Prevention of Infection Table of Evidence: Recommended for Practice—General				
Study	**Intervention**	**Sample and Design**	**Findings**	**Limitations**
Adherence to general infection control recommendations				
CDC, 2011	Infection prevention for outpatient settings	Guideline	Minimum recommendations for safe care	–
Freifeld et al., 2011 (IDSA)	Antimicrobial agents in neutropenic patients with cancer	Guideline	Comprehensive guideline to guide clinicians in the care of patients with chemotherapy-induced neutropenia and in the management of FN	–
O'Grady et al., 2011 (HICPAC)	Prevention of IV catheter-related infections	Guideline	Recommendations regarding education and training of staff, selection of catheters and sites, hand hygiene, use of maximal sterile barrier precautions for insertion, and other recommendations for the management of IV catheters and system components.	–
Antibiotic prophylaxis in at-risk patients				
Boztug et al., 2017	Teicoplanin or vancomycin; incidence of viridans sepsis	Retrospective cohort of 50 pediatric patients with AML	Prophylaxis effective compared to historic cases with no prophylaxis ($p < 0.0001$); no change in VRE incidence	Sample size; no comparison to recommended antibiotics
Bucaneve et al., 2005	Levofloxacin compared to placebo	Double-blind, placebo-controlled, multicenter RCT of 760 patients with various cancer types expected to develop neutropenia in greater than 7 days	No difference in all-cause or infection-related mortality between groups; levofloxacin group had lower risk of bacteremia and fewer fevers ($p = 0.001$).	Most patients had hematologic malignancies; parenteral antibiotics begun at discretion; no subgroup analysis based on additional antibiotic treatment
Cruciani et al., 1996	Prophylaxis with fluoroquinolones for bacterial infections	Meta-analysis of 19 studies	Prophylaxis with fluoroquinolones alone was significantly shown to reduce the frequency of gram-negative bacteremia.	–
Cruciani et al., 2003	Gram-positive prophylaxis with fluoroquinolone in neutropenic patients	Meta-analysis 9 RCTs with 1,202 patients	Evidence does not support routine use of gram-positive coverage in combination with a fluoroquinolone for antibacterial prophylaxis in neutropenic patients.	–

Cullen et al., 2007	Levofloxacin compared to placebo	Double-blind, placebo-controlled RCT of 1,565 patients beginning chemotherapy associated with risk of neutropenia	Incidence of fever in levofloxacin group lower ($p < 0.001$). No difference in rates of severe infections	Underpowered for severe infection analysis; study outcomes were "probable" infection based only on MD judgment.
Engels et al., 1998	Quinolone prophylaxis in neutropenic patients	Meta-analysis of 18 RCTs with 707 patients	The effect of quinolone prophylaxis on the rate of quinolone-resistant infection is unknown.	–
Feng et al., 2014	Vancomycin and cefepime	Observational, nonrandomized, two-group study of 38 pediatric patients with AML	Less frequent fever and longer interval to fever with prophylaxis ($p < 0.001$); few side effects	Sample size; study design
Fernandes et al., 2016	CSF use and antibiotic prophylaxis	Systematic review of 14 studies	Prophylaxis associated with decreased FN and chemotherapy delays; no ability to differentiate CSF versus antibiotic effects	Limited search; small samples; mostly studies with high risk of bias
Flowers et al., 2013	Antibiotic prophylaxis and FN management	Guideline	Antimicrobial prophylaxis if ANC less than 100 for greater than 7 days is expected	Limited specific evidence
Freifeld et al., 2011 (IDSA)	Antibiotic prophylaxis	Guideline	Recommended for high-risk neutropenic patients (expect to have ANC 100 or greater for greater than 7 days); not recommended for low-risk patients	Moderate level of evidence
Gafter Gvili et al., 2012	Antibiotic prophylaxis	Meta-analysis of 109 studies	Antibiotic prophylaxis reduced risk of mortality (RR = 66.95, $p < 0.00001$) and infection-related mortality ($p = 0.04$)	All-cause mortality only available in 47 studies; benefit in solid tumors not clear because of few studies
Ganti et al., 2017	Levofloxacin prophylaxis	Retrospective cohort of 145 patients with refractory AML	Time to bacteremia after neutropenia delayed with levofloxacin; no other differences between groups	Design
Garnica et al., 2013	Comparison of patients receiving quinolone prophylaxis to historic controls	Retrospective matched control 220 patients with hematologic malignancy or HCT	With quinolones, shorter periods of neutropenia ($p = 0.02$), less hospitalization ($p = 0.002$), fewer febrile episodes ($p < 0.001$), decreased mucositis ($p = 0.003$), and decreased bacteremia ($p = 0.04$); quinolone-resistant enterobacteria	Cohorts at different times; lack of control blood sample data

			noted in quinolone group and others hospitalized at the same time	
Ghadiany et al., 2016	Comparison of outcomes with and without prophylaxis	Retrospective cohort of 69 patients with AML	No difference in outcomes between groups	Design
Imran et al., 2008	Quinolone prophylaxis	Meta-analysis of 8 trials with 2,721 neutropenic patients with cancer	Statistical (nonsignificant) reduction in all-cause mortality with fluoroquinolone; reduced risk of febrile episode with solid tumors and lymphoma but not with hematologic inpatient and stem cell patients	Limited number studies for pooled analysis in subgroups.
Inaba et al., 2014	Outpatient antibacterial after chemotherapy and nadir; patients trained to do IV antibiotics at home	Secondary data analysis of 103 patients with AML	Patients who received full protocol had fewer infectious episodes of any type ($p = 0.002$); home management seen to be feasible.	Design
Lalami et al., 2004	G-CSF or G-CSF with ciprofloxacin and amoxicillin or clavulanate	Randomized prospective pilot of 48 patients with prior episode of febrile neutropenia	Antibiotics did not provide any additional benefit for prophylaxis.	Small sample
Laoprasopwattana et al., 2013	Ciprofloxacin or placebo within five days of beginning chemotherapy	Double-blind, placebo-controlled RCT of 95 pediatric patients with ALL or lymphoma	Fewer patients with neutropenia on ciprofloxacin developed fever ($p = 0.046$); no serious side effects	Sample size
Mayer et al., 2015	Cotrimoxazole/colistin versus ciprofloxacin	Retrospective cohort of 204 patients with AML	Incidence of about 80% FN in both groups; no differences between groups	Design
Moran et al., 2007	Managing infections in patients with CLL	Expert opinion	Combinations of antibacterial, antiviral, and antifungal prophylactic medications may be appropriate in patients with CLL to prevent life-threatening infection.	Limited to recommendations for patients with CLL
NCCN, 2017	–	Guideline	Recommends consideration of prophylaxis in intermediate and high-risk patients	–
Rahman & Khan, 2009	Levofloxacin compared to placebo	Single-blind, placebo-controlled RCT with 80 patients with acute leukemia	Levofloxacin reduced incidence of fever and microbial infection ($p < 0.001$)	Limited sample; statistical analysis not well described; hospital environment/study site noted to have hygiene issues

Shinohar et al., 2013	Moxifloxacin versus tosufloxacin	Retrospective cohort of 161 patients with ALL or AML	Moxifloxacin associated with less incidence of FN and more fungal infection; no other differences between groups; no difference in fluoroquinolone resistance	Study design
Tomblyn et al., 2009 (CDC)	Prevention of infection complications among recipients of HCT	Guideline	Specific interventions for prevention of infection among recipients of HCT is a complex field, and healthcare providers who work with these patients need to be aware of current knowledge.	–
Van de Wetering et al., 2005	Prophylactic antibiotics in neutropenic afebrile patients with cancer	Systematic review of 22 RCTs	Antibacterial prophylaxis significantly reduced bacteremia and infection-related mortality. Quinolones significantly reduced the risk of gram-negative bacteremia, but antibacterial prophylaxis did not.	–
Yeh et al., 2014	Ciprofloxacin prophylaxis and voriconazole	Retrospective cohort of 113 pediatric patients with ALL or AML	Fewer episodes of bloodstream infections and FN, lower cost, and shorter ICU stay with prophylaxis ($p < 0.01$)	No blinding; study design
Antifungal prophylaxis in at-risk patients				
Ananda-Rjah, 2012	Primary prophylaxis with multiple different agents	Retrospective cohort of 216 patients with AML or MDS	All provable fungal infections were molds, mostly aspergillosis; incidence of breakthrough fungal infection lowest with voriconazole/posaconazole (8%; $p = 0.011$)	Descriptive only
Annino et al., 2013	Prophylactic liposomal amphotericin B	Pilot single-center trial of 48 patients with AML	Amphotericin B can be used safely in patients with AML undergoing induction chemotherapy.	Sample; methods not well described
Bochennek, 2015	Micafungin prophylaxis	Retrospective cohort of 21 pediatric patients with a hematologic malignancy intolerant to azoles	No fungal infections; no discontinuation because of adverse events	Sample size; design
Bow et al., 2002	Antifungal prophylaxis	Systematic review of 38 RCTs with 7,014 patients	Antifungal prophylaxis reduced use of parenteral antifungals, fungal infection–related mortality, and	–

			superficial fungal infections for patients with leukemia	
Cho et al., 2015	Posaconazole versus fluconazole	Retrospective cohort of 424 patients with AML or MDS	Breakthrough invasive fungal infection ($p < 0.001$) and invasive fungal infection–related mortality ($p = 0.028$) lower with posaconazole	Design
Cornely et al., 2003	Antifungal prophylaxis	Systematic review of 38 RCTs with more than 9,000 patients	Recommends prophylaxis for HCT and hematologic malignancies	–
Cornely et al., 2007	Posaconazole, fluconazole, or itraconazole	RCT of 602 patients expected to have neutropenia for 7 or greater days	Posaconazole (2% had probable infection); fluconazole/irtraconazole (8% had probable infection)	–
Cornely et al., 2009 (Infectious Disease Working Party of German Society for Hematology and Oncology)	Primary prophylaxis for fungal infections in patients with hematologic cancers	Guideline of 86 trials with 16,922 patients	Fluconazole as primary prophylaxis for recipients of allogeneic HCT; posaconazole recipients of allogeneic HCT with GVHD and in AML or MDS; not recommended: itraconazole, voriconazole, caspofungin, micafungin and conventional amphotericin B.	–
Doan et al., 2016	Use of antifungal prophylaxis	Retrospective cohort of 98 patients with ALL	Those receiving prophylaxis had lower incidence of invasive fungal disease than those who did not get antifungal prophylaxis ($p = 0.024$).	Design
Egerer & Geist, 2011	Posaconazole	Retrospective observational cohort of 40 patients with AML	23 patients developed pneumonia; 13 possible fungal and 1 aspergillosis. One-third had systemic therapies because of signs and symptoms of fungal infection.	Retrospective design; some patients had multiple drugs, so effect of posaconazole monotherapy unclear
Ethier et al., 2012	Mold-active compared to fluconazole prophylaxis	Systematic review and meta-analysis of 20 studies with 5,725 patients	Mold-active prophylaxis compared to fluconazole significantly reduced the risk of invasive fungal infections (RR = 0.71, $p = 0.03$). Mold-active prophylaxis decreased the risk of aspergillus infection (RR = 0.53) and mortality (RR = 0.67). Use of mold-active agents was associated with more adverse events.	Design of included studies not well described; adverse events not described

Fisher et al., 2014	Prophylaxis versus none	Retrospective cohort of 871 patients with AML	Higher mortality in no prophylaxis group (RR = 0.42; 95% CI [19, 90]); no difference with mold-active or not; fewer diagnostics needed with prophylaxis	Design; causes of mortality not stated
Fleming et al., 2014	Antifungal prophylaxis in patients with hematologic malignancies	Guideline	Provides information regarding risk factors for consideration in determining the specific type of prophylactic agent to be used and provides comprehensive information regarding metabolism of individual antifungals	–
Freifeld et al., 2011 (IDSA)	Use of antimicrobial agents in neutropenic patients	Guideline	Comprehensive guide to clinicians for the care of patients with chemotherapy-induced neutropenia in the management of FN	Low-level evidence
Gerber et al., 2014	Posaconazole prophylaxis	Retrospective cohort of 88 patients with AML, APL, or MDS	Fewer invasive fungal infections with prophylaxis (p = 0.0088)	Possible infections included in invasive fungal infection outcomes
Glasmacher et al., 2003	Itraconazole compared to control	Systematic review of 13 RCTs with 3,597 patients	Significant reduction in fungal infections with prophylaxis	–
Gomes et al., 2014	Identification of risk factors for invasive fungal infection and role of aspergillus prophylaxis	Retrospective cohort of 25 patients with AML	Higher incidence of invasive fungal infections in those not on mold-active agents (p = 0.004); no difference in all-cause mortality	Design Very few invasive fungal infections overall
Gonzalez et al., 2008	Fungal prophylaxis in patients with AML undergoing BMT with GVHD and MDS	Expert opinion	Posaconazole recommended as primary antifungal prophylaxis; preventive treatment in these patients is not recommended.	–
Gotzsche & Johansen, 2002	Antifungal administration for control of fungal infections in patients with cancer	Cochrane review of 32 studies with 4,287 patients	Amphotericin B is the only antifungal studied that showed reduced mortality significantly and consistently, used either prophylactically or empirically.	–
Gotzsche & Johansen, 2014	Nystatin prophylaxis	Meta-analysis of 14 studies with 1,529 patients	Azoles more effective in preventing invasive fungal infection and colonization; concluded nystatin cannot be recommended	5 trials included in meta-analysis

Johansen & Gotzsche, 2000	Amphotericin versus lipid-soluble amphotericin	Systematic review of 12 RCTs with 1,895 neutropenic patients	No difference in mortality; fewer infections with lipid-soluble version	–
Johansen & Gotzsche, 2002	Amphotericin B versus fluconazole	Cochrane review of 17 RCTs with 3,798 patients	No significant difference was found between fluconazole and amphotericin B with regard to mortality, invasive fungal infection, colonization, use of rescue therapy, or dropouts.	–
Jorgensen et al., 2014	Voriconazole versus amphotericin B or fluconazole in neutropenic patients with cancer	Cochrane review of 3 RCTs with 391 patients with varied diagnoses	For the empirical treatment of patients with cancer who are immunosuppressed, liposomal amphotericin B is significantly more effective than voriconazole.	Trials could not be pooled for analysis because of heterogeneity in study design.
Kanda et al., 2000	Oral fluconazole prophylaxis	Meta-analysis of 16 RCTs with 3,734 patients	Prophylactic fluconazole was not effective in reducing fungal-related death in non-BMT patients (but was effective in recipients of BMT) and did not reduce systemic fungal infections in non-BMT recipients (but was effective in recipients of BMT).	–
Kusuki et al., 2009	Micafungin prophylaxis	Retrospective cohort of 40 pediatric patients with varied tumor types	30 of 40 had successful prevention of invasive fungal infection	Small sample; mixed findings in solid tumors versus hematologic types; retrospective only
Liu et al., 2014	Secondary antifungal prophylaxis with various agents	Retrospective cohort of 164 patients with acute leukemia	Lower rate of recurrent invasive fungal infections with secondary prophylaxis ($p = 0.000$)	Design; no definition of invasive fungal infections
Mandhaniya et al., 2011	Low-dose amphotericin B versus oral voriconazole	RCT of 100 pediatric patients with leukemia	Overall proven and possible fungal infections were 5%.	No blinding
NCCN, 2017	Prevention and treatment of cancer-related infections	Guideline	Consideration of antifungal prophylaxis until resolution of neutropenia in those at intermediate risk (7–10 days) and for anticipated mucositis	Limited search information
Pechlivanoglou et al., 2014	Antifungal agents	Systematic review of 25 studies with 7,062 patients with hematologic malignancy	Invasive fungal infection prophylaxis reduces risk but may not affect all-cause mortality. Posaconazole is superior for prophylaxis against	Studies were inconsistent in reports and reporting outcomes.

		undergoing transplantation	invasive fungal infections in neutropenic patients.	
Peterson et al., 2013	Antifungal prophylaxis	Retrospective cohort of 200 patients with AML or MDS	Findings support the routine use of antifungal prophylaxis in high-risk patients.	Risk of bias; definition of high risk was not specifically described.
Ping et al., 2013	Azoles for antifungal prophylaxis	Systematic review and meta-analysis of 4 studies with 2,267 patients with hematologic malignancies	Second-generation azoles appear to be superior to first-generation azoles with regard to prevention of invasive fungal infections without increasing risk of adverse events.	Small number of studies reviewed
Robenshtok et al., 2007	Antifungal prophylaxis in patients with cancer	Systematic review of 64 RCTs in patients receiving chemotherapy or allogeneic transplantation	Antifungal prophylaxis significantly decreased risk for mortality. Risk reduction was greater with combined antifungal and antibacterial prophylaxis.	Strongest evidence in HCT and acute leukemia during induction; insufficient evidence in other patients with acute leukemia
Schrenk et al., 2015	Posaconazole oral suspension	Retrospective cohort of 79 patients with AML	Optimal agent for prophylaxis not clear.	Design
Science et al., 2014	Primary antifungal prophylaxis for pediatric patients with cancer or patients undergoing HCT	Guideline	Recommend primary antifungal prophylaxis in at-risk children; the reference identifies specific doses recommended.	Some studies reviewed did not include pediatric patients.
Shen et al., 2013	Posaconazole and fluconazole prevention of invasive fungal infection	RCT of 244 patients with AML	Posaconazole showed significant advantage compared with fluconazole in reducing the incidence of invasive fungal infections. The advantage of posaconazole in decreasing the incidence may translate into reduced need for systemic antifungal treatment.	–
Song et al., 2010	Effect of secondary prophylaxis	Retrospective review of 57 patients with hematologic malignancies	11 failures of secondary prophylaxis during HCT or chemotherapy	Small sample; retrospective design
Tacke et al., 2014	Antifungal recommendations	Guideline	Strong recommendation for daily PO posaconazole; provides specific comparisons and recommendations for specific drugs	Search strategy not specified

Vardakas et al., 2005	Fluconazole versus itraconazole for antifungal prophylaxis	Meta-analysis of 5 studies of patients with hematologic malignancies	Fluconazole was associated with slightly more fungal infections, but there was no difference in mortality between fluconazole and itraconazole. Fluconazole was associated with fewer side effects.	–
Wang et al., 2010	Itraconazole versus fluconazole	Meta-analysis of 9 studies with 2254 patients	Itraconazole stated to have higher effect and more adverse effects	Conflicting results statements; high variability in dosages of medications studied; high heterogeneity
Yeh et al., 2014	Antibiotic and antifungal prophylaxis	Retrospective cohort of 113 patients with AML or ALL	Prophylaxis decreased the occurrence of FN, bloodstream infections, invasive fungal infections, ICU length of stay, and cost.	Risk of bias
Zhao et al., 2016	Azoles for prophylaxis	Meta-analysis of 21 studies	All azoles were effective; itraconazole was least effective, and posaconazole was most cost effective.	Limited to AML and HCT without GVHD
Ziakas et al., 2010	Antifungal prophylaxis	Meta-analysis of 25 studies in 3,979 patients (transplantation and non-transplantation)	Prophylaxis associated with significant reduction in proven fungal infections, fungal-related mortality, reduced risk for candida infections, and decreased need for antifungal therapy ($p = 0.05$) (OR = 0.28–0.63); reduced risk in HCT only	Analysis showed multicenter and double-blind designs were moderators of findings in mortality and proven infections.
Antiviral prophylaxis for select at-risk patients				
Cheuk et al., 2011	Vaccines for prophylaxis of viral infection	Cochrane review of 8 RCTs with 643 patients with hematologic malignancies	Inactivated varicella zoster vaccine might reduce zoster severity in adult recipients of HCT, as well as respiratory infections and hospitalizations.	Low quality of evidence
Freifeld et al., 2011 (IDSA)	Antimicrobial agents in neutropenic patients	Guideline	Comprehensive guideline for clinicians in the care of patients with chemotherapy-induced neutropenia	–
Glenny et al., 2009	Interventions for the prevention or treatment (or both) of herpes simplex virus	Meta-analysis of 17 studies	Antivirals were more effective than placebo (RR = 0.11)	Small effect size
NCCN, 2016	Prevention of infection	Guideline	Consideration of antiviral prophylaxis in high-risk patients	No reported quality evaluation of literature included

Paul et al., 2016	Hepatitis B prophylaxis	Meta-analysis of 26 studies with 2,079 patients	OR for reactivation without prophylaxis was 0.12 (p = 0.05; 95% CI [0.6, 0.22]).	High heterogeneity and small effect size
Tang et al., 2015	Prophylaxis and preemptive antiviral treatment	Meta-analysis of 6 studies with 430 patients	Early preemptive/prophylactic lamivudine superior in reducing hepatitis B virus recurrence (OR = 0.13, p < 0.0001) and chemotherapy disruption (OR = 0.37, p < 0.0001)	Few studies
Sandherr et al., 2015	Antiviral prophylaxis	Guideline	Recommends influenza vaccination; does not recommend other routine prophylaxis	No search results provided; no study quality evaluation
Catheter care bundle for prevention of CLABSI				
Bundy et al., 2014	Multisite collaborative with implementation of a catheter care bundle	Cohort time series of 28 units	28% reduction in CLABSI after implementation (p = 0.05)	Design; bundle audit reliability not examined
Choi et al., 2013	Staff education and implementation of hand hygiene, dressing change frequency, tubing change, and skin cleaning with chlorhexidine	Historic comparison of 130 pediatric patients	CLABSI rates declined in general and HCT groups (p < 0.04); 90% self-reported compliance with bundle	–
O'Grady et al., 2011	All aspects of catheter care	Guideline	Bundling individual recommendations is recommended.	–
Rinke et al., 2012	Care bundle use based on CDC guidelines	Observational historic comparison of 30 cases with pediatric patients during 14,059 days with central line catheters	Second year of intervention showed 64% decline in CLABSI rate (not significant)	Sample size
Schiffer et al., 2013	Evidence-based guideline for central venous catheter care for patients with cancer	Guideline of 105 RCTs and 25 meta analyses	Recommend hand hygiene, barrier precautions for insertion, chlorhexidine skin antisepsis, and avoiding use of femoral line	–
Secola et al., 2012	Catheter care bundles in pediatric patients	Systematic review of 24 studies with 8,862 patients	Concluded that implementation of central venous catheter care bundles is effective.	–
Wolf et al., 2008	Central venous catheter–related infections	Guideline	Recommendations include adherence to hygiene principles with inserting central venous catheters and employing standardized aseptic	No conflict of interest concerns were addressed.

			placement, using subclavian vein versus internal jugular vein, and using catheters impregnated with antiseptics like chlorhexidine/silver sulfadiazine or antibiotics, as well as nurse and MD education and ultrasound guidance for insertion.	
Chlorhexidine skin preparation				
Lai et al., 2016	Skin antisepsis for catheter care	Meta-analysis of 12 studies with 2,011 patients	Chlorhexidine lowered risk of catheter-related bloodstream infections (RR = 0.64, p = 0.05) and was associated with less colonization (RR = 0.08, p = 0.0003).	Mostly studies with high risk of bias
O'Grady et al., 2011	Prevention of central venous catheter infections	Guideline	Recommends skin preparation prior to insertion and with dressing changes of chlorhexidine and alcohol; notes that no comparison was made between chlorhexidine/alcohol versus povidone iodine (unresolved issue at that time)	–
Pages et al., 2016	Chlorhexidine plus alcohol versus povidone iodine skin disinfection with catheter care	Prospective cohort multisite trial of 3,207 patients with cancer and other diseases	Decreased risk of catheter-related infection with chlorhexidine (p = 0.037); no significant difference overall in CLABSI; one site switched from povidone to chlorhexidine (risk lower with chlorhexidine; p = 0.005, HR = 0.31)	No information on other aspects of catheter care and insertion; reports on catheter-related infection and CLABSI with unclear differentiation
Schiffer et al., 2013	Central venous catheter care	Guideline	Chlorhexidine skin antisepsis recommended for insertion	–
Yamamoto et al., 2014	Chlorhexidine plus ethanol versus povidone iodine skin preparation prior to central venous catheter insertion and with central venous catheter care	RCT of 84 patients with hematologic cancers	Higher CLABSI rate and skin colonization with povidone iodine (p < 0.05)	High attrition in povidone group; higher percentage in povidone group had inguinal central venous catheter insertion; no subgroup analysis
CSFs and biosimilars for at-risk patients				
Aapro et al., 2011	G-CSFs for primary and secondary prophylaxis	Guideline	Prophylactic G-CSF recommended for febrile neutropenia risk 20% or greater but not recommended if less	Consensus plus evidence; provides clear risk percentage per chemotherapy regimen for

			than 10%; secondary recommended if previous FN with chemotherapy	some cancers, identifies other risk factors, but offers little guidance in calculating risk for other than chemotherapy
Aapro et al., 2016	Biosimilar filgrastim	Prospective observational study of 1,447 patients with multiple tumor types	No difference in FN outcomes across age groups	Design
Almenar et al., 2013	Review of outcomes with daily G-CSF versus pegfilgrastim	Retrospective multisite study 391 patients with solid tumors	Higher risk of infection with G-CSF (OR = 1.73, p = 0.05); more dose reductions and delays with G-CSF	Non-randomized and retrospective design
Badalamenti et al., 2013	Lenograstim for primary prophylaxis	Observational study of 36 patients with soft tissue sarcoma	No episodes of FN in 3 cycles observed; no treatment delays or dose reduction	Sample size; observational design
Balducci et al., 2007	Proactive pegfligrastim versus pegfilgrastim after neutropenia is present (at discretion of MD)	Phase 4 open label RCT of 852 patients with various cancers	Prophylactic use significantly better regarding FN overall; fewer grade 3 or 4 neutropenia events	No blinding; dosing in discretion arm unclear
Bhana, 2007	Various CSFs	Systematic review of 20 studies with 7,409 patients with various cancers; meta-analysis in pediatric patients	G-CSFs are effective in reducing risk of neutropenia and FN.	Various study designs in terms of use with and without antibiotics or secondary prophylaxis
Blackwell et al., 2015	Filgrastim versus biosimilar	Non-inferiority RCT of 218 patients with breast cancer	No differences between groups in outcomes or side effects	–
Blackwell et al., 2016	Pegfilgrastim versus biosimilar	Non-inferiority RCT of 275 patients with breast cancer	No difference between groups; 95% in both had bone pain.	No blinding
Bohlius et al., 2008	G-CSF or GM-CSF prophylaxis compared to placebo	Systematic review and meta-analysis of 13 RCTs with 2,607 patients with lymphoma	G-CSF and GM-CSF significantly reduced risk of neutropenia, FN, and risk of infection	Risk of bone pain more than double
Bongiovanni et al., 2017	Biosimilar filgrastim	Retrospective cohort of 67 patients with soft-tissue sarcoma	No differences between biosimilar and other	Design

Borinstein et al, 2009	Pegfilgastrim 24–48 hours after chemotherapy	Retrospective, descriptive study of 47 pediatric patients with hematologic malignancies	FN occurred in 28% of courses; course delay in 9% of courses; no adverse effects seen	Only to establish safety in pediatric cases; small sample; retrospective only
Brito et al., 2016	Biosimilar filgrastim, filgrastim, and pegfilgrastim comparison	Retrospective cohort of 420 patients with breast cancer	FN episodes more frequent in biosimilar group ($p < 0.02$); ANC at time of FN diagnosis lower in biosimilar group ($p = 0.015$); more dose delays with biosimilars ($p = 0.04$)	Design; many risk-related differences in these study groups.
Burris et al., 2010	Pegfilgrastrim on last day of cycle versus 24 hours later	Double-blind, placebo-controlled RCT of 275 patients with varied cancer types	No statistical differences between groups; some trend toward less grade 4 neutropenia in next-day patients.	Minimal statistical analysis reported; substantial differences in sample characteristics for disease stage; only analyzed in 1 cycle
Chan et al., 2011	Pegfilgrastim versus filgrastim for primary prophylaxis	Retrospective cohort 204 patients with non-Hodgkin lymphoma	No significant differences in outcomes observed between groups	Retrospective from medical record data
Cheng et al., 2014	Pegfilgrastim	Retrospective cohort of 141 patients with non-Hodgkin lymphoma	Patients who received pegfilgrastim on the same day of chemotherapy had the highest incidence of FN compared to those who received the drug on day 1 or beyond	Key group differences; measurement validity and reliability questionable
Crawford et al., 2010 (European Society for Medical Oncology)	Hematopoietic growth factors	Guideline	Outlines indications or the use of hematopoietic growth factors as primary prophylaxis and situations for the use of growth factors in standard therapy	No process was provided for how the guideline was developed.
Do et al., 2015	G-CSF with taxotere and cyclophosphamide regimen	Meta-analysis of 8 studies with 1,542 patients	92% lower FN incidence rate with use of G-CSF (OR = 0.077, $p = 0.05$)	OR direction reporting is confusing.
Engert et al., 2009	XM02, a G-CSF, versus filgrastim	Phase 2 randomized comparison trial of 92 patients with lymphoma	No differences between groups in FN outcomes or adverse events	Small sample size; filgrastim only given in first chemotherapy cycle, then all got XM02, but results were analyzed across all chemotherapy cycles.

Freifeld et al., 2011 (IDSA)	CSFs	Guideline	Recommended when anticipated risk of febrile events is 20% or greater	Does not differentiate primary and secondary prophylaxis
Freyer et al., 2013	G-CSF secondary prophylaxis	Observational study of 548 patients with solid tumors with previous neutropenic event	Only use of G-CSF was associated with reduced rate of febrile episodes (less than 0.001).	FN defined as temperature elevation for 1 hour or causing dose reduction or delay; unclear description for strategy of dose reduction or delay
Gladkov et al., 2016	Balugrastim (2 different doses) compared to pegfilgrastim	Randomized non-inferiority trial of 238 patients with breast cancer	No differences between groups; adverse effects similar; balugrastim not inferior	Open label; no blinding
Goldschmidt et al., 2014	Pegfilgrastim compared to on-demand G-CSF	Retrospective cohort of 40 patients with hairy cell leukemia	No significant difference between prophylactic pegfilgrastim or on demand filgrastim	–
Green et al., 2003	Single-dose pegfilgrastim versus daily filgrastim	Double-blind RCT of 152 women	No difference in duration of grade 4 neutropenia	Disease type was not stated.
Gruschkus et al., 2010	CSF primary prophylaxis	Data analysis using SEER data of 13,203 patients with non-Hodgkin lymphoma	42% lower risk of FN with prophylaxis and 27% lower incidence of infection with 5–9 CSF doses. Primary prophylaxis not associated with increased survival; secondary prophylaxis associated with 23% lower risk mortality.	Limitations of SEER data and analysis by codes; no subgroup analysis by different chemotherapy regimens; more who got primary prophylaxis had more advanced disease and were more likely to have received radiation therapy too; survival effect would be affected.
Gupta et al., 2010	Prophylactic filgrastim	Prospective, observational, comparison study of 50 patients with multiple cancers	Neutrophil recovery time, duration antibiotics, treatment delays, or reductions reduced ($p < 0.01$)	Sample size; different numbers stated throughout the article; those who developed severe neutropenia during trial were eliminated from analysis.
Gurion et al., 2011	CSF versus no CSF	Meta-analysis of 19 studies with 5,256 patients with AML	CSFs associated with shortened neutropenia and hospital stay; no differences in 30-day all-cause mortality, survival, remission, or bloodstream infections.	Varied chemotherapy regimens; 2 studies in pediatric patients; no subgroup analysis; included relapsed, secondary, and refractory AML cases

Hecht et al., 2010	Pegfilgrastim	Double-blind, placebo-controlled RCT of 135 patients with advanced colorectal cancer	Treated 13% less likely grade 3–4 neutropenia and had fewer dose reductions or treatment delays	Authors own stock in company making the drug
Hegg et al., 2016	Two different brands of filgrastim	Randomized, phase 3, non-inferiority study of 219 patients with breast cancer	No differences between groups in grade 4 neutropenia	No blinding; 10% non-inferiority margin
Herbst et al., 2009	Prophylactic G-CSF or GM-CSF with antibiotics	Systematic review of 2 RCTs with 195 patients with solid tumors	No apparent difference between the two regimens	Only 2 studies included in the review
Holmes et al., 2002	Single-dose pegfilgrastim versus daily filgrastim	Randomized two-group multisite trial of 137 patients with breast cancer	Lower time to ANC recovery and duration of grade 4 neutropenia with pegfilgrastim; no other differences	No blinding; only 1 cycle of data analyzed
Inaba et al., 2011	G-CSF daily after courses 1 and 2 of induction	Double-blind RCT of 46 pediatric patients with AML	No differences in episodes of FN, neutropenic days, antibacterial or antifungal therapy, cost etc.	Not clear if all received prophylactic antibiotics and antifungals; sample size limitation
Kosaka et al., 2015	Pegfilgrastim	Double-blind, placebo-controlled RCT of 346 patients with breast cancer	Less FN with pegfilgrastim ($p < 0.001$); no hospitalizations with pegfilgrastim; less antibiotic use; 4% with pegfilgrastim developed FN compared to 100% with placebo	Non-standard dose used
Kourlaba et al., 2015	Compare effectiveness of single-dose pegfilgrastim versus daily filgrastim	RCT of 1,058 patients with breast cancer	No difference in FN rates between groups; dose reductions and delays lower with pegfilgrastim	Several different chemotherapy regimens; poor description of original studies; CSF given at MD discretion; FN measurement not well described
Kubo et al., 2016	Pegfilgrastim versus filgrastim	Double-blind RCT of 107 patients with non-Hodgkin lymphoma	Established non-inferiority of pegfilgrastim	–
Kuderer et al., 2007	Primary and secondary G-CSF prophylaxis	Systematic review and meta-analysis of 17 RCTs with 3,493 patients	Risk of febrile neutropenia reduced; infection-related mortality reduced	–
Kuderer, 2011	Various CSFs	Meta-analysis of 17 RCTs	Primary prophylaxis with G-CSF reduced risk FN and dose reduction; reduction in infection-related	Broad sample size ranges and tumor and treatment types;

			mortality (RR = 0.552, p = 0.018) and all-cause early mortality (RR = 0.599, p = 0.002)	early mortality not defined; heterogeneity not reported
Lalami et al., 2004	G-CSF or G-CSF with 1 of 3 antibiotics daily, beginning 48 hours after start of chemotherapy	Prospective randomized trial of 48 patients on chemotherapy with prior episode of FN	No episodes of FN in G-CSF group	No blinding or appropriate controls; variation in study groups in items of relevance
Lee et al., 2013	G-CSF prophylaxis compared to historic controls	Descriptive study of 65 patients with non-Hodgkin lymphoma	Incidence of FN 5% with G-CSF compared to 60% controls	Study design
Lee et al., 2015	Phase 2 for dose-finding and phase 2 for efficacy of pegteograstim	Double-blind, non-inferiority RCT of 176 patients with breast cancer	No differences between groups except for ANC recovery time (lower after cycle 1 in pegteograstim group); adverse event prevalence 3.4% with pegfilgrastim and 5.3% with new drug	–
Loibl et al., 2011	Pegfilgrastim on day 2 versus day 4 as primary prophylaxis	RCT of 355 patients with breast cancer	No clinically relevant differences between groups	–
Lyman et al., 2002	Prophylactic G-CSF	Meta-analysis of 8 RCTs with 1,244 patients with various malignancies	CSFs significantly reduced FN, documented infections, chemotherapy dose reductions. CSFs increased the risk of bone pain and did not improve infection-related mortality.	–
Milano-Bausset et al., 2009	G-CSF versus pegylated G-CSF	Retrospective comparative analysis of 20 pediatrics patients with Ewing sarcoma	Pegfilgrastim associated with lower incidence of severe neutropenia (p = 0.034) and shorter duration of severe neutropenia (p = 0.03) compared with filgrastim	Small sample size; retrospective study; no random assignment of which treatment
Minuk et al., 2012	Change from use of CSF as primary to secondary prophylaxis	Prospective cohort with historic comparison of 122 patients with Hodgkin lymphoma	No significant difference between groups in FN rate	Design limitations; sample size
Mitchell et al., 2016	Comparison of prophylaxis with short- versus long-acting CSF	Systematic review of 18 studies	FN and associated hospitalization lower with long-acting CSF; fewer FN-related deaths, severe neutropenia, dose reductions, and antimicrobial use	Various tumor types (low versus high risk); no subgroup analysis; low quality ratings of some studies; use of medical claims data

Munoz et al., 2012 (Spanish Society of Clinical Oncology)	Myeloid growth factors	Guideline	Provides evidence-based guideline for the use of CSFs for prophylaxis and treatment of FN	–
NCCN, 2017	Myeloid growth factors	Guideline	CSF recommended for greater than 20% risk FN and those with prior neutropenic events	Mainly consensus recommendations
O'Shaughnessy, 2007	Study outcomes with G-CSF	Expert opinion	G-CSF prophylaxis decreases rates of FN.	Search and literature evaluation not described
Paksu et al., 2012	High-dose methyl prednisolone versus G-CSF versus no treatment	Retrospective cohort of 29 pediatric patients with ALL	High-dose methyl prednisolone was equal to G-CSF for successful outcome of shortening the course of delayed treatment because of neutropenia. It is also less expensive than G-CSF.	Small sample; risk of bias
Park et al., 2013	Biosimilar pegylated G-CSF compared to filgrastim	Open-label, phase 2 randomized study of 61 patients with breast cancer	No differences in nadirs, time to recovery, or FN incidence	Design
Park et al., 2017	Daily filgrastim versus DA-3031, a pegylated CSF	Open-label, non-inferiority RCT of 74 patients with breast cancer	No difference between groups in duration of grade 4 neutropenia, incidence, recovery time, or side effects	Sample size; no blinding
Pfeil et al., 2015	Long-acting CSFs	Systematic review of 44 studies with 58,342 patients	Long-acting CSFs did not consistently show better effects, but majority showed better efficacy compared to daily or placebo.	No differentiation between primary and secondary prophylaxis
Phillips et al., 2012	Myeloid growth factor use in adults	Guideline	Recommends no routine CSF prophylaxis; states high-quality evidence	Cost-effectiveness considered; limited references provided; commissioned by NICE
Pinto et al., 2007	Pegfilgrastim versus filgrastim	Meta-analysis of 5 studies with 617 patients	Results suggest that daily filgrastim and single-dose pegfilgrastim provide essentially the same effect for time to ANC recovery, grade 4 neutropenia rates, and bone pain.	Small samples; study heterogeneity
Poonawalla et al., 2016	Erythropoietin-stimulating factors and G-CSFs in reducing blood transfusions and neutropenia incidence	Retrospective cohort of 5,572 elderly patients with ovarian cancer	CSF effective in reducing incidence of FN and associated with improved survival	Design; SEER database source

Rajan et al., 2011	Primary prophylactic G-CSF	Retrospective analysis of SEER data of 10,441 patients with breast cancer and aged older than 65 years	Primary prophylaxis associated with 16% reduction in neutropenia hospitalizations	Only dealt with hospitalizations for neutropenia; retrospective SEER data analysis only via SEER data
Renner et al., 2012	G-CSF primary prophylaxis	Systematic review and meta-analysis of 8 studies	CSF showed reduced risk of FN (RR = 0.27, 95% CI [0.11, 0.7]), early mortality (RR = 0.32, p = 0.05); with removal of 1 study, no longer significant	Mortality evidence was of low quality; only moderate evidence overall; most from 1 large study only
Sagara et al., 2013	Filgrastim biosimilar FSK0808 daily injections	Multisite, prospective study with 104 patients with breast cancer	Neutropenia recovery time and side effects similar to those reported for filgrastim	No control or comparison; no blinding
Sari et al., 2013	Filgrastim versus lenograstim	Randomized, crossover study of 29 pediatric patients with multiple tumor types	No difference between groups in infection outcomes; filgrastim less expensive	Sample size
Shi et al., 2013	Single-dose pegfilgrastim versus daily filgrastim	Randomized, crossover, multisite study of 337 patients with multiple tumor types	No difference between groups	Not clear that any patients were at risk population who should get CSFs
Smith et al., 2015	Growth factors	Guideline	Primary prophylaxis recommended in high-risk patients; reasonable for use in children; secondary prophylaxis recommended for prior neutropenic complicated cases	–
Spunt et al., 2010	Pegfilgrastim dose escalation versus filgrastim	Open-labe, phase 2 RCT of 35 patients with sarcoma	85% in filgrastim and 68% in pegfilgrastim had FN; time to recovery similar in both groups	Small sample; limited statistical analysis
Sung et al., 2004	CSFs as primary prophylaxis	16 RCTs with 1,183 pediatric patients	CSFs reduced rate of FN, infections rate, duration of neutropenia, and hospitalizations; no effect on infection-related mortality or chemotherapy delays	–
Sung et al., 2007	CSFs as primary prophylaxis	Systematic review of 148 RCTs with 16,839 participants or cycles	CSFs reduced infection and FN.	–

Sviekata et al., 2011	Recombinant G-CSF	Open-label trial of 50 women with breast cancer	Incidence of grade 4 neutropenia was 42% overall; FN incidence was 14%; bone pain was the most frequent moderate to severe side effect.	Sample size; open-label design for safety and efficacy only
Thiepold et al., 2014	Pegfilgrastim	Retrospective cohort of 60 patients with recurrent glioma	Pegfilgrastim reduced incidence of grade 3 neutropenia in early nadir ($p = 0.04$); no difference in late nadir	Design
Timmer-Bonte et al., 2008	Comparison of paclitaxel dose escalations and reduction associated with G-CSF and antibiotics	Prospective study of 47 patients with lung cancer	G-CSF and antibiotics enabled higher chemotherapy dosing.	No analysis of survival time; no control or comparison
Volovat et al., 2016	Lipegfilgrastim versus placebo	Post-hoc analysis of an RCT of 375 patients with lung cancer	No significant difference in the incidence of FN following the first chemotherapy cycle between lipegfilgrastim and placebo for patients aged 65 years and younger. In older patients, lipegfilgrastim significantly reduced the incidence of FN in addition to the benefits realized by younger patients.	Risk of bias; only 13% of participants were women.
Von Minckwitz et al., 2008	Pegfilgrastim or pegfilgrastim plus ciprofloxacin as primary prophylaxis	Retrospective analysis of 1,256 previously untreated patients with breast cancer who were part of a chemotherapy trial	Pegfilgrastim alone or with ciprofloxacin significantly more effective in prevention of FN and grade 4 neutropenia; no difference in prevention of infection with neutropenia	G-CSF not administered according to protocol with continuation until recovery (inappropriate comparison)
Von Minckwitz et al., 2009	Primary prophylaxis with pegfilgrastim versus standard short course of treatment after first cycle	Systematic review of 19 studies with 2,282 patients receiving chemotherapy for breast cancer	Incidence of FN significantly lower with prophylaxis, along with related hospitalizations and incidence of grade 3 or 4 neutropenia	–
Waller et al., 2010	Biosimilar filgrastim versus filgrastim	Randomized, double-blind, phase 3, multisite study of 276 patients with breast cancer	Two formulations essentially equivalent; no significant differences	Sample differences at baseline could have influenced some findings in severity of bone pain with formulation.
Wang et al., 2016	G-CSF prophylaxis	Systematic review and meta-analysis of 27 studies with 6,037 patients	Primary prophylaxis using all formulations were significantly better than placebo to prevent FN.	–

Weycker et al., 2012	Filgrastim, pegfilgrastim, and sargramostim as prophylaxis	Retrospective cohort of 208,401 participants with various malignancies	Prophylactic pegfilgrastim administration was associated with less risk of hospitalizations for neutropenia and neutropenia-related complications than either prophylactic filgrastim or sargramostim in patients undergoing chemotherapy.	Data based on insurance claims from 2 healthcare claims databases
Weycker et al., 2014	Daily filgrastim during chemotherapy cycles	Retrospective cohort of 14,288 medical claims	Odds of chemotherapy-induced neutropenia complications lower with greater than 7 days compared to either 1–3 days or 4–6 days ($p = 0.05$)	Design; medical claims data
Weycker et al., 2016	Pegfilgrastim prophylaxis	Retrospective cohort of 42,314 patients with various cancers	5.3% on intermediate- or high-risk chemotherapy did not get prophylaxis for second cycle; FN higher in group without continued prophylaxis (OR = 3.5, $p < 0.001$)	Definition of FN; use of claims data; design; no information on ANC; no differentiation between intermediate or high risk; funded by manufacturer
Yakushijin et al., 2011	Daily versus every other day G-CSF	RCT of 30 patients with diffuse large B-cell non-Hodgkin lymphoma	No differences in WBC recovery time (mean = 4 days in both); no differences in FN episodes; cost of daily G-CSF significantly higher	Small sample; limited study duration (first course only); no blinding
Zhou et al., 2016	Mecapegfilgrastim, a biosimilar	RCT of 146 patients with lung cancer	Biosimilar more effective than placebo ($p < 0.0001$)	–
Contact precautions for resistant organisms				
Almyroudis et al., 2016	Discontinuation of routine VRE surveillance and contact precautions	Prospective, nonrandomized cohort of 2,319 patients with hematologic malignancies	No difference between groups for VRE, MRSA, and C. difficile infections	Study design
Kawamura et al., 2013	Strict enforcement of contact precautions and surveillance	Descriptive cohort of 1,000 patients with MRSA	Reduction in MRSA colonization and infections ($p < 0.001$)	Study design
Montecalvo et al., 1999	Surveillance and contact isolation procedures	Descriptive study of 469 patients on an adult oncology unit	Incidence of VRE reduced by about 50%.	–
Ohmagarai et al., 2014	Contact precautions implemented for targeted drug-resistant organisms	Cohort of 1.3 million inpatient days	Rates of multidrug resistant organisms increased after intervention may be because of increased detection.	Study design

Shaik et al., 2002	Initiation of surveillance and monitored isolation practice	Descriptive study of 1 cancer center	Incidence of VRE reduced by 50%.	–
Srinivasian et al., 2002	Gown and gloves versus gloves only	Descriptive study of 315 patients in an intensive care unit	Reports only prevalence	–
Environmental interventions				
Freifeld et al., 2011 (IDSA)	Guidelines for neutropenic patients	Guideline	Environmental recommendations; HCT in private room (others not necessary); HEPA filtration and air exchanges for allogeneic HCT; no protective gear; routine barrier precautions for body fluid contact	–
Stoll et al., 2013	Compared a protective environment (high-efficiency particulate filters, positive air pressure, well-sealed rooms and infection control routines) to outcomes in patients prior to these standards	Descriptive cohort of 371 patients with hematologic malignancies undergoing HCT	The protective environment was associated with reduced FN ($p = 0.009$), overall and 30-day mortality ($p = 0.002$), and prevalence of fungal infections ($p = 0.04$).	Design; no information regarding hand hygiene or use of protective gear
Hand hygiene with alcohol sanitizer				
O'Grady et al., 2011 (HICPAC)	Prevention of intravascular catheter-related infections	Guideline	Extensive recommendations regarding the education and training of staff, selection of catheters and sites, use of specific equipment, hand hygiene, use of maximal sterile barrier precautions for insertion, skin preparation, use of standard dressing regimens, and other recommendations.	–
Influenza vaccination				
Flowers et al., 2013	Prophylaxis in adults with neutropenia	Systematic review of 43 studies	Recommends annual influenza vaccination	Limited evidence
Freifeld et al., 2011 (IDSA)	Guidelines	Guideline	Recommends annual influenza vaccination; optimal timing not established	–
Kruger et al., 2005	Recommendations in allogeneic HCT	Guideline	Multiple vaccination and prophylaxis guidelines	–
Ljungman et al., 2005	Recommendations for HCT survivors	Guideline	Multiple vaccination guidelines	–

NCCN, 2016	Prevention of infection	Guideline	Recommends influenza vaccination 2 weeks prior to chemotherapy and annually	Limited evidence review
Ring et al., 2002	Influenza vaccination	Systematic review of 11 studies	Mainly reports seroconversion rates; suggests timing of vaccination may be critical	–
Rizzo et al., 2006	Guidelines for prevention of infection with HCT	Guideline	Influenza vaccination recommended	Consensus
Sandherr et al., 2015	Antiviral prophylaxis	Guideline	Influenza vaccination recommended	Consensus-based
Pneumococcal and meningococcal vaccination				
Freifeld et al., 2011 (IDSA)	Antimicrobial agents for chemotherapy-induced fever and neutropenia	Guideline	Comprehensive guideline for the care of patients with chemotherapy-induced neutropenia and the management of FN	–
Kruger et al., 2005 (German Society of Haematology and Oncology)	Antimicrobial prophylaxis for patients in an allogeneic BMT setting	Guideline	Specific recommendations with strong evidence	–
Ljungman et al., 2005	Vaccination for patients receiving HCT	Guideline	Concise summary for providers when considering the vaccination needs of patients receiving HCT	–
NCCN, 2011	Prevention and treatment of infection	Guideline	Comprehensive references to assess patient risk of infection and expert recommendations regarding interventions aimed at the prevention and treatment of infection in patients with cancer	Most recommendations were consensus-based.
Rizzo et al., 2006	Screening and preventive practices for long-term survivors after HCT	Expert opinion	Guidelines for prevention of infection are described, including recommendations for many other aspects of post-transplantation care.	–
Tomblyn et al., 2009 (CDC)	Prevention of infection for patients receiving HCT	Guideline	Specific interventions for prevention of infection among recipients of HCT	–

ALL—acute lymphocytic leukemia; AML—acute myeloid leukemia; ANC—absolute neutrophil count; APL—acute promyelocytic leukemia; BMT—bone marrow transplantation; CDC—Centers for Disease Control and Prevention; CI—confidence interval; CLABSI—central line–associated bloodstream infection; CLL—chronic lymphocytic leukemia; CSF—colony-stimulating factor; FN—febrile neutropenia; G-CSF—granulocyte–colony–stimulating factor; GM-CSF—granulocyte macrophage–colony-stimulating factor; GVHD—graft-versus-host disease; HCT—hematopoietic cell transplantation; HICPAC—

Healthcare Infection Control Practices Advisory Committee; HR—hazard ratio; ICU—intensive care unit; IDSA—Infectious Diseases Society of America; MD—medical doctor; MDS—myelodysplastic syndrome; MRSA—methicillin-resistant Staphylococcus aureus; NICE—National Institute for Health and Care Excellence; NCCN—National Comprehensive Cancer Network; OR—odds ratio; RCT—randomized, controlled trial; RR—relative risk; SEER—Surveillance, Epidemiology, and End Results Program; VRE—vancomycin-resistant enterococci; WBC—white blood cell count