Infectious Diseases and Therapy

Can we lower the burden of antimicrobial resistance (AMR) in heavily immunocompromised patients? A narrative review and call to action

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Table of Contents

Table S1: Eligibility criteria for identified publications

Inclusion criteria	Exclusion criteria

• Reports published from 12/11/2018 to 11/11/2023
• Reporting bacterial AMR infection
• Including measure of mortality, underlying disease outcomes or any other measure of burden (e.g. treatment delay)
• Studies conducted within Europe (European Union, European Economic Area, United Kingdom and Switzerland) or North America (United States and Canada)
• Publications considered eligible for discussion included:
  ○ Peer-reviewed journal articles
  ○ Clinical trials and RCTs (N≥10 patients)
  ○ Real-world evidence reports
  ○ Retrospective analyses, *post-hoc* analyses
  ○ Case reports
  ○ Meta-analyses
  ○ Guidelines within the transplant, oncology, immunocompromised or antimicrobial resistance settings
  ○ Reviews
  ○ Systematic reviews
• Only publications with full text available in English were considered eligible
	• Viral (including COVID-19), fungal, archaea, protozoa, or algae infection
	• Animal or *in vitro* studies
	• Genetic or biomarker studies
	• Irrelevant publication types
	  ○ Congress abstracts
	  ○ Books
	  ○ Executive summaries
	  ○ Biographies
	  ○ Published errata
	  ○ Clinical study protocol
	• Clinical trials with N<10 patients
	• Studies focusing on:
	  ○ New technologies for potential routes of administration
	  ○ Baseline characteristics only
	• Non-English language
	• Does not report bacterial AMR infection in at least one patient
	• No relevant measures of patient or disease outcome

AMR, antimicrobial resistance; COVID-19, coronavirus disease 2019; RCT, randomised controlled trial.

Table S2: Literature search strings

Search of PubMed consisted of the combined search logic:

- (#1 NOT #2 NOT #3) AND (#4 AND #3) AND #5 AND #6 AND (#7 OR #8)

† This additional search string was used to calculate the number of paediatric studies within haematological malignancy.

#1 (publications of interest from the 5 year period 12/11/2018–11/11/2023)	Antimicrobial/antibiotic drug resistance	drug resistance, microbial[MH]
		antimicrobial resistan*[TIAB]
		antimicrobial-resistan*[TIAB]
		anti-microbial resistan*[TIAB]
		anti-microbial-resistan*[TIAB]
		microbial resistan*[TIAB]
		microbial-resistan*[TIAB]
		microbial drug resistan*[TIAB]
		microbial-drug resistan*[TIAB]
		microbial drug-resistan*[TIAB]
		microbial-drug-resistan*[TIAB]
		antibiotic resistan*[TIAB]
		antibiotic-resistan*[TIAB]
		anti-biotic resistan*[TIAB]
		anti-biotic-resistan*[TIAB]
		anti biotic resistan*[TIAB]
		anti biotic-resistan*[TIAB]
	MDR	multidrug resistan*[TIAB]
		MDR[TIAB]
		multi drug resistan*[TIAB]
		multi-drug resistan*[TIAB]
		multidrug-resistan*[TIAB]
		multi drug-resistan*[TIAB]
		multi-drug-resistan*[TIAB]
	EEDR/XDR bacteria	emerging-extensively drug resistan*[TIAB]
		emerging-extensively-drug resistan*[TIAB]
		emerging-extensively drug-resistan*[TIAB]
		emerging-extensively-drug-resistan*[TIAB]
		XDR[TIAB]
		EEDR[TIAB]
		extensively drug resistan*[TIAB]
		extensively-drug resistan*[TIAB]
		extensively drug-resistan*[TIAB]
		extensively-drug-resistan*[TIAB]
	PDR	pan drug resistan*[TIAB]
		PDR[TIAB]
		pan-drug resistan*[TIAB]

		pan drug-resistan*[TIAB]
		pan-drug-resistan*[TIAB]
	Specific antibiotic resistance mechanisms	carbapenems[MH]
		carbapenem resist*[TIAB]
		carbapenem-resist*[TIAB]
		carbapenem resistant-enterobacter*
		carbapenem-resistant-enterobacter*
		carbapenemase[Supplementary Concept]
		carbapenemase[TIAB]
		vancomycin resistance[MH]
		vancomycin resist*[TIAB]
		vancomycin-resist*[TIAB]
		vancomycin resistant-enterobacter*[TIAB]
		vancomycin-resistant-enterobacter*[TIAB]
		beta-lactamases[MH]
		beta-lactamase*[TIAB]
		beta lactamase*[TIAB]
		ESBL[TIAB]
		methicillin resistance[MH]
		methicillin-resistant staphylococcus aureus[MH]
		MRSA[TIAB]
		methicillin resist*[TIAB]
		methicillin-resist*[TIAB]
		meticillin resist*[TIAB]
		meticillin-resist*[TIAB]
	Cross infection	cross infection[MH]
		cross infect*[TIAB]
		cross-infect*[TIAB]
	Hospital-acquired infection	hospital-acquired infect*[TIAB]
		hospital acquired infect*[TIAB]
		healthcare-associated infect*[TIAB]
		healthcare associated infect*[TIAB]
	HAP/VAP	healthcare-associated pneumonia[MH]
		healthcare-associated pneumonia[TIAB]
		healthcare associated pneumonia[TIAB]
		hospital-acquired pneumonia[TIAB]
		hospital acquired pneumonia[TIAB]
		pneumonia, ventilator-associated[MH]
		ventilator-associated pneumonia[TIAB]
		ventilator associated pneumonia[TIAB]
		ventilator-associated infect*[TIAB]
		ventilator associated infect*[TIAB]
	Last 5 years	2018/11/12[PDAT] : 2023/11/11[PDAT]
#2 (exclude irrelevant publication types)	English only	English[Language]
	Humans	humans[MH]

	Animal models	animals[MESH:noexp]
		models, animal[MH]
		animal[TIAB]
		bird[TIAB]
		canine[TIAB]
		dog[TIAB]
		goat[TIAB]
		mouse[TIAB]
		mice[TIAB]
		rat[TIAB]
		murine[TIAB]
		mammal[TIAB]
		veterinary[TIAB]
		nonhuman[TIAB]
		non human[TIAB]
		non-human[TIAB]
	In vitro/cell culture methods	in vitro techniques[MH]
		in vitro[TIAB]
		ex vivo[TIAB]
		cancer model*[TIAB]
		tumor cell*[TIAB]
		tumour cell*[TIAB]
		tumor model*[TIAB]
		tumour model*[TIAB]
		xenograft*[TIAB]
		cell culture techniques[MH]
		cell culture*[TIAB]
	Genetics	genes[MH]
		genetics[MH]
		genetics[Subheading]
		gene[TIAB]
		genes[TIAB]
		gene's[TIAB]
		genetic*[TIAB]
	Epigenetics	epigenomics[MH]
		epigenet*[TIAB]
		epigenom*[TIAB]
	Biographies	biography[PT]
	Veterinary RCTs	randomized controlled trial, veterinary[PT]
	Erratum	published erratum[PT]
#3 (excluding non-bacterial infection)	Fungal or viral infection	mycoses[MH]
		mycosis[TIAB]
		mycoses[TIAB]
		fungi[MH]
		fungi*[TIAB]

		fungus[TIAB]
		fungal[TIAB]
		virus diseases[MH]
		viral infection[TIAB]
		virology[MH]
		virol*[TIAB]
		viral*[TIAB]
		virus*[TIAB]
	COVID	sars-cov-2[MH]
		covid-19[MH]
		sars-cov-2[TIAB]
		covid*[TIAB]
	Archae, protozoa, algae	archaea[MH]
		archaea*[TIAB]
		parasitology[Subheading]
		parasite*[TIAB]
		parasitology[TIAB]
		protozoa*[TIAB]
		algae*[TIAB]
		algas[TIAB]
		alga's[TIAB]
#4 (including bacterial infection)	Bacteria or microbe	bacterial infections[MH]
		bacterium[TIAB]
		bacteria*[TIAB]
		Acinetobacter[TIAB]
		baumannii[TIAB]
		Pseudomonas[TIAB]
		aeruginosa[TIAB]
		Staphylococcus[TIAB]
		aureus[TIAB]
		Klebsiella[TIAB]
		aerogenes[TIAB]
		cloacae[TIAB]
		pneumoniae[TIAB]
		K pneumonia[TIAB]
		K. pneumonia[TIAB]
		Enterobacter*[TIAB]
		Enterococc*[TIAB]
		E faecalis[TIAB]
		E. faecalis[TIAB]
		E faecium[TIAB]
		E. faecium[TIAB]
		E coli[TIAB]
		E. coli[TIAB]
		microbe*[TIAB]
		microbial[TIAB]

#5 (from Europe or North America)	Europe (EU, EEA, UK, CH), USA, Canada	Europe[MH]
		United States[MH]
		Canada[MH]
		Austria[MH]
		Belgium[MH]
		Bulgaria[MH]
		Croatia[MH]
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#6 Including mention of ≥1 burden of disease concept	Mortality	survival[MH]
		survival[TIAB]
		mortality[MH]
		mortality[Subheading]
		mortality[TIAB]
		death[MH]
		death[TIAB]
		fatal*[TIAB]
	Tumour outcomes	response rate[TIAB]
		complete response[TIAB]
		partial response[TIAB]
		stable disease[TIAB]
		disease progression[MH]
		disease progression[TIAB]
		progressive disease[TIAB]
		tumor burden[MH]
		burden[TIAB]
		size[TIAB]
		grow[TIAB]
		shrink[TIAB]
	Transplant outcomes	reject*[TIAB]
		impaired graft[TIAB]
		graft versus host[TIAB]
		graft-versus-host[TIAB]
		graft vs host[TIAB]

		graft-vs-host[TIAB]
		recurrent disease[TIAB]
		post-transplant*[TIAB]
		post transplant*[TIAB]
	QoL	quality of life[MH]
		quality of life[TIAB]
		complications[Subheading]
		complications[TIAB]
		psycholog*[TIAB]
		caregivers[MH]
		carer*[TIAB]
		caregiv*[TIAB]
		family[MH]
		family[TIAB]
	Economic factors	economics[Subheading]
		economics[TIAB]
		costs and cost analysis[MH]
		cost[TIAB]
		cost analy*[TIAB]
		length of stay[MH]
		length of stay[TIAB]
		days of therapy[TIAB]
		bed occupancy[MH]
		bed occupancy[TIAB]
		bed days[TIAB]
		quality-adjusted life years[MH]
		quality-adjusted life year*[TIAB]
		quality adjusted life year*[TIAB]
		quality-adjusted life-year*[TIAB]
		QALY[TIAB]
		health care economics and organizations[MH]
		health care econom*[TIAB]
		healthcare econom*[TIAB]
		health-care econom*[TIAB]
		health econom*[TIAB]
		outcome assessment, health care[MH]
		health economics and outcomes research[TIAB]
		HEOR[TIAB]
#7 (in oncology)	Solid tumours	cancer*[TIAB]
		neoplasms[MH]
		neoplasm*[TIAB]
		malignan*[TIAB]
		cysts[MH]
		cysts[TIAB]
		cyst's[TIAB]

		cyst[TIAB]
		neurofibroma[MH]
		neurofibroma*[TIAB]
		tumor*[TIAB]
		tumour*[TIAB]
	Relevant therapies	chemotherap*[TIAB]
		radiotherapy[MH]
		radiotherapy[Subheading]
		radiotherap*[TIAB]
		immunotherapy[MH]
		immunotherap*[TIAB]
	Haem/Onc malignancies, leukaemia, lymphoma, myeloma	hematologic neoplasms[MH]
		hematologic neoplasm*[TIAB]
		hematologic malignan*[TIAB]
		haematologic malignan*[TIAB]
		blood malignan*[TIAB]
		blood cancer[TIAB]
		hematologic cancer*[TIAB]
		haematologic cancer*[TIAB]
		leukemia[MH]
		leukemia*[TIAB]
		leukaemia*[TIAB]
		lymphoma[MH]
		lymphoma*[TIAB]
		multiple myeloma[MH]
		myeloma*[TIAB]
	Paediatric & Oncology†	pediatrics[MH]
		paediatric*[TIAB]
		pediatric*[TIAB]
		child[MH]
		child*[TIAB]
#8 (in transplant)	Transplantation	transplantation[MH]
		organ transplantation[MH]
		organ transplant*[TIAB]
		transplantation[Subheading]
		transplant*[TIAB]
		transplants[MH]
		transplant recipients[MH]
		transplant recipient*[TIAB]
	Specific organ transplant	kidney transplantation[MH]
		kidney transplant*[TIAB]
		heart transplantation[MH]
		heart transplant*[TIAB]
		liver transplantation[MH]
		liver transplant*[TIAB]

		lung transplantation[MH]
		lung transplant*[TIAB]
		stem cell transplantation[MH]
		stem cell transplant*[TIAB]
		hematopoetic transplant*[TIAB]
		haematopoetic transplant*[TIAB]
	Adoptive immunotherapy/CAR T	immunotherapy, adoptive[MH]
		adoptive immunotherapy[TIAB]
		CAR T cell[TIAB]
		CAR T-cell[TIAB]
		CAR-T cell[TIAB]
		CAR-T-cell[TIAB]

ABC, antibiotic class breakdown; AD, affiliation data; AMR, antimicrobial resistance; CAR T-cell, chimeric antigen receptor T-cell; CCA, cholangiocarcinoma; CH, Switzerland; COVID, coronavirus disease; CRE, carbapenem-resistant Enterobacteriaceae; EEA, European Economic Area; EEDR, emerging-extensively drug resistance; ESBL, extended-spectrum beta-lactamase; HEOR, health economics and outcomes research; HAP, hospital-acquired pneumonia; HSCT, haematopoietic stem cell transplant; ICU, intensive care unit; IV, intravenous; MH, Medical Subject Heading; MRSA, methicillin-resistant Staphylococcus aureus; MDR, multidrug resistance; OT, original title; PDR, pandrug resistance; PDAT, publication date; PT, publication type; QoL, quality of life; QALY, quality-adjusted life year; RCT, randomised controlled trial; SOT, solid organ transplant; TIAB, title and abstract; VAP, ventilator-associated pneumonia; VRE, vancomycin-resistant Enterococcus; XDR, extensively drug resistance.