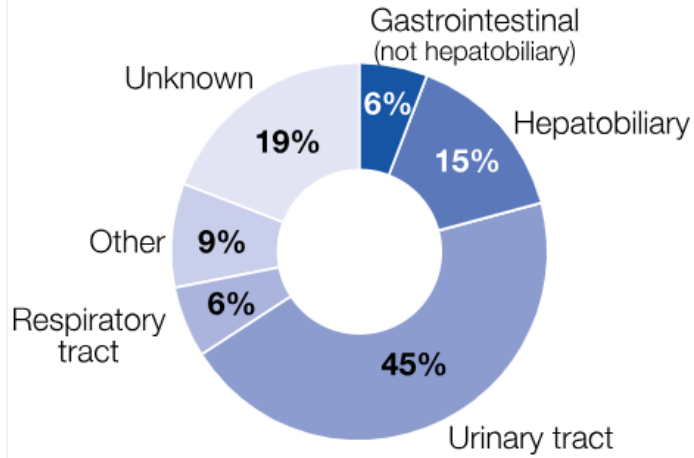


Pseudomonas aeruginosa



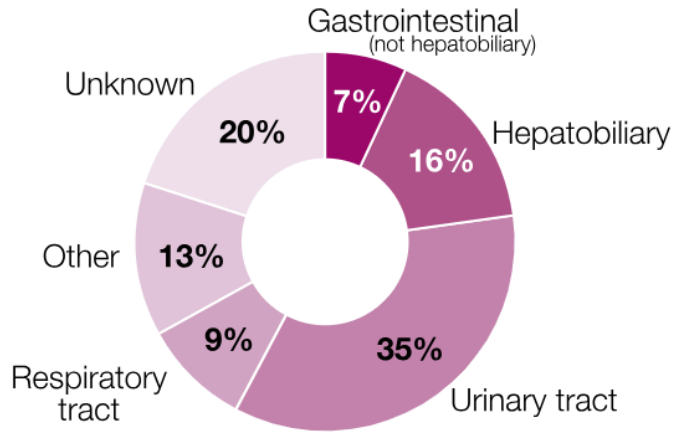
E coli, Klebsiella spp, Pseudomonas aeruginosa Bacteraemia 2023-2024

Most common primary focus of infection



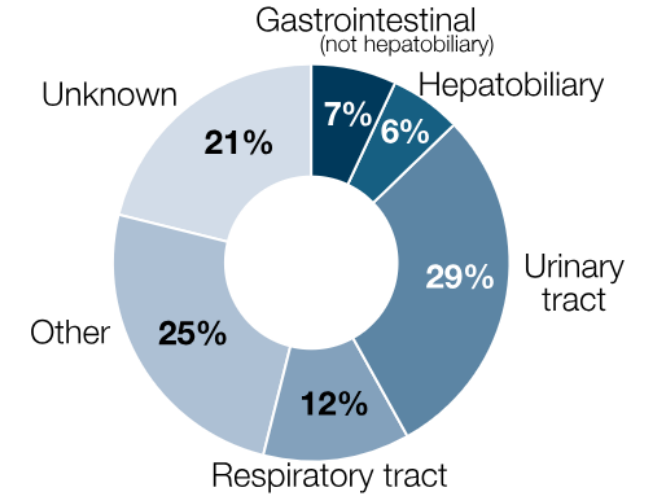
E coli

Most common primary focus of infection



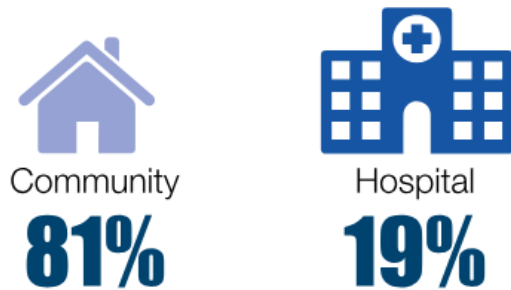
Klebsiella spp

Most common primary focus of infection



Pseudomonas aeruginosa

Most cases are community onset



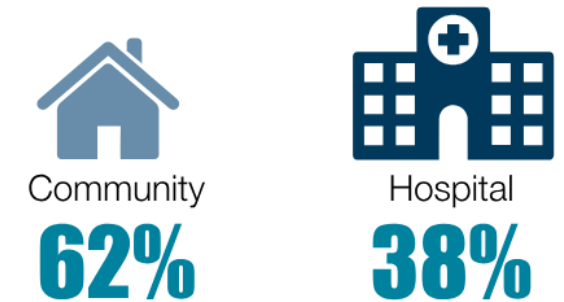
Hospital-onset: Any specimens taken on the **third** day of admission onwards (when day one equals day of admission)

Most cases are community onset



Hospital-onset: Any specimens taken on the **third** day of admission onwards (when day one equals day of admission)

Most cases are community onset



Hospital-onset: Any specimens taken on the **third** day of admission onwards (when day one equals day of admission)

E coli

Risk greater among elderly

Adult male rate



52

out of every
100,000
(age 45-64)

Adult female rate



53

out of every
100,000
(age 45-64)

vs

Elderly male rate



854

out of every
100,000
(age greater than or equal to 85)

Elderly female rate



570

out of every
100,000
(age greater than or equal to 85)

Klebsiella spp

Risk greater among elderly

Adult male rate



24

out of every
100,000
(age 45-64)

Adult female rate



16

out of every
100,000
(age 45-64)

vs

Elderly male rate



279

out of every
100,000
(age greater than or equal to 85)

Elderly female rate



96

out of every
100,000
(age greater than or equal to 85)

Pseudomonas aeruginosa

Risk greater among elderly

Adult male rate



8

out of every
100,000
(age 45-64)

Adult female rate



5

out of every
100,000
(age 45-64)

vs

Elderly male rate



108

out of every
100,000
(age greater than or equal to 85)

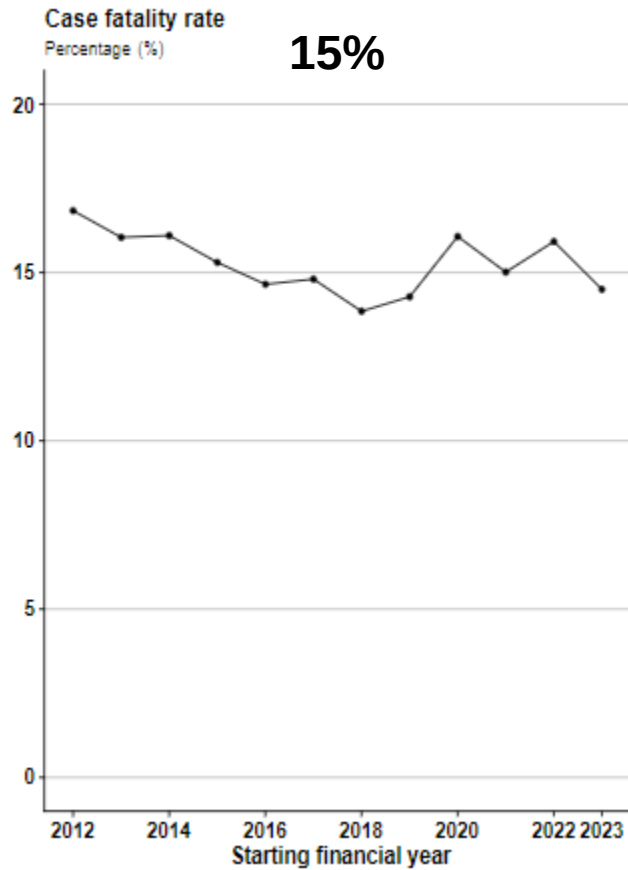
Elderly female rate



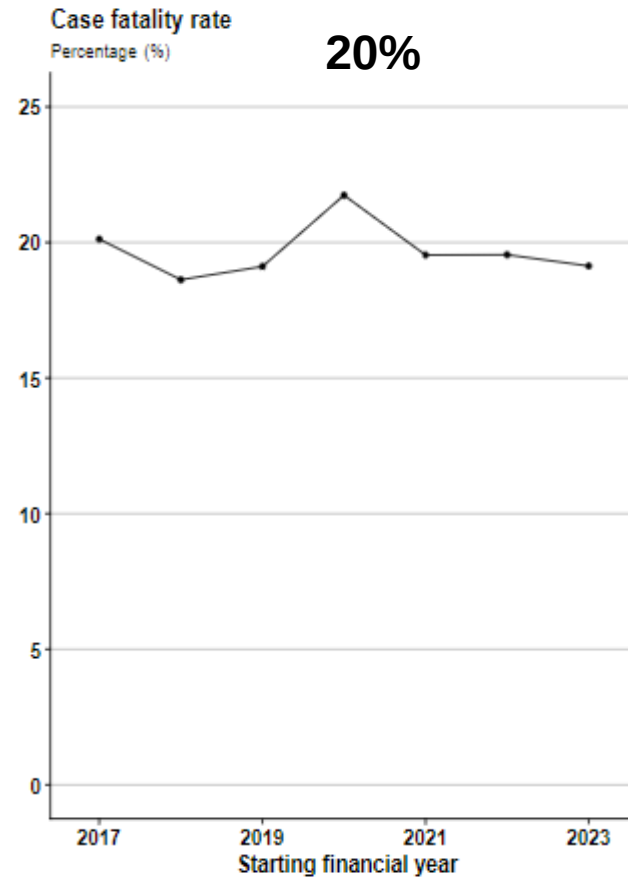
26

out of every
100,000
(age greater than or equal to 85)

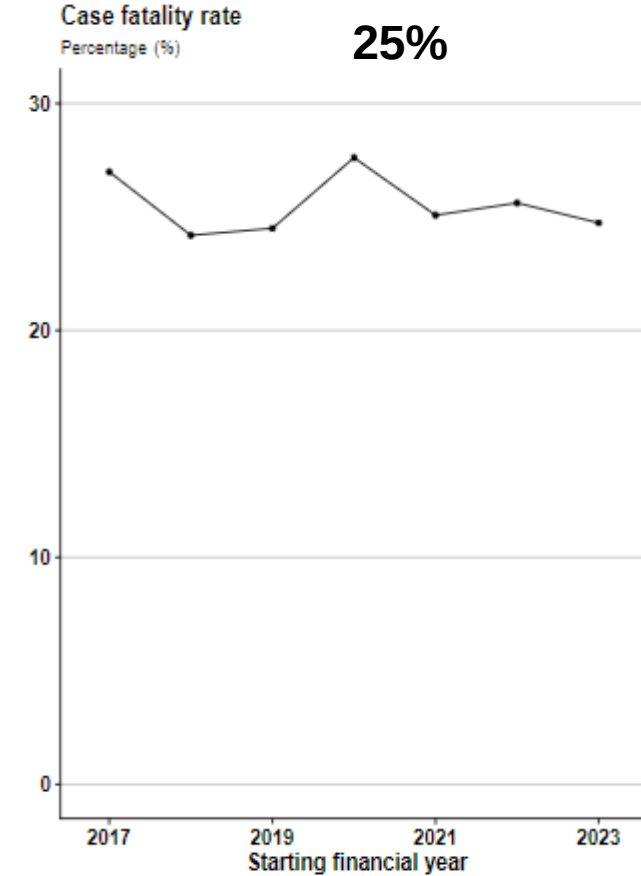
Comparison of case fatality rate E.coli, Klebsiella and P. aeruginosa



Escherichia coli bacteraemia



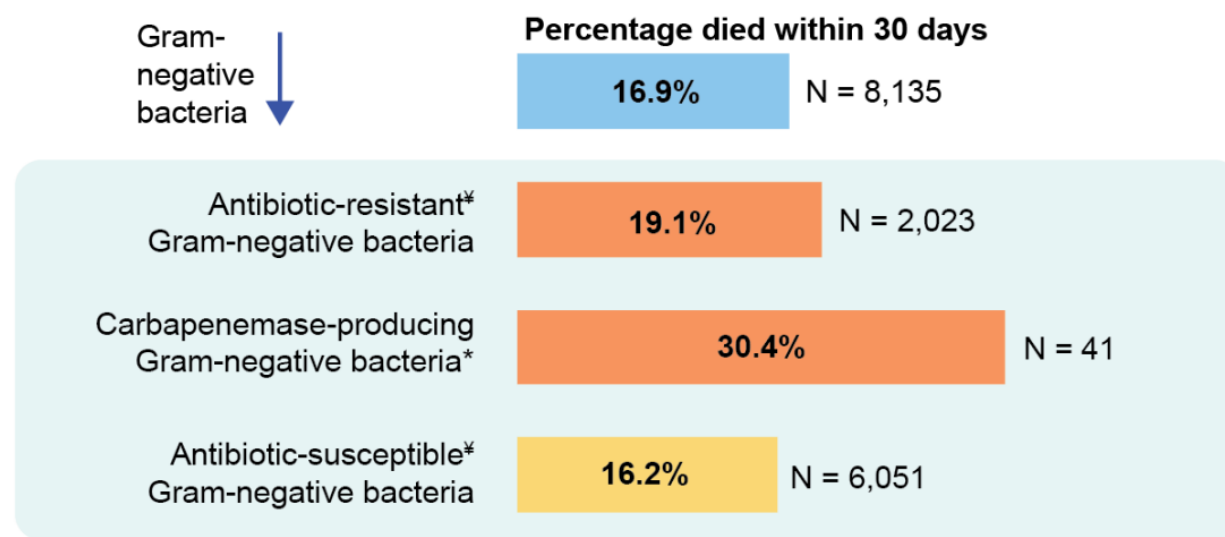
Klebsiella spp. bacteraemia



Pseudomonas aeruginosa bacteraemia

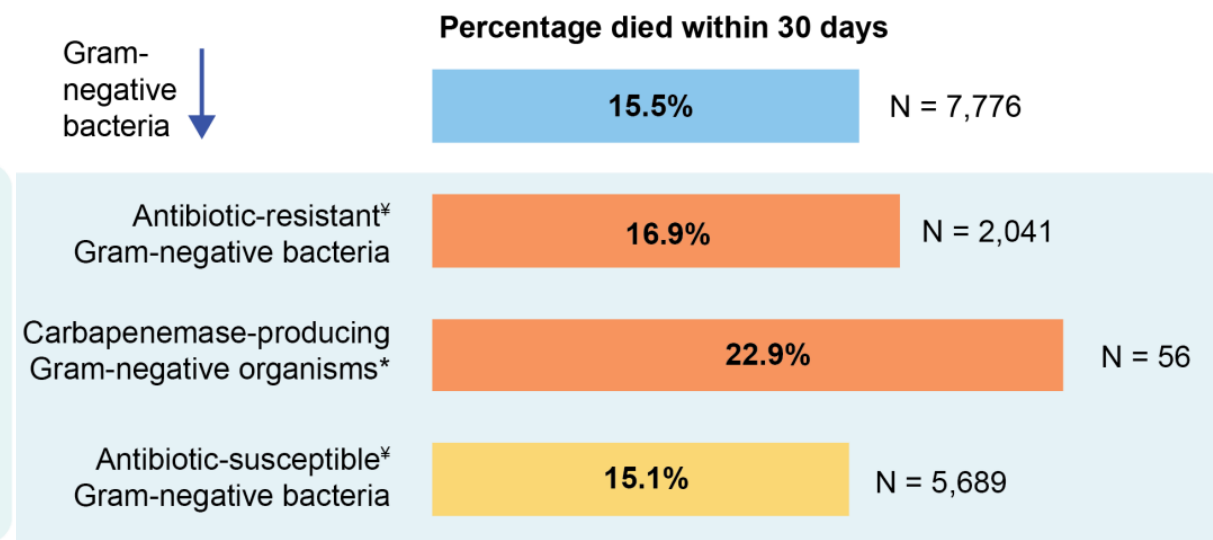
30-day all-cause mortality of patients with Gram-negative bloodstream infections

2022



*invasive infections; *AMR burden combinations

2023



*sterile site infections; *AMR burden combinations

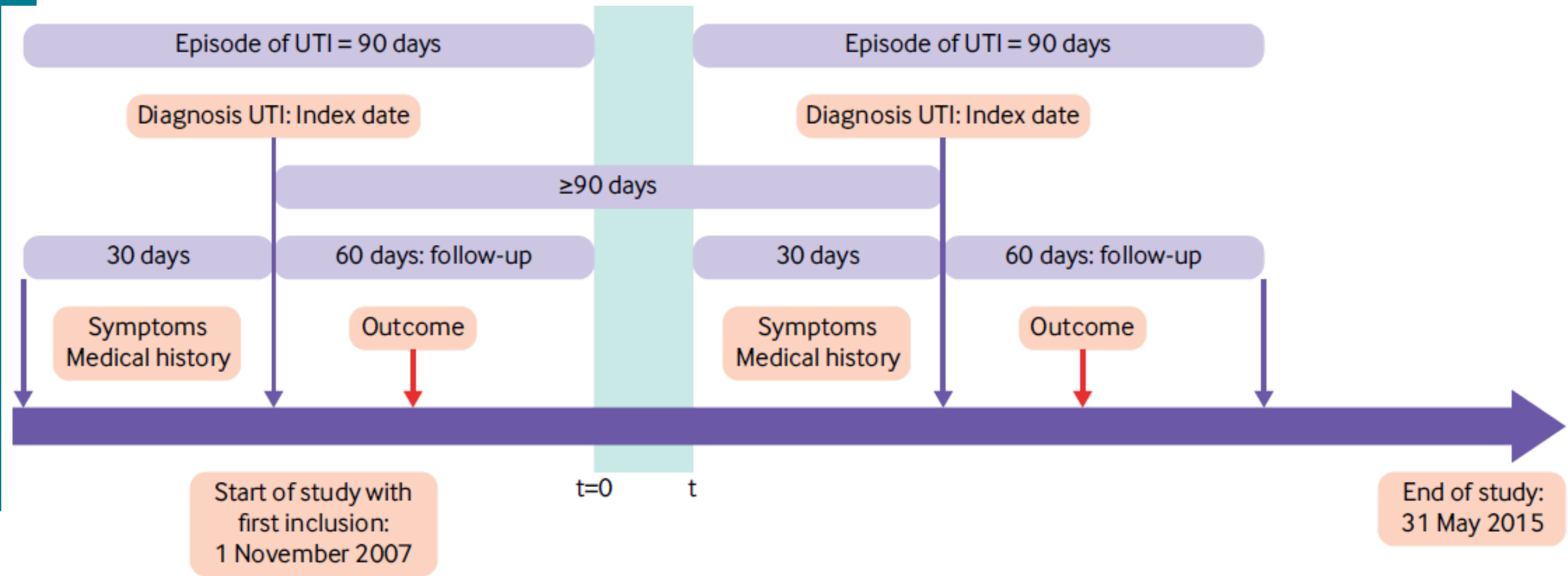
[ESPAUR report infographics 2023](#)

[ESPAUR report infographics 2023 to 2024](#)

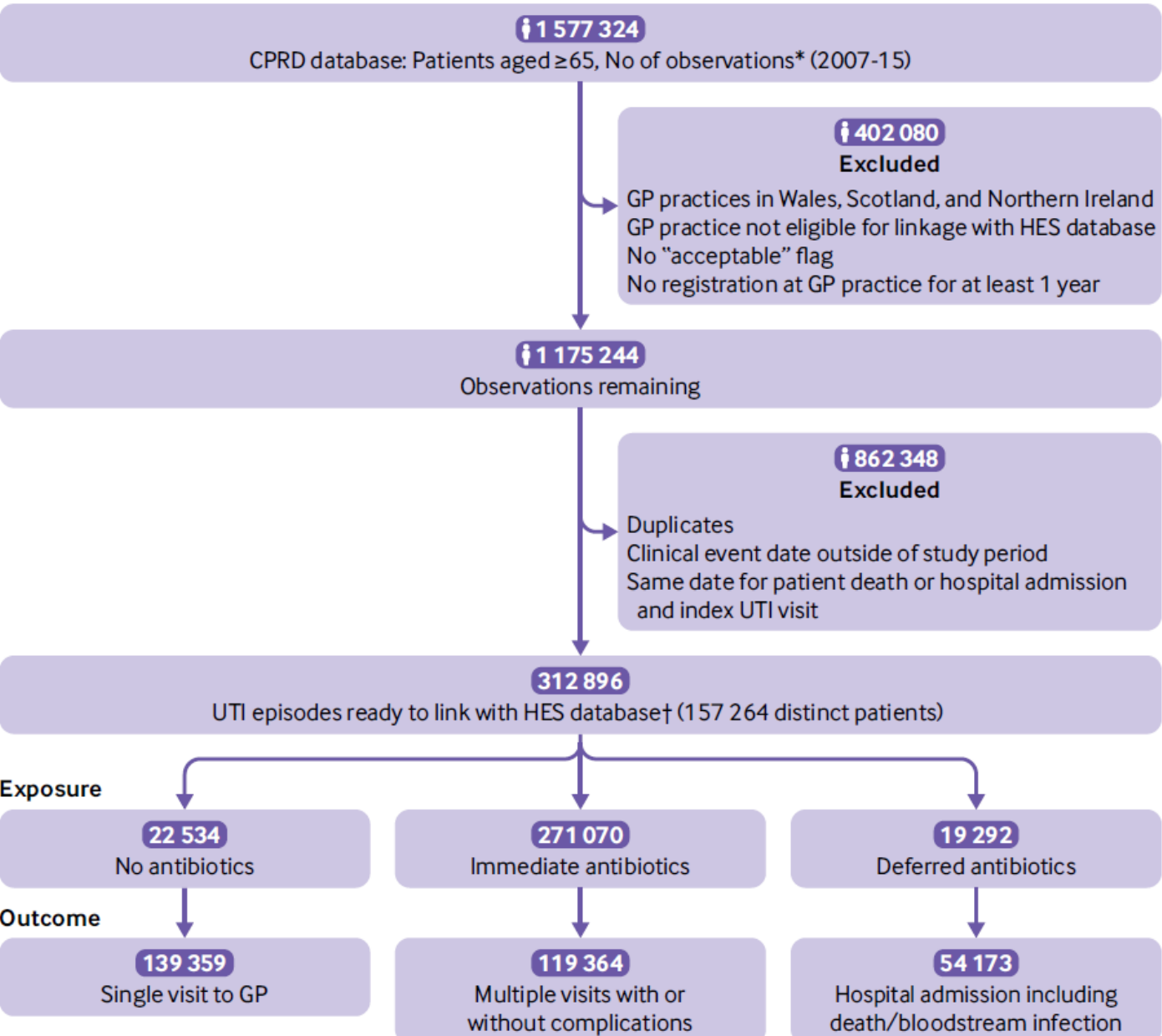
- Urinary tract infection (UTI) is the most common bacterial infection in the older patient population, and *Escherichia coli* is the most common uropathogen in community dwelling people older than 65 years.
- The spectrum of UTI ranges from a mild self limiting illness to severe sepsis, with a mortality rate of 20-40%. **The incidence of sepsis and its associated mortality increases disproportionately with age, and UTI in men is more likely to be severe.**
- **Both sexes develop UTI in old age**, with a female to male ratio of 2:1 in patients older than 70 years, compared with the overwhelming UTI susceptibility of females in younger populations, with a 50:1 ratio.
- The diagnosis of UTI in older patients can be problematic, as these patients are less likely to present with a typical clinical history and localised urinary symptoms compared with younger patients.
- The rising incidence of **asymptomatic bacteriuria** in older adults is also contributing to further diagnostic difficulty (>20% of women aged ≥ 65 years compared with <5% in younger women), which results in probable over-diagnosis of UTI and unnecessary treatment.

- UTI is the second most common diagnosis for which empirical antibiotics are prescribed in both primary and secondary care,
- with more than 50% of the antibiotics prescribed for a suspected UTI in older adults being considered unnecessary.
- With the spread of antibiotic resistance and its increasing threat to public health (about 30% of urinary isolates of *E coli* are now resistant to trimethoprim), national guidelines and antimicrobial stewardship programmes have been proposed to combat these challenges.

Timeline of study and criteria for differentiating independent episodes of urinary tract infection (UTI)



Antibiotic management of urinary tract infection in elderly patients in primary care and its association with bloodstream infections and all cause mortality: population based cohort study
Myriam Gharbi et al BMJ 2019;364:l525 <http://dx.doi.org/10.1136/bmj.l525>



Flowchart of study cohort. *Observations define all general practitioner (GP) contacts (rows in database) in Clinical Research Datalink database (CPRD).
†UTI episode contains all GP contacts that define a single event of UTI for a patient.
UTI episode includes 30 day period before diagnosis and 60 day follow-up period after diagnosis.
HES=hospital episodes statistics

- Among 312 896 UTI episodes (157 264 unique patients), 7.2% (n=22 534) did not have a record of antibiotics being prescribed and 6.2% (n=19 292) showed a delay in antibiotic prescribing.
- 1539 episodes of bloodstream infection (0.5%) were recorded within 60 days after the initial UTI.
- The rate of bloodstream infection was significantly higher among those patients not prescribed an antibiotic (2.9%; n=647) and those recorded as revisiting the general practitioner within seven days of the initial consultation for an antibiotic prescription compared with those given a prescription for an antibiotic at the initial consultation (2.2% v 0.2%; P=0.001).
- After adjustment for covariates, patients were significantly more likely to experience a bloodstream infection in the deferred antibiotics group (adjusted odds ratio 7.12, 95% confidence interval 6.22 to 8.14) and no antibiotics group (8.08, 7.12 to 9.16) compared with the immediate antibiotics group.

- The number needed to harm (NNH) for occurrence of bloodstream infection was lower (greater risk) for the no antibiotics group (NNH=37) than for the deferred antibiotics group (NNH=51) compared with the immediate antibiotics group
- The **rate of hospital admissions was about double among cases with no antibiotics** (27.0%) and deferred antibiotics (26.8%) compared with those prescribed immediate antibiotics (14.8%; $P=0.001$).
- The **risk of all cause mortality was significantly higher with deferred antibiotics and no antibiotics** than with immediate antibiotics at any time during the 60 days follow-up (adjusted hazard ratio 1.16, 95% confidence interval 1.06 to 1.27 and 2.18, 2.04 to 2.33, respectively)
- **Men older than 85 years were particularly at risk for both bloodstream infection and 60 day all cause mortality.**

- In elderly patients with a diagnosis of UTI in primary care, no antibiotics and deferred antibiotics were associated with a significant increase in bloodstream infection and all cause mortality compared with immediate antibiotics.
- In the context of an increase of *Escherichia coli* bloodstream infections in England, early initiation of recommended first line antibiotics for UTI in the older population is advocated.

- 75M
- ? UTI
- CSU sample
Diabetic T2DM,
Vascular,
- Foot cellulitis,
- Rt femoral
endarterectomy

?UTI

Sample 88F036597 (Catheter specimen urine) Collected 09 Aug 2018 Received 09 Aug 2018 20:22

URINE CULTURE

White Blood cells	>100	cmm
Red blood cells	<10	cmm
Epithelial cells	Not Seen	.
Isolate		

1) 10⁸ CFU/1 Klebsiella pneumoniae
This is an ESBL Producer.

	1)
Trimethoprim.....	R
Cephalexin.....	R
Co-amoxiclav.....	R
Amoxicillin.....	R
Nitrofurantoin.....	R
Ciprofloxacin.....	R
Cefuroxime.....	R
Gentamicin.....	R
Ceftazidime.....	R
Ertapenem.....	S
Piperacil/tazobactam	R
Amikacin.....	S
Fosfomycin.....	R

Fos MIC = 256

Comment:

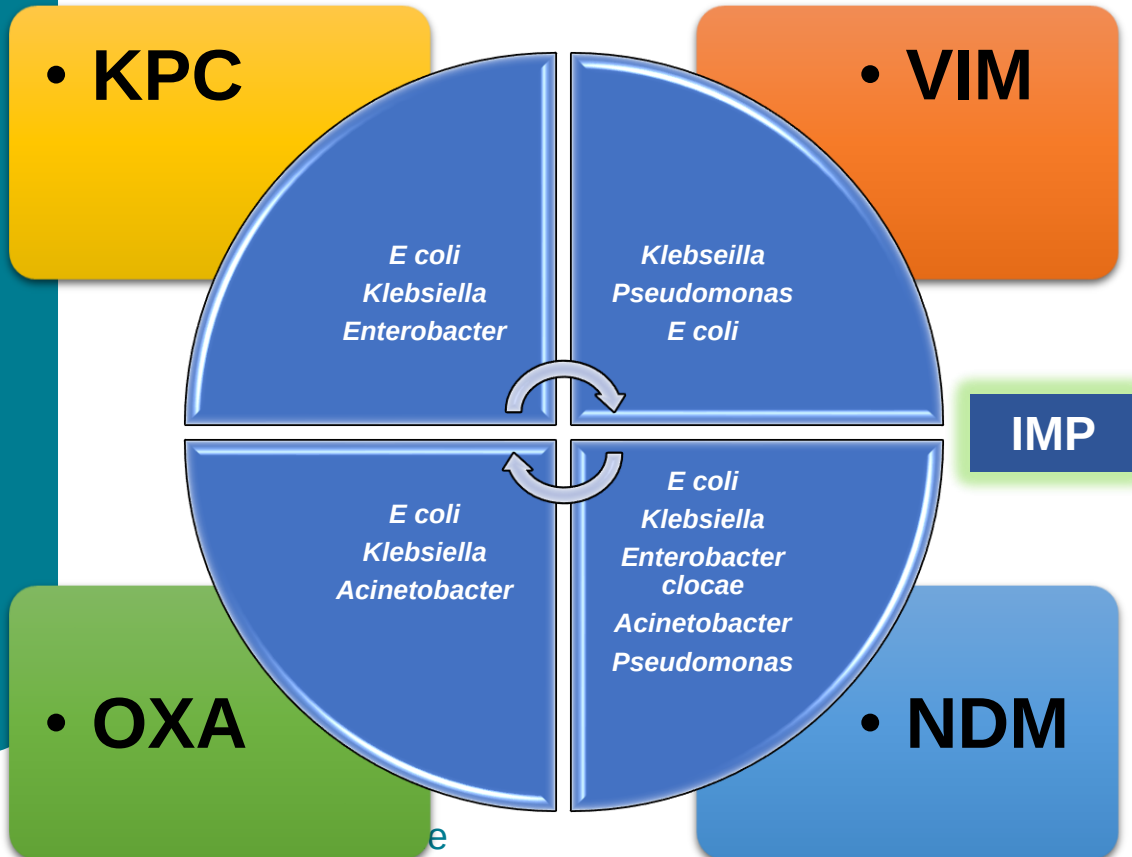
Do not prescribe antibiotics to treat asymptomatic bacteriuria in adults with catheters (NICE Quality Standards).

For suspected Catheter associated UTI: If culture positive, remove/change catheter and treat only if patient is symptomatic.

Resistant Gram negatives in MSUs

Nitrofurantoin

Fosfomycin may still be sensitive for E coli only



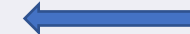
Sample 23F785402 (Mid-stream urine) Collected 20 Apr 2023 Received 20 Apr 2023 18:25

URINE CULTURE

White Blood cells	>100	cmm
Red blood cells	>100	cmm
Epithelial cells	Not Seen	.
Isolate		

1) 10⁸ CFU/l predominately *Escherichia coli*

	1)
Trimethoprim.....	R
Cephalexin.....	R
Amoxicillin.....	R
Co-amoxiclav	R
Nitrofurantoin.....	S
Ciprofloxacin.....	R
Ertapenem.....	R
Amikacin.....	S
Piperacil/tazobactam	R
Ceftazidime.....	R
Cefuroxime.....	R
Meropenem.....	R
Gentamicin.....	R
Fosfomycin.....	S
Cefiderocol.....	R



Key - Sensitivity interpretation (Note: update to I)

S - Sensitive

R - Resistant

I - Sensitive at high dose as per Trust Antibiotic Guidelines

HR - Highly resistant

CARBAPENAMASE DETECTION

KPC	Not Detected
NDM	DETECTED
VIM	Not Detected
IMP	Not Detected
OXA-48	Not Detected

Test comment:

This test is positive for Carbapenemases gene.
For infection control information, see Multidrug Resistant Organism Policy on the intranet and/or contact infection control team, if you are considering antibiotic treatment,

One continuum – just additional resistance

Klebsiella – amp resistant

- pneumoniae
- oxytoca



Klebsiella - ESBL Extended spectrum beta lactamases



Klebsiella – CPE

- NDM, OXA 48, KPC, VIM, IMP

Enterobacterales

- Escherichia coli
- Klebsiella pneumoniae (other sp)
- Serratia marcescens
- Enterobacter cloacae (other sp)

Non-fermenters

- Pseudomonas aeruginosa
- Acinetobacter baumannii (other sp)

The organism is the same, same virulence factors but acquired resistance

The patients – how do they feel?

Morbidity & Mortality

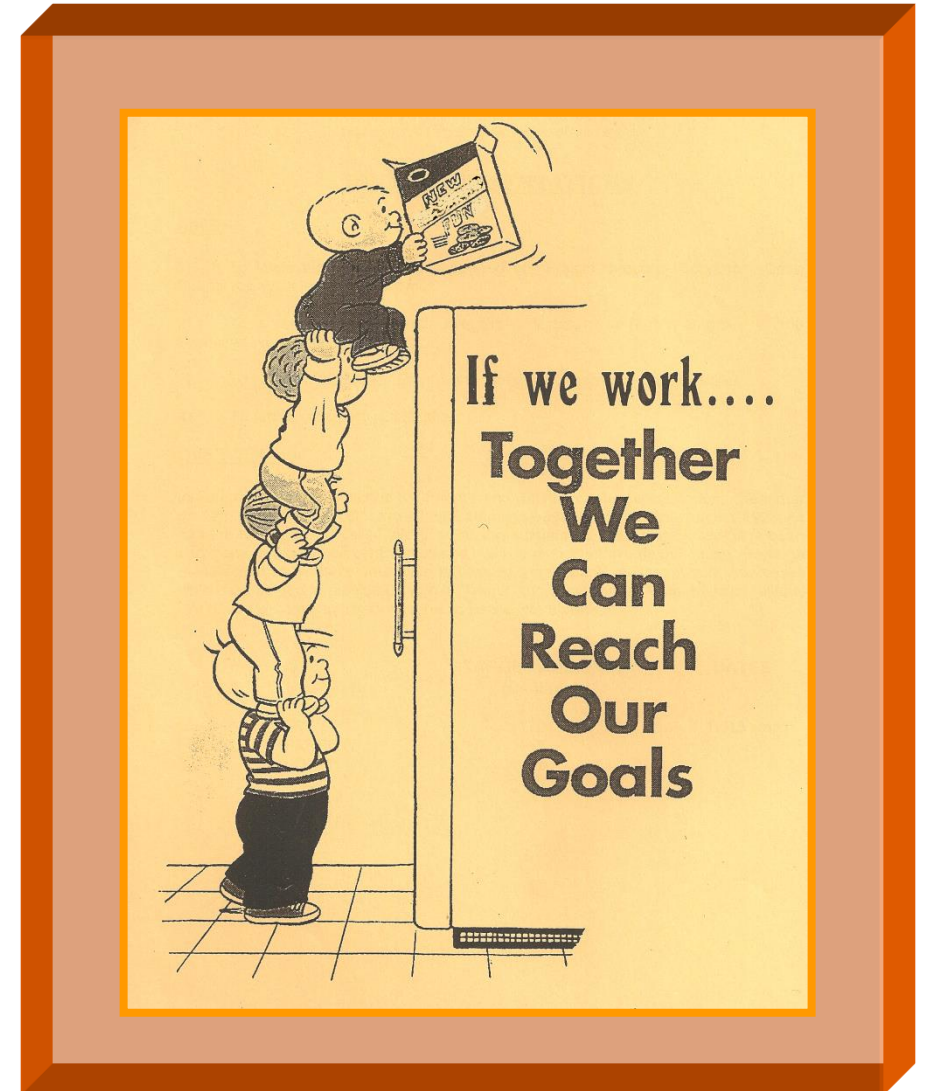
“|”

Patient safety – Quality in healthcare delivery – Zero tolerance

Multiple concurrent strategies

- Prevention
- Catheter management
- Catheter passport
- Hydration
- Early Detection
- Diagnostics
- Prescribing
- Service Changes (Prostate Surgery)

Multiple specialist skills & teams Joint & joined up working

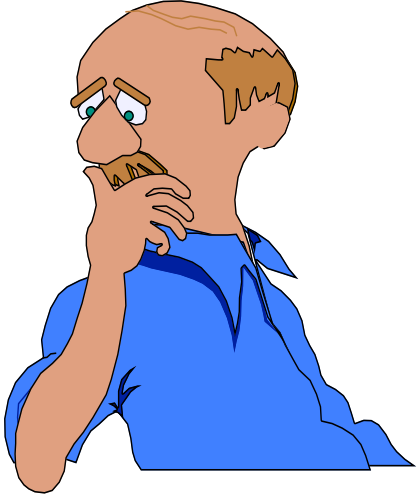


References

- <https://www.gov.uk/government/statistics/mrsa-mssa-and-e-coli-bacteraemia-and-c-difficile-infection-annual-epidemiological-commentary/annual-epidemiological-commentary-gram-negative-mrsa-mssa-bacteraemia-and-c-difficile-infections-up-to-and-including-financial-year-2023-to-2024>
- <https://www.gov.uk/government/statistics/mrsa-mssa-and-e-coli-bacteraemia-and-c-difficile-infection-annual-epidemiological-commentary/mrsa-mssa-and-gram-negative-bacteraemia-and-cdi-infographics-for-england-financial-year-2023-to-2024>

In Conclusion

Learning Points



Some UTIs & BSI are preventable

1. Preparation
2. Prevent
 - Smart & Sustainable interventions
3. Detect early
4. Treat
5. Learn lessons

Acknowledgements:

Anam Bilal (Personal Assistant)
Journal articles publishers and authors
UKHSA website
CDC website
NHS Colleagues

Thank you for listening

Making a difference
How can you make a difference?



Making things safe safer
Protecting the public
How can you help?
What can you do?