Impact of Multi-drug Resistant Organisms on Clinical Outcomes

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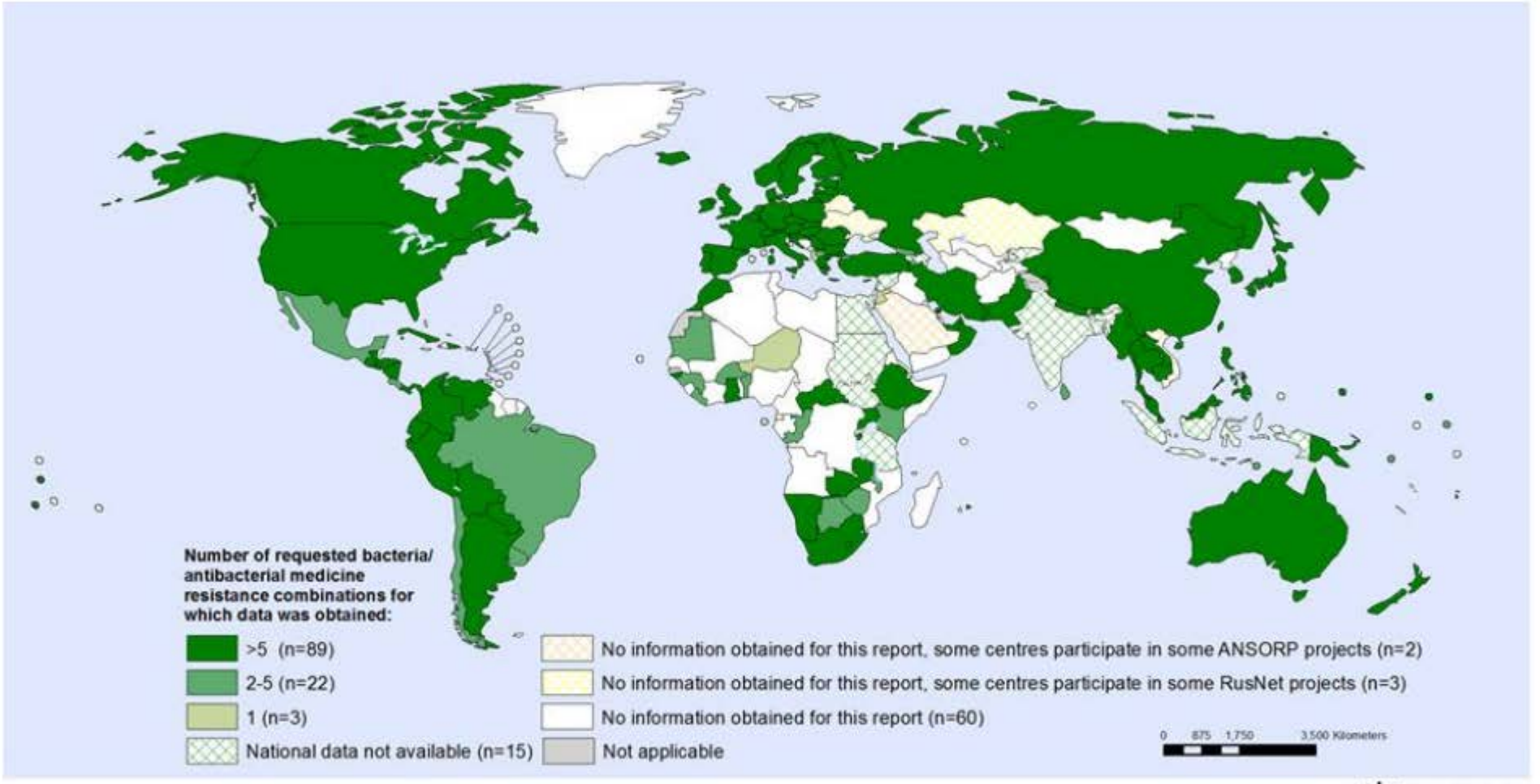
Available National Data* on Resistance for Nine Selected Bacteria/Antibacterial Drug Combinations, 2013



Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization

World Health Organization

*National data means data obtained from official sources, but not that data necessarily are representative for the population or country as a whole

Estimates of Burden of Antibacterial Resistance

European Union
population 500m

25,000 deaths per year

2.5m extra hospital days

Overall societal costs
(€ 900 million, hosp. days)
Approx. €1.5 billion per year

Source: ECDC 2007

Thailand
population 70m

>38,000 deaths

>3.2m hospital days

Overall societal costs
US$ 84.6–202.8 mill. direct
>US$1.3 billion indirect

Source: Pumart et al 2012

United States
population 300m

>23,000 deaths

>2.0m illnesses

Overall societal costs
Up to $20 billion direct
Up to $35 billion indirect

Source: US CDC 2013

Global information is insufficient to show complete disease burden impact and costs

High Risk Populations – Nosocomial Infection with MDR Organisms

- ICU
- Increased length of stay
- Surgical Wounds
- Prior infection
- Antibiotic exposure
- Invasive devices
  - Catheters (iv, urinary)
  - Ventilators
- Colonization

Transplant patients have many of these risk factors

Risk Factors for VRE

Carmeli, et al, Emerging Infect Dis 2002

Table 2. Multivariable explanatory model for having vancomycin-resistant enterococci–positive case

Variable	Odds ratio (95% CI)	p value
Main admitting disorder	0.44 (0.28 to 0.68)	<0.001
Cardiovascular	2.9 (1.5 to 5.7)	0.002
Infectious		
Coexisting conditions		
Diabetes mellitus	2.1 (1.5 to 3.1)	<0.001
Transplant recipient	2.6 (1.6 to 4.5)	<0.001
Hepatobiliary disease	2.9 (1.8 to 4.6)	<0.001
MRSA (in past yr)	3.5 (1.8 to 6.9)	<0.001
Clostridium difficile (in past yr)	2.0 (0.97 to 4.3)	0.06

CI, confidence interval; MRSA, methicillin-resistant *Staphylococcus aureus*.

Multidrug resistance increasingly recognized in transplantation

- Surgical Site Infections
  - RESITRA liver transplant[1]
    - 21% of infections were E. coli – 47% of these were ESBL producers
  - Liver transplant in Poland
    - Gram positive predominant with high level aminoglycoside resistant Enterococci (24.3% of G+ infections)
    - 13.3% of Enterobacteriaceae were ESBL[2]
- Urinary Tract Infections
  - Poland – 52.5 % Renal Transplant GNR UTIs ESBL; 38.5% Liver Transplant GNR UTIs ESBL[3,4]
  - Rates of ESBL Enterobacteriaceae 8–77%[5]

[1]Garcia Prado, et al Transplantation 2008, [2]Kawecki, et al. Transplantation Proceedings 2007, [3]Kawecki, Transplantation Proceedings 2011, p 2991, [4]Kawecki, Transplantation Proceedings 2011, 3052 [5]Van Duin, et al. Am J Transplant 2014;14:

Resistance and Transplantation

- Background/Epidemiology
- Impact of resistance
  - Outcomes
- Sources
- Identification
- Management
  - Treatment
  - Prevention
    - Patient selection

Multidrug Resistant Bacteria and Transplantation

- Incidence of MDR organisms varies with
  - Geography (worldwide, care setting)
  - Year
  - Organism
  - Organ transplanted
  - Time pre/post transplant
    - MDR organisms tend to occur earlier post transplant

Carbapenem Resistant Enterobacteriace

Gupta, et al. Clin Infect Dis 2011;53:61

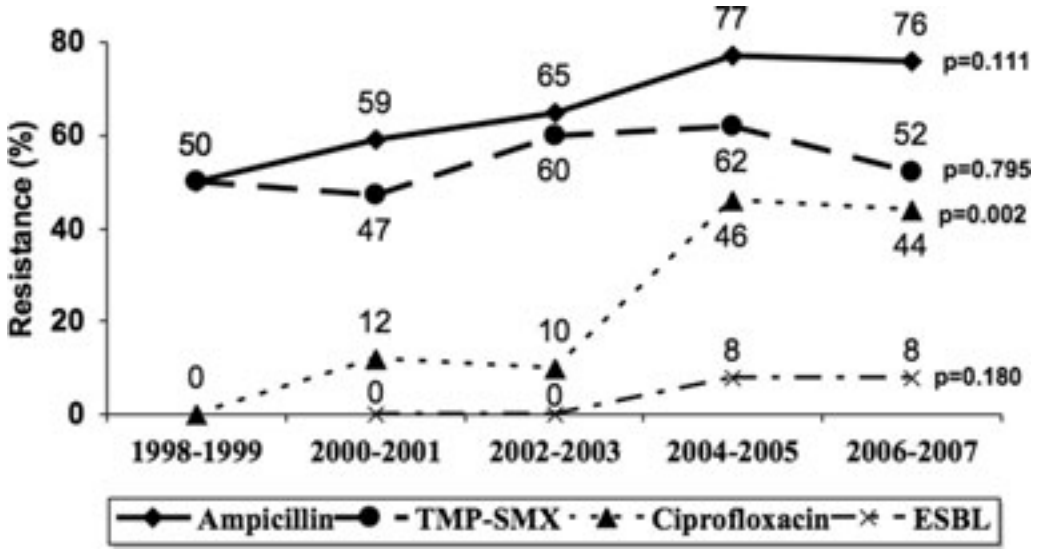
Prevalence of MDR Organisms is Highest in

- Hospital settings
  - Especially the ICU
  - Outbreaks on specialized units
- Long term care
  - Including ventilator weaning facilities

Community sources may be less common but some MDR especially in UTIs in renal transplant recipients

In Vitro Resistance of E. coli Isolates By Year – Mayo Clinic

Al-Hasan, et al Am J Transplant 2009;9:835



Bloodstream Infections After Liver Transplantation

Bert, et al. Liver Transplantation 2010;16:393

TABLE 6. Temporal Trends in the Incidence Rate, Microbiology, and Outcome of BSIs Following LT

	Number (%) of Patients or Episodes			
	1997-2000	2001-2004	2005-2007	*P* Value*
LT recipients	217	254	233	
Patients with BSIs	60 (27.6)	76 (29.9)	69 (29.6)	0.65
BSI episodes with				
Enterobacteriaceae	35 (42.7)	39 (40.2)	36 (45)	0.84
Staphylococcus aureus	19 (23.2)	24 (24.7)	13 (16.2)	0.20
MRSA	12 (14.6)	9 (9.3)	7 (8.7)	0.17
Pseudomonas aeruginosa	10 (12.2)	6 (6.2)	9 (11.2)	0.68
Enterococci	8 (9.7)	12 (12.4)	16 (20)	0.12
Yeasts	7 (8.5)	7 (7.2)	6 (7.5)	0.68
15-day mortality	18 (22)	15 (15.5)	9 (11.2)	0.047

*Test of the trend between the 3 periods.

Bloodstream Infections in Spanish Transplant Recipients

Moreno, et al. Am J Transplant 2007; 7:2579

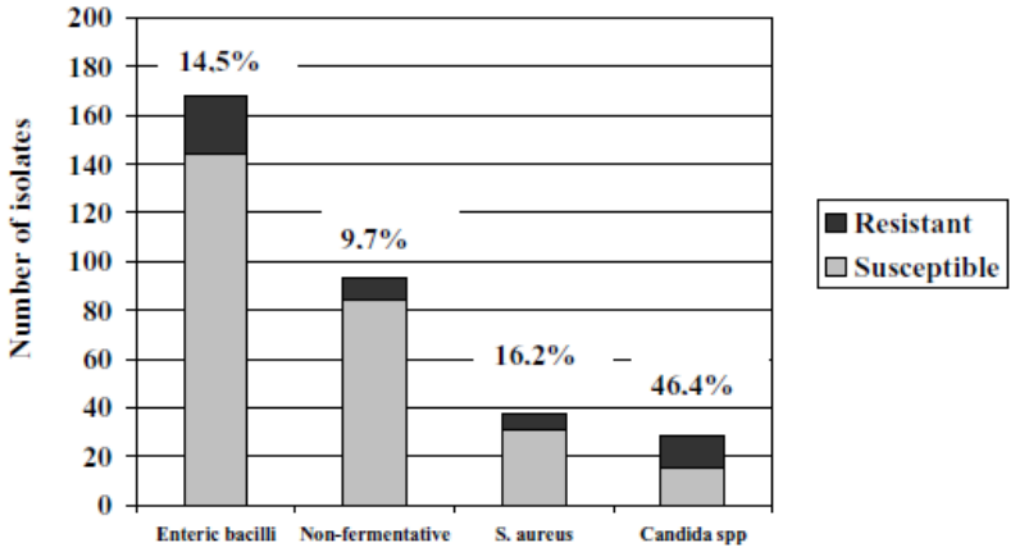


Figure 3: Percentage of multiresistant isolates compared with their susceptible counterparts.

Prevalence of ESBL in SOT: Shanghai

Men, et al. Transpl Infect Dis 2013: 15: 14–21

The results of extended-spectrum beta-lactamase (ESBL) and metallo-beta lactamases (MBL) testing in 71 strains of multidrug-resistant gram-negative bacilli

Species	ESBLs positive	MBLs positive
Escherichia coli	88.9% (16/18)	0/18
Enterobacter cloacae	4/4	1/4
Klebsiella pneumoniae	81.3% (13/16)	2/16
Pseudomonas aeruginosa	0/9	7/9
Acinetobacter baumanii	0/24	91.7% (22/24)

Prevalence of extended-spectrum beta-lactamase genes by multiplex polymerase chain reaction and sequencing in *Klebsiella pneumoniae*, *Enterobacter cloacae*, and *Escherichia coli*

Genotype	*K. pneumoniae*	*E. cloacae*	*E. coli*
TEM	6/13 (46.2%)	4/4 (100%)	15/16 (93.8%)
SHV	9/13 (69.2%)	4/4 (100%)	11/16 (68.8%)
CTX-M-9	6/13 (46.2%)	4/4 (100%)	15/16 (93.8%)
CTX-M-2	0/13 (0)	2/4 (50.0%)	1/16 (6.3%)

Table 5

80 MDR Gram negative isolates from 250 consecutive liver, 100 consecutive renal recipients from 4/2007-12/2010

Prevalence of MRSA and VRE in SOT

Ziakas, et al. Am J Transplant 2014;14: 1887–94

	Pre transplant		Post Transplant	
	#Patients (Studies)	Prevalence (95% CI)	#Patients (Studies)	Prevalence
MRSA	9 (2885)	8.5% (3.2–15.8)	6 (2342)	9.4% (3.0–18.5)
MRSA Liver pts	7 (1350)	11.8% (6.8–17.9)	3 (583)	13% (3.0–27.0)
VRE	8 (1381)	11.9% (6.8–18.2)	8 (1369)	16.2% (10.7–22.6)
VRE Liver pts	N/A		6 (987)	16% (8.8–24.7)

Timing of Organisms Following LDLT

Nafady-Hego, et al. Liver Transplantation 2011; 17:976

Etiological Organism	1st Week	2nd Week	3rd Week	4th Week	2nd Month	3rd Month
Total	197 (39%)	108 (22%)	75 (15%)	41 (8%)	59 (12%)	19 (4%)
Bacteria	183/197	99/108	65/75	39/41	52/59	17/19
Gram-positive organisms	100	61	41	20	24	5
Gram-positive cocci	100	59	41	20	23	5
Enterococcus species	38	19	22	13	9	1
Staphylococcus aureus (% of MRSA)	43 (81%)	27 (77%)	8 (75%)	4 (75%)	9 (56%)	2 (100%)
Coagulase-negative staphylococci (% methicillin-resistant coagulase-negative staphylococci)	17 (19%)	9 (33%)	8 (0%)	3 (0%)	1 (100%)	1 (0%)
Other gram-positive cocci	2	4	3	0	4	1
Gram-positive rods	0	2	0	0	1	0
Gram-negative organisms	81	36	24	19	28	12
Pseudomonas aeruginosa	49	14	13	5	15	5
Klebsiella (pneumoniae)	5	2	1	5	5	3
Escherichia coli (% extended-spectrum ß-lactamase producer)	5 (20%)	3 (0%)	3 (0%)	2 (0%)	3 (0%)	2 (0%)

Carbapenemase producing Klebsiella pneumoniae bacteremia

Clancy, et al. Am J Transplant 2013; 13:2619–33

- 0.7% (17 pts)of SOT in 3 year period with CRKP
  - 1.3% liver; 5.4% intestine, 0.4% lung
  - Median time to onset of infection 163 days
    - 29% (5/17) in 1st 30 days; 47% (8/17) >180 days post tx

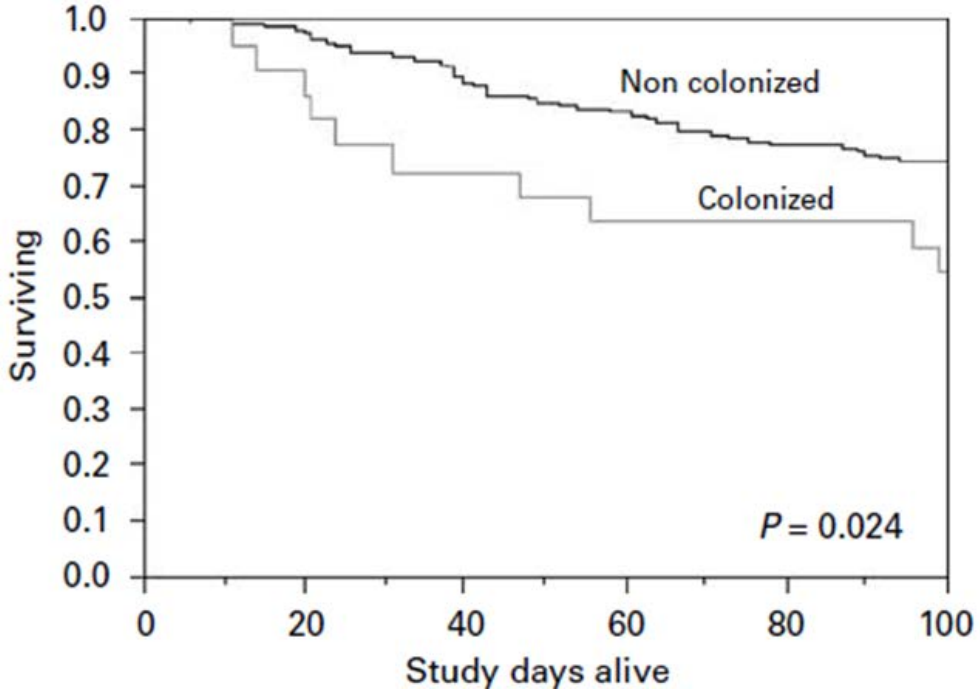
VRE in HSCT

Kamboj, et al. Biology of Blood & Marrow Transplant 2010;16:1576

- 247 allogeneic HSCT patients screened with rectal cultures
- 23 of 43 patients with post HSCT blood stream infection in 1st 30 days (pre-engraftment) had VRE
  - VRE attributable mortality in 9% with VRE BSI

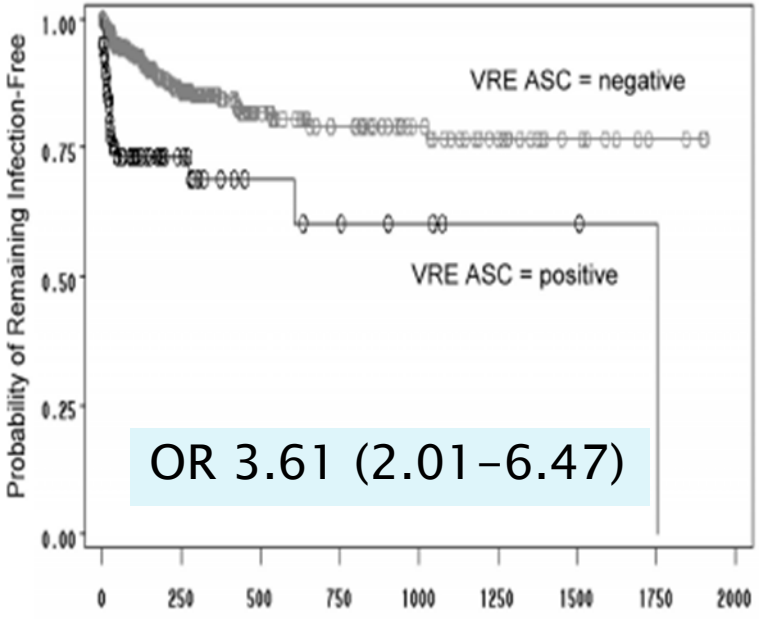
Impact of VRE on Survival SCT

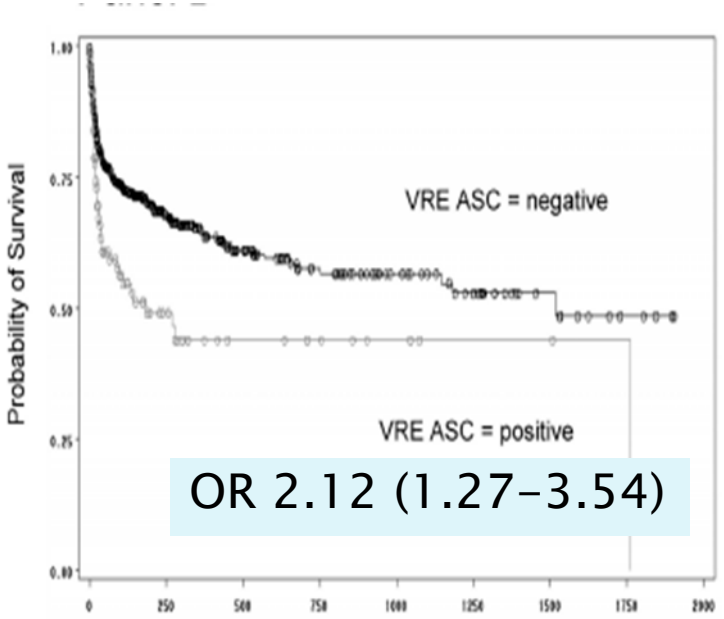
Zirakzadeh, et al. Bone Marrow Transplant 2008;41:385-92



Outcomes in Liver Transplant Patients with VRE Colonization and Infection

Russell, et al. Amer J Transplant 2008;8:1737

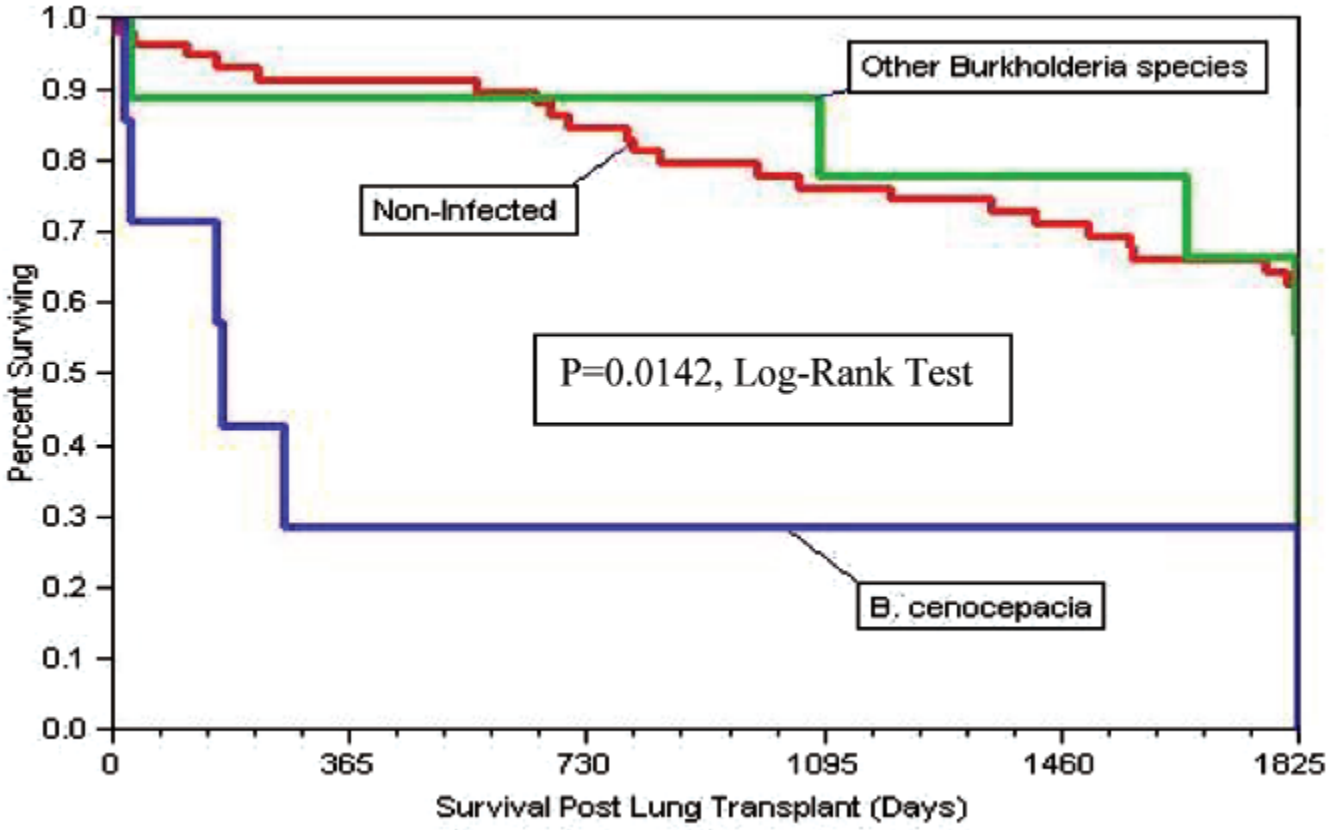




- Rectal cultures on admission to ICU
- Includes both pre and post transplant patients

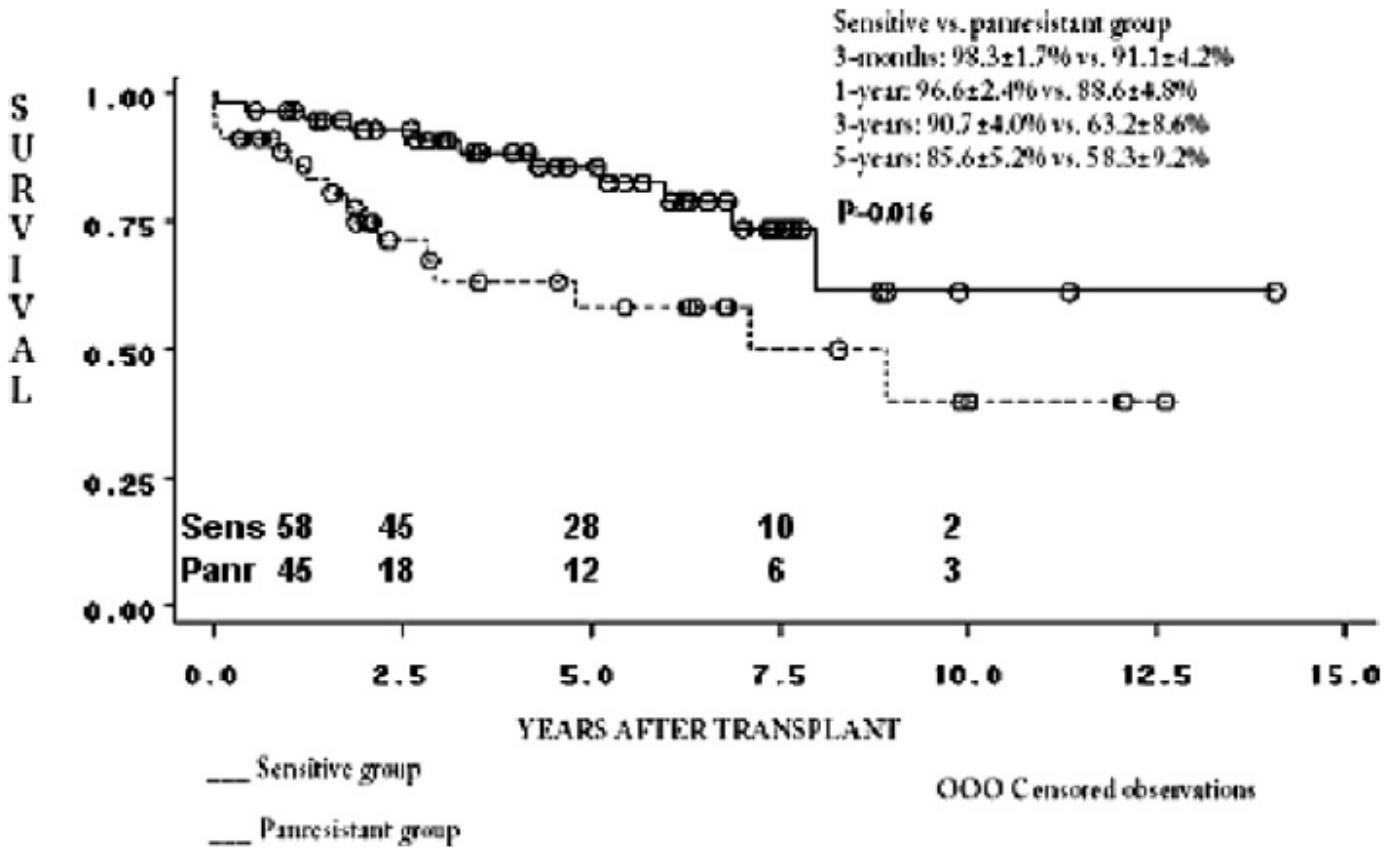
Survival After Lung Transplantation of Cystic Fibrosis Patients Infected with *Burkholderia cepacia* Complex

Alexander, et al. Amer J Transplant 2008;8:1025



Impact of Pan-Resistant Bacteria on Outcomes in Lung Transplant Patients with Cystic Fibrosis

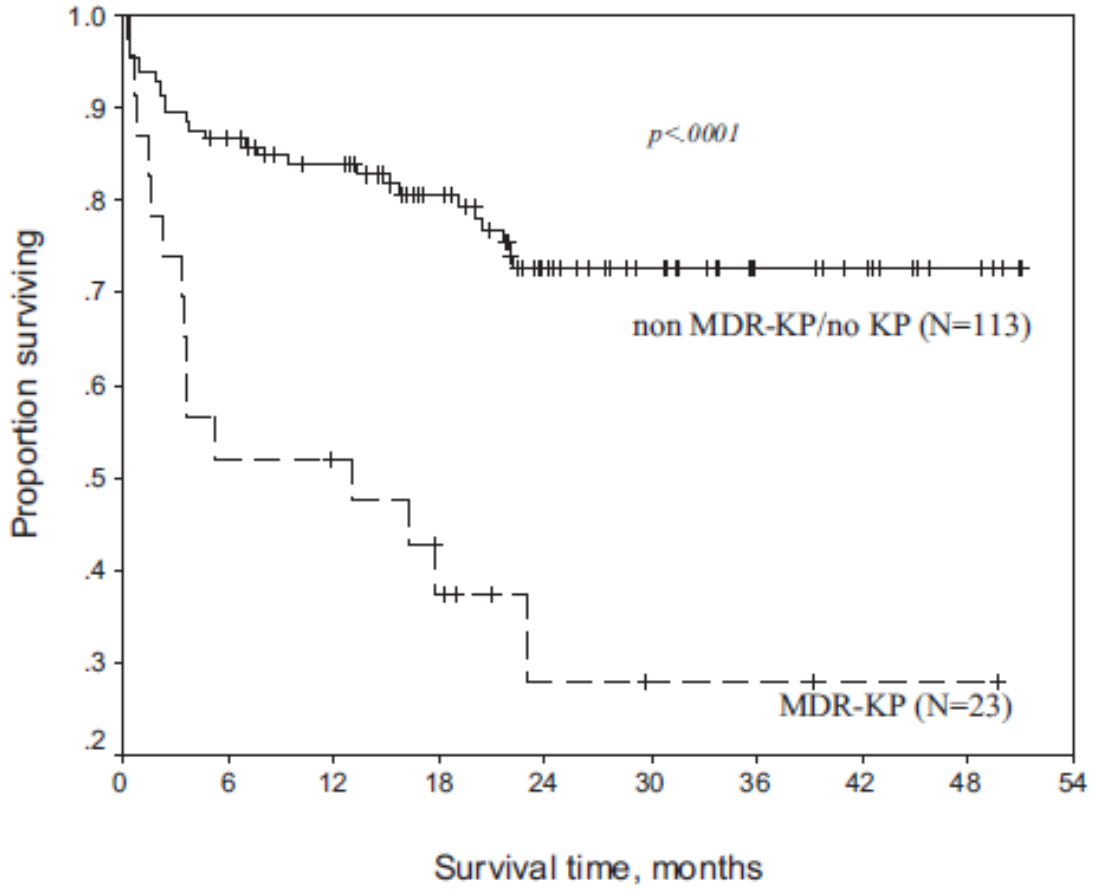
Hadjiliadis,et al. J Heart Lung Transplant 2007;26:834



Impact of Resistance on Lung Transplant Survival (K pneumoniae)

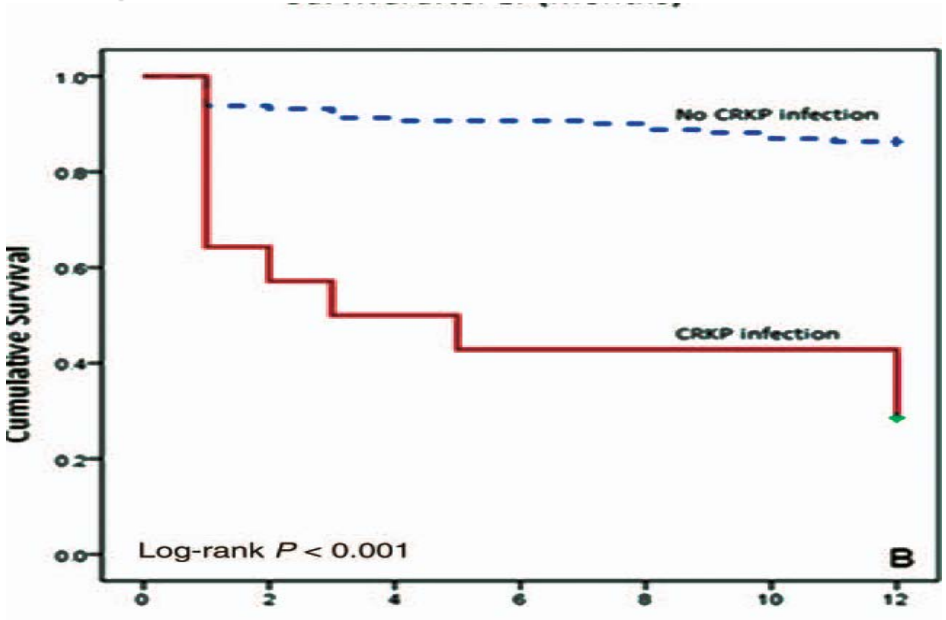
Raviv, et al.Clin Transplant 2012: 26: E388

Organism (# patients)	12 months
MDR KP (23)	47.4
CRKP (11)	36.4
ESBL KP (12)	48.6
Susceptible KI (29)	77.8
No KP (84)	83.8



Mortality Associated with KPC Infections after Liver Transplantation

Kalpoe JS, et al. Liver Transplant 2012; 18:468



Carbapenem resistant Acinetobacter and mortality

Gouvêa et al. BMC Infectious Diseases 2012, 12:351

Table 5 Variables associated with mortality among liver and kidney transplant recipients with *A. baumannii* infection in multivariate logistic regression analysis

Models	Odds ratio (95% CI)	p
A. baumannii-associated mortality[a]		
Infection acquired in the ICU	34.8 (2.05 - 593.1)	0.01
Mechanical ventilation	15.2 (1.22 – 189.2)	0.04
Appropriate empiric therapy	0.04 (0.002 – 0.74)	0.03
Resistance to carbapenem	0.73 (0.12 – 4.47)	0.70
Overall 30- day mortality[b]		
Infection acquired in the ICU	11.5 (2.61 – 49.8)	0.001
Resistance to carbapenem	1,93 (0.48 – 7.85)	0.36

CI: confidence interval; ICU: intensive care unit.
[a] p = 0.89 in the Hosmer-Lemeshow test; [b] p = 0.94 in the Hosmer-Lemeshow test.

- 37% A baumanii carbapenem resistant
- Risk factors for CRAB: prior antibiotics, hemodialysis, central venous access

Carbapenemase producing Klebsiella pneumoniae bacteremia

Clancy, et al. Am J Transplant 2013; 13:2619–33

- Outcomes
  - 18% (3) died rapidly of septic shock
  - 24% (4) cured at first presentation
  - 60 day mortality 47% (8/17)
  - 71% of 30+ day survivors had
    - Persistent bacteremia (2>300 days)
    - Recurrent bacteremia
      - Sources/sites of infection diverse, including intra-abdominal/surgical site, urinary tract, pneumonia, cardiovascular

Are the MDR organisms the cause of death or merely another marker of severe illness?

Dubberke, et al. Bone Marrow Transplantation 2006; 38:813

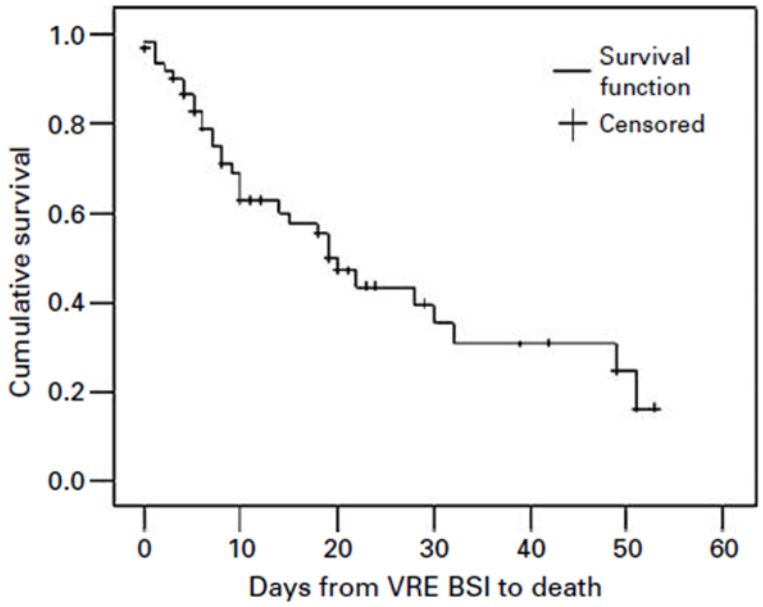


Table 3 Hazard ratios associated with not surviving hospitalization in patients with VRE BSI by multivariable Cox proportional hazards

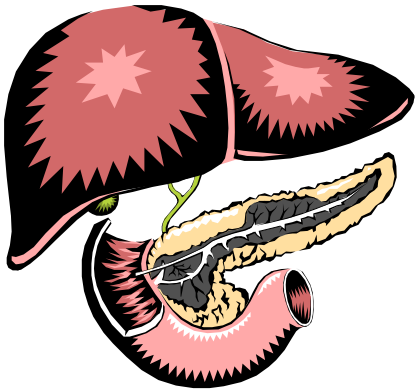
Variable	*HR*	*95% CI*
Admitted for GVHD	6.6	2.4–17.7
Pneumonia in previous 42 days	2.3	1.1–4.9
Receipt of anti-fungals	4.2	1.6–11.3
APACHE II Score at time of VRE BSI	1.1	1.0–1.2

Abbreviations: CI = confidence interval; GVHD = graft-versus-host disease; HR = hazard ratio; VRE BSI = vancomycin-resistant enterococcal bloodstream infection.

Impact Extends Beyond the Single Patient

- Transplant recipients can be the source of MDR organisms in nosocomial outbreaks
  - Can occur regardless of whether recipient infected pre transplant, from donor, or post transplant
  - Survival in environment can lead to spread even after patient discharged

What are the sources of MDR organisms?

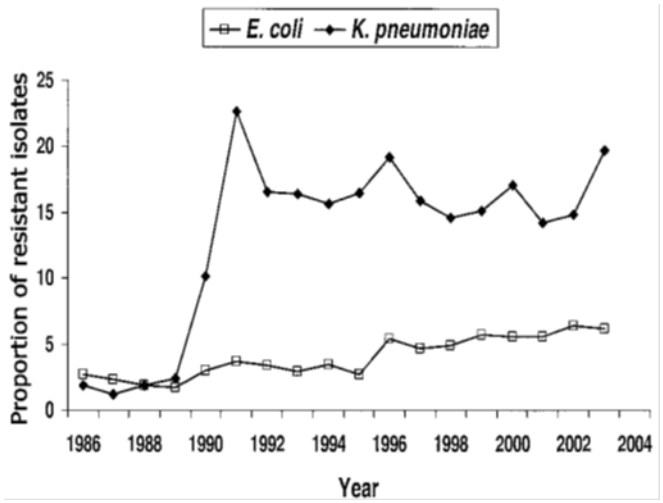


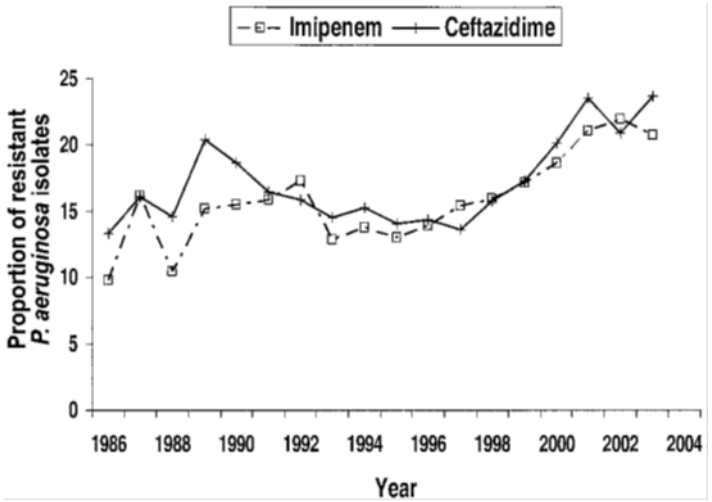
Shared Risks for MDR Organisms: Transplant Candidates, Donors and Recipients

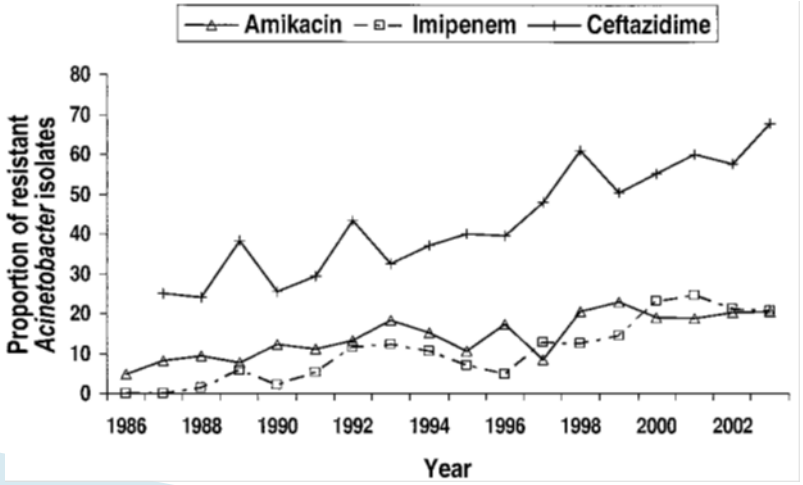
- Prior antimicrobial exposure
- Critical illness
- Prolonged hospital stay
- Devices (central lines, urinary catheters, endotracheal tubes, V^2ADs)
- Dialysis
- Cohorting with other high risk patients
- Colonization (MRSA, VRE, Acinetobacter)

Bacterial Resistance In US ICUs

Gaynes, et al. Clin Infect Dis 2005







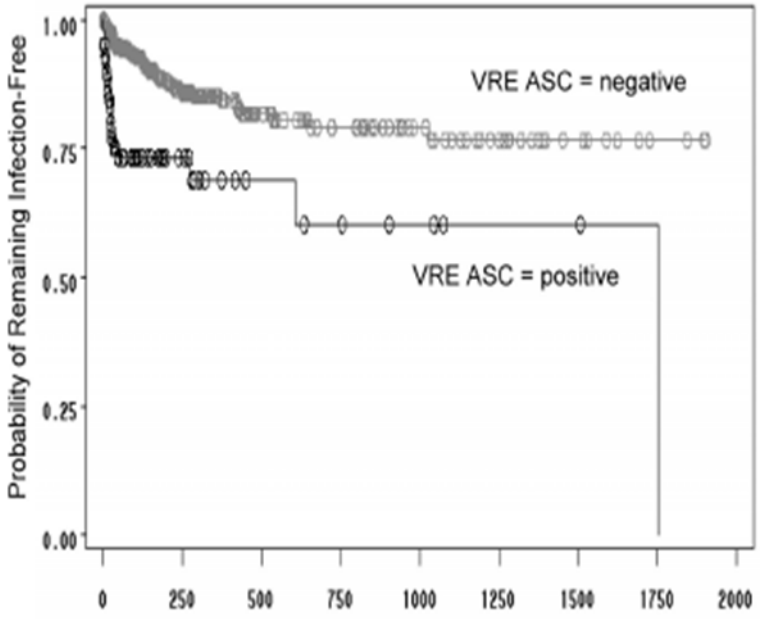
Recipient Issues (pre-transplant)

- Pre-transplant candidate isolates often found post transplant
  - B cepacia and Pseudomonas isolates found pre transplant in lung candidates typically recurs post transplant
  - High correlation of MRSA colonization with infection[1,2]
  - Pre-transplant VRE in SCT and liver transplant often found post transplant [3, 4]

[1] Bert, et al, Liver Transplantation 2005; 11:1093; [2]Russell, et al, Am J Transplant 2008: 8:1737 ; [3] Ziakas, et al. Am J Transplant 2014;14: 1887; [4] Ziakas, et al. Am J Transplant 2014;14: 1887-94

Colonization with VRE in Liver Transplant Candidates and Recipients

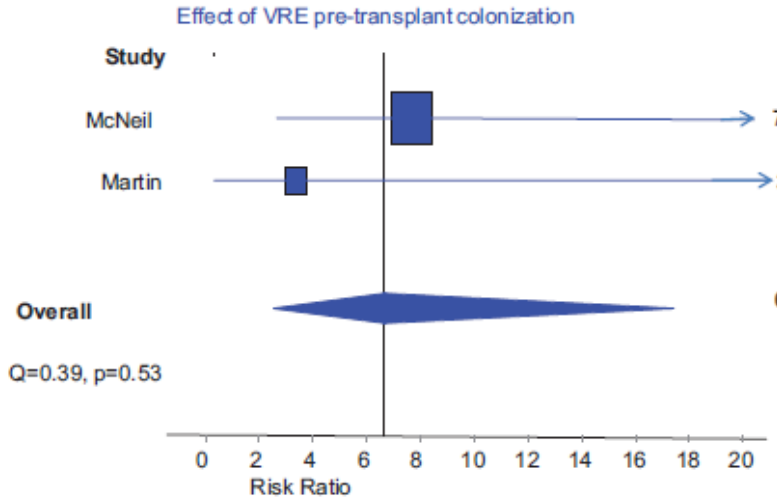
Russell, et al. Am J Transplant 2008;8: 1737

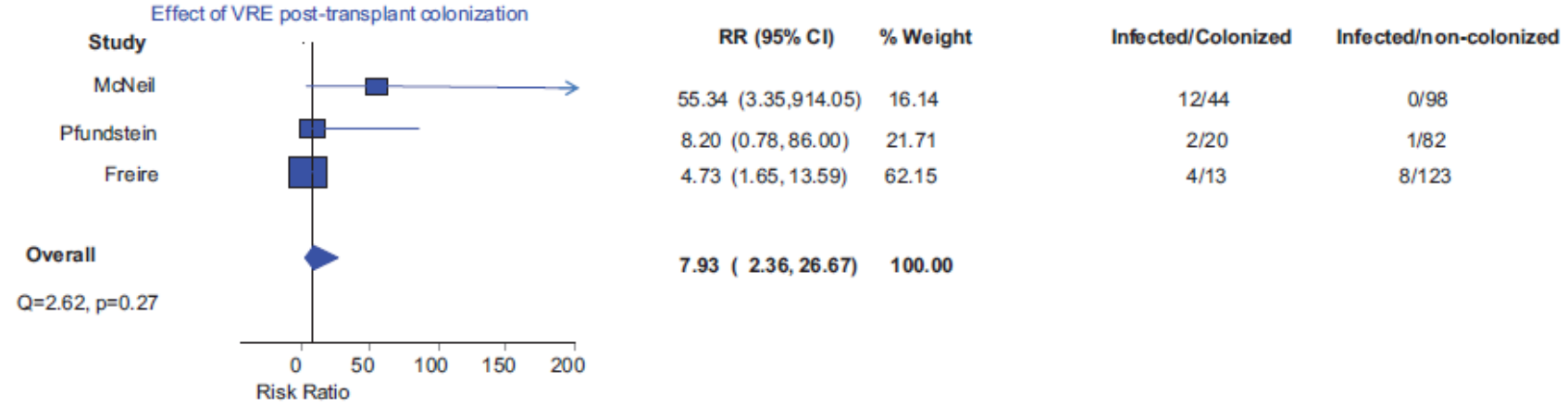


Rectal cultures on admission to ICU
OR 3.61 (2.01-6.47
McNeil et al reported OR of 13.8 for pre transplant colonization and infection (CID 2006;42: 195)

Risk of VRE Infection in Colonized SOT

Ziakas, et al. Am J Transplant 2014;14: 1887-94





VRE Colonization in HSCT*

Kamboj, et al. Biology of Blood & Marrow Transpl 2010;16:1576

- 247 allo HSCT patients screened with rectal cultures
  - 68 (27.5%) colonized pretransplant
  - 13/23 patients (57%) colonized with VRE pre transplant developed post transplant infection

Risk Factors for S aureus Infection post Liver Transplant

Bert, et al. Liver Transplantation 2005;11:1093

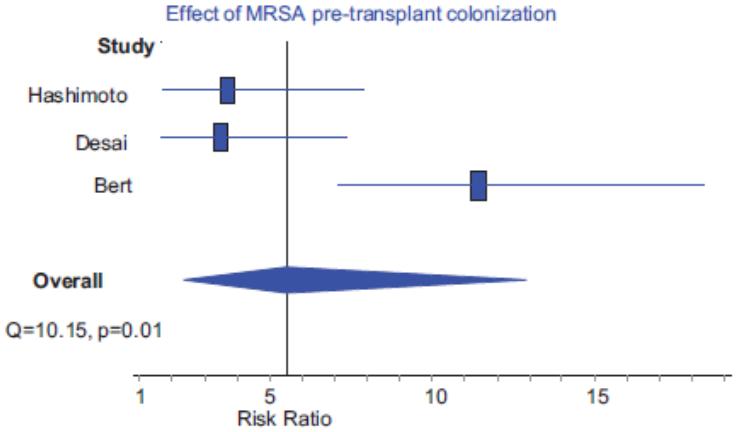
Table 3. Multivariate Analysis of Risk Factors for *S. Aureus* Infection in Liver Transplant Recipients

Variable	OR (95% Confidence Interval)	*P* Value
MRSA nasal carriage	20.9 (6.2-70.1)	<0.0001
MSSA nasal carriage	3.4 (1.7-6.8)	0.0004
Alcoholic cirrhosis	2.4 (1.2-4.8)	0.0156
Decreased prothrombin ratio	1.2 (1.03-1.3)	0.0125

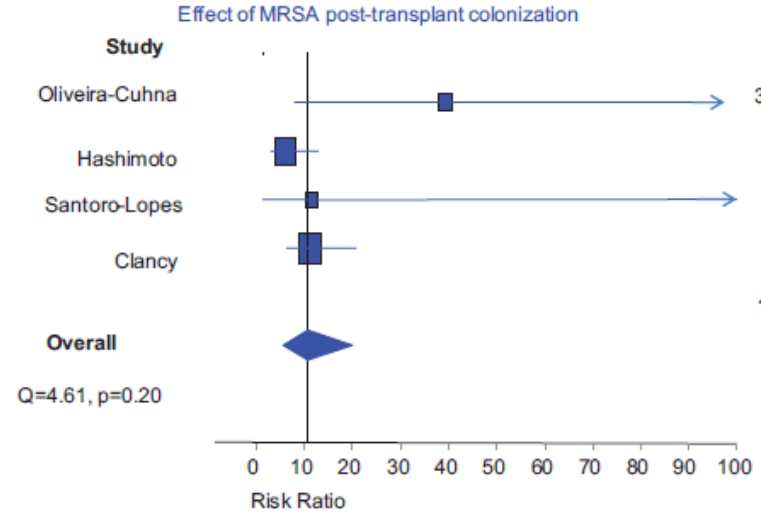
13 of 15 MRSA isolates causing post transplant infection were identical or nearly so by molecular typing to the pre-transplant isolate

Risk of MRSA Infection in Colonized SOT

Ziakas, et al. Am J Transplant 2014;14: 1887–94



Study	RR (95% CI)	% Weight	Infected/Colonized	Infected/non-colonized
Hashimoto	3.70 (1.73, 7.92)	31.35	7/23	18/219
Desai	3.49 (1.65, 7.35)	31.63	11/35	11/122
Bert	11.43 (7.12, 18.35)	37.02	15/19	21/304
Overall	**5.51 (2.36, 12.90)**	**100.00**		



Study	RR (95% CI)	% Weight	Infected/Colonized	Infected/non-colonized
Oliveira-Cuhna	39.36 (7.84,197.58)	12.85	2/14	4/1102
Hashimoto	6.04 (2.83, 12.92)	35.99	16/55	9/187
Santoro-Lopes	11.33 (1.14,112.31)	6.98	2/9	1/51
Clancy	11.21 (6.11, 20.55)	44.18	19/57	16/538
Overall	**10.56 (5.58, 19.95)**	**100.00**		

Nosocomial Acquisition Post Transplant

- Issues similar to non-transplant recipients
  - Risk factors similar
  - Horizontal transmission plays important role

Donor Source

- Relatively uncommon source of bacterial infections post transplant – most reports are anecdotal
  - MDR pathogens increasingly recognized (especially MDR Gram negatives)*
  - Donor association with trauma (including abdominal trauma), prolonged hospital stay
  - Donor derived infections using result in surgical site infections most common
    - Includes anastomotic dehiscences and allograft loss

*Wendt, et al. Am J Transplant 2014;14:2633; Giani, et al. J Clin Microbiol 2014;52:2702; Altman, et al. Am J Transplant 2014;14:2640; Ariza-Heredia, et al, Transplant Inf Dis 2012; 14:229; Goldberg, et al 2012;14:296……

Identification of MDR Organisms

- Early lab identification critical
  - Alterations in screening with new CLSI and EUCAST criteria for GNR – especially for KPC, ESBL
    - If lab is not using these, specialized testing may be required for antimicrobial testing (e.g. Hodge testing, etc)
    - Synergy testing (e.g. for MDR Pseudomonas) of limited utility

CLSI Breakpoints for Carbapenem Resistant Enterobacteriaceae

Gupta, et al. Clin Infect Dis 2011;53:61

Table 2. Clinical and Laboratory Standards Institute Interpretive Criteria for Carbapenems and *Enterobacteriaceae* [41]

	Previous breakpoints (M100-S19)MIC (μg/mL)			Revised breakpoints (M100-S20)MIC (μg/mL)		
Agent	Susceptible	Intermediate	Resistant	Susceptible	Intermediate	Resistant
Doripenem	…	…	…	≤1	2	≥4
Ertapenem	≤2	4	≥8	≤0.25	0.5	≥1
Imipenem	≤4	8	≥16	≤1	2	≥4
Meropenem	≤4	8	≥16	≤1	2	≥4

NOTE. MIC, minimum inhibitory concentration.

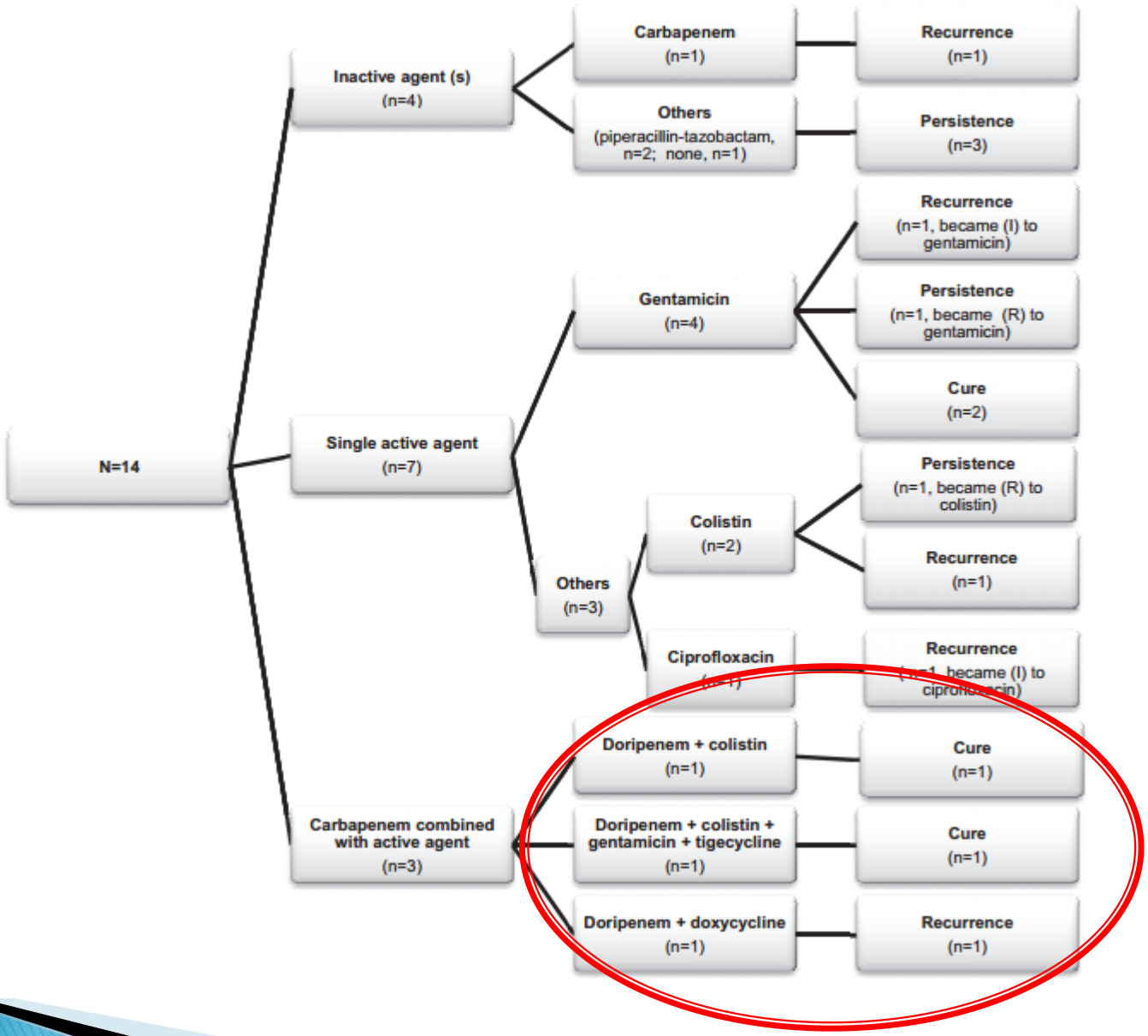
Treatment Considerations

- ***Source control critical***
- Choice of antimicrobials
  - Consider the site (e.g Tigecycline contraindicated for BSI and UTI; Daptomycin for lungs)
  - Consider potential for emergence of resistance (e.g. cefepime and ESBL)
  - Administration considerations
    - Extended infusions for beta lactams to take advantage of time dependent killing

Pathogen	Specific testing[a]	Potentially effective antibiotics
Methicillin-resistant *Staphylococcus aureus* (MRSA)	**Vancomycin MIC <= 1.5** **Vancomycin MIC > 1.5**** **Alternatives**	Vancomycin[b] Linezolid[c], Daptomycin[d], Ceftaroline[e] Quinopristin-dalfopristin, Trimethoprim-sulfamethoxazole, Clindamycin, Tigecycline[f]
Vancomycin-resistant *Enterococci* (VRE)	**Ampicillin-susceptible** **Ampicillin-resistant**	Ampicillin Linezolid, daptomycin, quinopristin-dalfopristin, chloramphenicol, fosfomycin[g], nitrofurantoin[g]
Extended-spectrum β-lactamase producers (ESBL)	**Carbapenem-susceptible** **Carbapenem-resistant**	Carbapenems Colistin, tigecycline[f], fosfomycin[g], aminoglycosides, chloramphenicol
***Klebsiella pneumoniae*- carbapenemase producers (KPC)**		Colistin, tigecycline[f], fosfomycin[g], aminoglycosides, chloramphenicol
***Pseudomonas* sp.**	**Carbapenem-susceptible** **Carbapenem-resistant**	Carbapenems (not ertapenem) Colistin, aminoglycosides
***Burkholderia* sp.**		Trimethoprim-sulfamethoxazole[h]

Special Considerations

- Combination therapy
  - Convincing data lacking but has been used for highly resistant gnr (esp Pseudomonas)
- Synergistic toxicities
  - Drug interactions affecting immunosuppressive agents (e.g. rifamycins)
  - Increased risk of nephrotoxicity, neurotoxicity (e.g. with colistin)



Clancy, et al. Am J Transplant 2013; 13:2619–33

Measures to Reduce Spread

- Screening/surveillance
- Isolation/barrier precautions
- Hand hygiene
- Antimicrobial stewardship

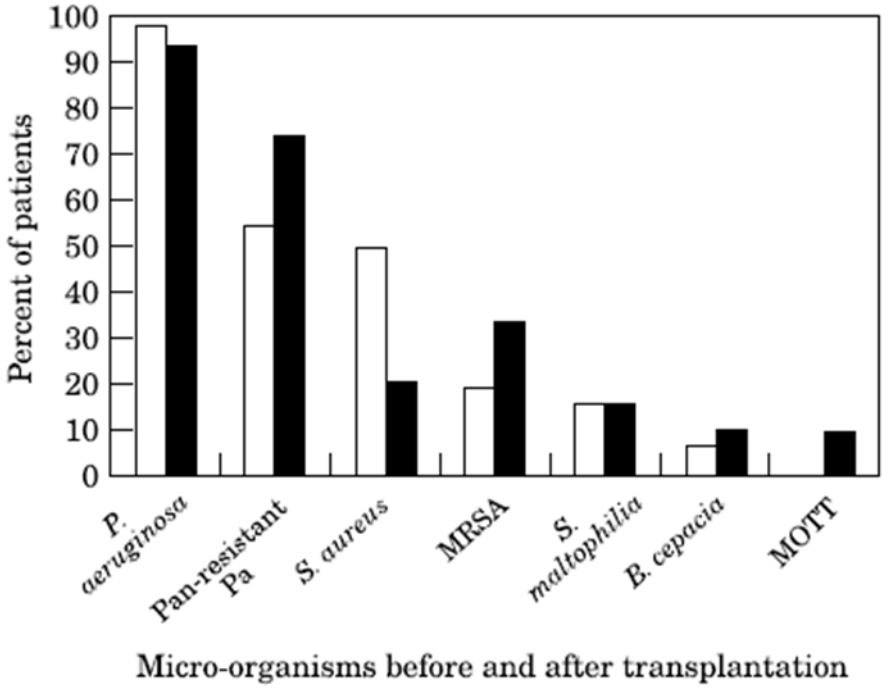
- Should we screen candidates or donors colonized or infected with MDR bacteria?
- If we find these organisms, should the candidate or donor be excluded?

Should candidates be screened for MDR organisms prior to transplant?

- If so, everyone or just those with defined risk factors?
  - e.g. patients with prior antibiotics, ICU, dialysis
- Screening techniques are imperfect
  - How frequently do you need to screen?
  - What are the optimal methods and sites?
- Is the cost of screening worth the benefit?
  - Post transplant acquisition can also occur and has been associated with worse outcomes
  - Cost of routine screening in absence of outbreak may be prohibitive (Gardam et al, JID 2002)
- Focus of current research

Variable outcomes with resistance in cystic fibrosis patients withlung transplantation

Dobbin, et al. J Hosp Infect 2004;56:277



- 30/54 lung transplant candidates with ≥1 pan-resistant organism pre-transplant
- 6/11 patients who died waiting had pan-resistant P aeruginosa
- But the overall survival of patients was similar regardless of resistance

Given poor outcomes, should we intervene in patients colonized with resistant pathogens?

- Decolonization – variable results with most data for S aureus
  - Optimal interventions/medications unknown
    - Some resistance to mupirocin
- Limited transplant specific data for S aureus

Mupirocin was not effective for prevention in liver transplant patients with MRSA

Paterson, et al. Transplantation 2003;75:194

TABLE 1. *Staphylococcus aureus* infections frequently occurred in patients who never previously had nasal colonization with *S. aureus*

Infections in patients never previously colonized	7
Infections in patients with prior nasal colonization	9
Never successfully decolonized	(1)
Decolonization from MSSA then recolonization with MRSA	(3)
Decolonization from MRSA then recolonization with MRSA	(3)
Decolonization from MRSA with persistence of decolonized state	(2)

MRSA, methicillin-resistant *S. aureus*; MSSA, methicillin- susceptible *S. aureus*.

Will a more aggressive approach work for MRSA?

Desai, et al. Liver Transplantation 2003;7:754

Table 3. Clinical Characteristics of Screened Population

	MRSA Carrier n (%)	MRSA Noncarrier n (%)	*P* Value
Ascites	22 (62.9)	69 (56.6)	.51 (Chi-squared)
Diuretics	28 (80.0)	79 (64.8)	.09 (Chi-squared)
Pretransplantation sepsis	08 (22.9)	04 (3.3)	.01
ICU stay (days)			<.001 (Mann-Whitney)
Mean	12.02	6.24	
Median	6	2	
Range	1–71	1–53	
Hospital stay (days)			.04 (Mann-Whitney)
Mean	24.88	14.16	
Median	15	11	
Range	1–144	1–59	
Renal dialysis			
Pretransplantation	0 (0)	5 (4.1)	.59
Posttransplantation	0 (0)	5 (4.1)	.59
Posttransplantation MRSA infection†	11 (31.4)	11 (9.0)	.002
Other posttransplantation infections	7 (20.0)	32 (26.22)	.45 (Chi-squared)
CMV	2 (5.7)	11 (9.0)	.73
HSV	1 (2.9)	10 (8.2)	.46
Pneumonia	4 (11.4)	7 (5.7)	.26
Other		4 (3.3)	.58
Deaths	11 (31.42)	24 (19.7)	.14 (Chi-squared)
	(16.8–49.3%)	95% CI (13.0–27.8%)	

Investigators used mupirocin for nasal decolonization and chlorhexidine baths in pts with + MRSA screens

Interventions for Patients Colonized with MRSA

- Difficulties with decolonization
  - Timing may not be predictable for all SOT (except for live donor transplants)
    - May be better option for HSCT
    - Would have to decide when to start and how long to continue
  - Optimal interventions/medications?
    - Some resistance to mupirocin

What about donors?

- Routine donor cultures done at time of procurement in donors hospitalized ≥ 72 hours regardless of signs of infection
  - Blood, urine , sputum
- Results not available until after transplant
  - Cannot always predict resistance patterns
- Clinical isolates during admission should be considered however

Are there patients with resistant organisms who should not be transplanted or donors who should be excluded?

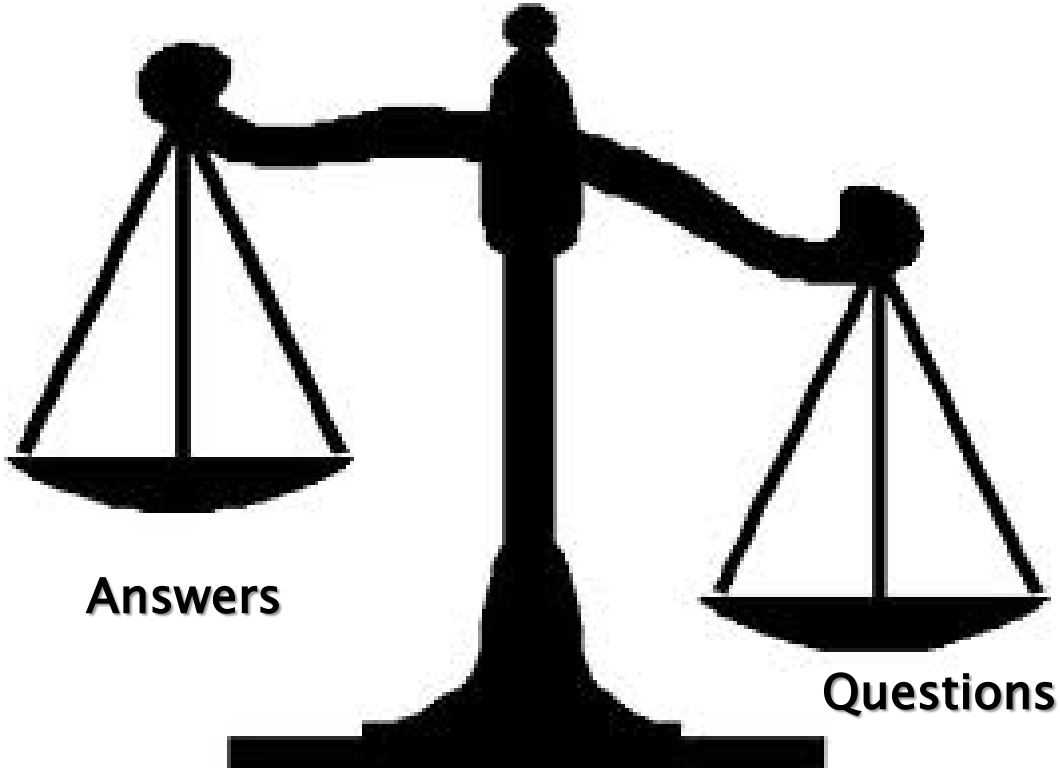
- Recipients
  - Data for most organisms not clear
    - In some/many cases resistance may be a hallmark of more severe illness
    - Best data may be for Burkholderia cenocepacia
      - Most centers refusing transplantation to those patients
      - Potentially not all B cenocepacia equal???
    - What about KPC? Resistant mycobacteria (e.g. M abscessus), etc?
- Donors
  - Insufficient data to answer this question
  - Consider antibiotic options prior to accepting organs
  - We do not use donors with KPC

Guidelines

- Still in formation
- Reluctance to make broad recommendations due to the life and death nature of transplantation

Other approaches?

- Altered prophylaxis
  - Consider changing antibiotics for prophylaxis
  - Vanco for OLT (Calleja Kempin et al Rev Esp Enferm Diag 1993)
- Altered empiric therapy for febrile illnesses, at least early after transplant


Answers
Questions