Transmission of MDROs in LTCFs and management of the MDR colonized patients in the continuity of care

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LTCFs

- Differ substantially from each other
  - Geriatric/other ages
  - Sub-acute care
  - Rehabilitation (short/long)
  - Skilled nursing
  - Ventilated patients (LTAC)
- Differ between countries
  - carrying at home for the debilitated, old and sick
- For patients/residents it is their home for prolonged periods and for many for the rest of their life

LTCFs, MDROs and continuity of care

- Patients referred to LTCFs are at high risk for carriage of MDROs:
  - After prolonged hospitalization
  - multiple procedures
  - antibiotic treatment
- Patients transfer with acute care hospitals is bidirectional
  - Multiple studies identify LTCF as risk factor for carriage and infection with resistant organisms
- LTCFs may serve as reservoir and amplifier of MDROs

Morbidity and mortality by MDROs infections among LTCFs residents

- The clinical impact of MDROs carriage in LTCFs are less severe than in acute-care setting
  - Invasive device and procedure
  - Acuity of disease
- Infections are less common and less severe
  - MRSA infections among carriers in LTCF 5-10% mostly SSTI with an associated mortality <1%
- Underestimation??
- The consequences and often the carriage status are becoming evident only after transfer to the acute-care setting

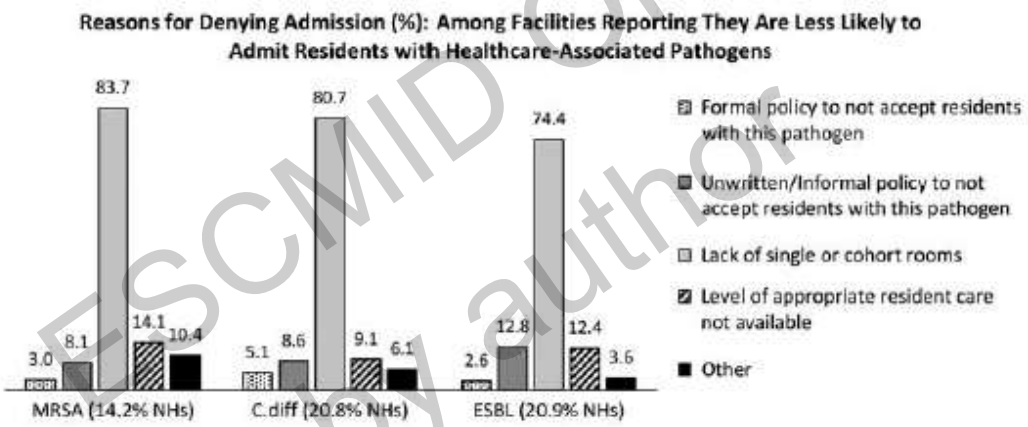
Manzur A. CMI 2009

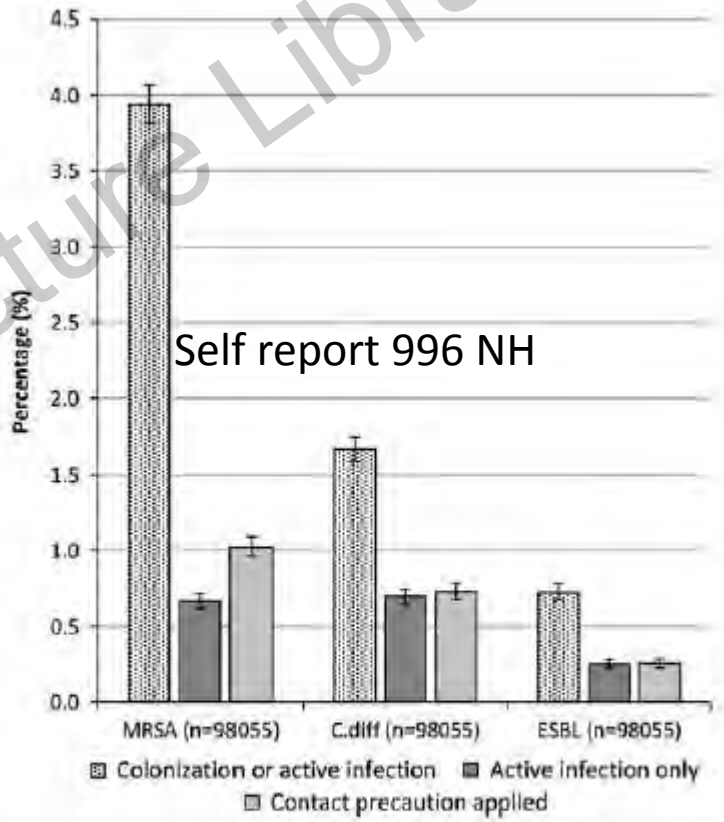
Healthcare-Associated Pathogens and Nursing Home Policies and Practices: Results From a National Survey

Zhiqiu Ye, Dana B. Mukamel, Susan S. Huang, Yue Li and Helena Temkin-Greener

996 Nursing homes replied	
Mean number of beds	126
Occupancy	86%
For profit	60%
Chain affiliation	51%

20% reported on denying admission of carriers
Mostly due to lack of single or cohort rooms





Self report 996 NH

IGURE 1. Overall prevalence rate of healthcare-associated athogens in nursing homes for methicillin-resistant *Staphylococcus ureus* (MRSA), *Clostridium difficile* (C.diff), or extended-spectrum -lactamase (ESBL) producers. Error bars indicate 95% CIs. =total number of residents.

ICHE 2015

CONTROL OF VANCOMYCIN-RESISTANT ENTEROCOCCUS IN HEALTH CARE FACILITIES IN A REGION

BELINDA E. OSTROWSKY, M.D., M.P.H., WILLIAM E. TRICK, M.D., ANNETTE H. SOHN, M.D., STEPHEN B. QUIRK, M.P.P., STACEY HOLT, M.M.SC., LORETTA A. CARSON, M.S., BERTHA C. HILL, B.S., MATTHEW J. ARDUINO, PH.D., MATTHEW J. KUEHNERT, M.D., AND WILLIAM R. JARVIS, M.D.

- Mid 90's 63 cases of VRE reported to the CDC from Siouxland region (Iowa, S. Dakota, Nebraska)
  - 135,000 population
  - 4 acute care facilities; 28 LTCFs

TABLE 3. PREVALENCE OF COLONIZATION WITH VANCOMYCIN-RESISTANT ENTEROCOCCI AMONG PATIENTS OR RESIDENTS OF 30 ACUTE CARE AND LONG-TERM CARE FACILITIES IN THE SIOUXLAND REGION IN JULY AND AUGUST 1997, OCTOBER 1998, AND OCTOBER 1999.*

TYPE OF FACILITY	COLONIZATION WITH VRE			1998 VERSUS 1997		1999 VERSUS 1998		1999 VERSUS 1997†	
	1997	1998	1999	RELATIVE RISK (95% CI)	P VALUE	RELATIVE RISK (95% CI)	P VALUE	RELATIVE RISK (95% CI)	P VALUE
	no. of patients (%)								
All	40 (2.2)	26 (1.4)	9 (0.5)	0.6 (0.4–1.1)	0.08	0.4 (0.2–0.8)	0.005	0.2 (0.1–0.5)	<0.001
Acute care	10 (6.6)	9 (5.5)	0	0.8 (0.4–2.0)	0.67	0	0.002	0	<0.001
Long-term care	30 (1.7)	17 (1.0)	9 (0.5)	0.6 (0.3–1.0)	0.05	0.6 (0.2–1.3)	0.14	0.3 (0.2–0.7)	0.001

NEJM 2001

The prevalence of MRSA in LTCFs: Systematic Review

Table 2: Summary of the reported prevalence of MRSA colonization in community LTCFs residents among different countries

Countries	Prevalence of MRSA in LTCFs (%)	(95% CI)
UK [No. 9, 12, 19]	7.8% -22%	(5.8-27)
Belgium [No. 4, 13]	12.2% -19.5%	(11.3-21.5)
Italy [No. 14]	7.8%	(5.7-10.4)
North Ireland [No. 15]	23.3%	(18.8-27.7)
Spain [No. 16]	16.8%	(14.9-18.8)
France[No. 17]	37.6%	(28.5-46.7)
Sweden [No. 6,10]	0% -50%	---
Israel [No. 11]	14%	---
Hong Kong [No. 20]	2.8%	(1.9-4.2)
Australia [No. 2]	16%	---
USA [No. 5]	24%	---

Lok Wan-ian. **http://hdl.handle.net/10722/206950**

MRSA transmission in high prevalence LTCFs

- Transmission and risk factors studied in 3 veteran LTCFs in the US over 6 months (415 pts)
  - 20% persistent carriers
  - 39% intermittent carriers
  - Only 41% non-carriers
- Of 254 residents with an initial negative swab
  - **10% acquired MRSA over the 6 months**
    - 36% of the acquisitions PFGE similar to roommate
- Antibiotic treatment was the only significant risk factor for acquisition

Stone ND. ICHE 2012

Transmission of methicillin-resistant *staphylococcus aureus* in the long term care facilities in Hong Kong

Vincent CC Cheng[1,2], Josepha WM Tai[2], Zoie SY Wong[3], Jonathan HK Chen[1], Kris BQ Pan[3], Yizchen Hai[3], Wing-Chun Ng[4], Denise MK Chow[5], Miranda CY Yau[1], Jasper FW Chan[1,2], Sally CY Wong[1,2], Herman Tse[1,6], Sophia SC Chan[5], Kwok-Leung Tsui[3], Felix HW Chan[4], Pak-Leung Ho[1,6] and Kwok-Yung Yuen[1,6*]

- 2020 residents in 40 LTCFs screened for MRSA carriage
  - 21% MRSA carriers
- 337 MRSA residents with negative screen admitted to acute care within 6 month and screened on admission
  - **65/337 (19%) MRSA positive on admission (LTCFs acquired)**
  - 21/272 (7.7%) discharge MRSA positive (hospital acquired)

BMC Infect Dis 2013

Carriage of methicillin-resistant *Staphylococcus aureus* on admission to European rehabilitation centres—a prospective study

- 1204 patients screened on admission
  - 105 (8.7%) MRSA +
  - Carriage varied between centers (7.1- 14.6%)

TABLE 2. Multivariable logistic regression model demonstrating variables associated with methicillin-resistant *Staphylococcus aureus* colonization

	OR	95% CI	p
Gender (male)	2.2	1.4–3.6	0.001
History of colonization with MRSA	6.8	3.8–12.3	<0.001
Peripheral vascular disease	2.5	1.2–5	0.013
Long acute-care hospital stay (>2 weeks)	1.9	1.2–3	0.004
Recent stay in another long-term-care facility	2.1	1.3–3.5	0.004

95% CI, 95% confidence interval; MRSA, methicillin-resistant *Staphylococcus aureus*; OR, odds ratio.

Bilavsky E. CMI 2012

MOSAR baseline phase patients characteristics

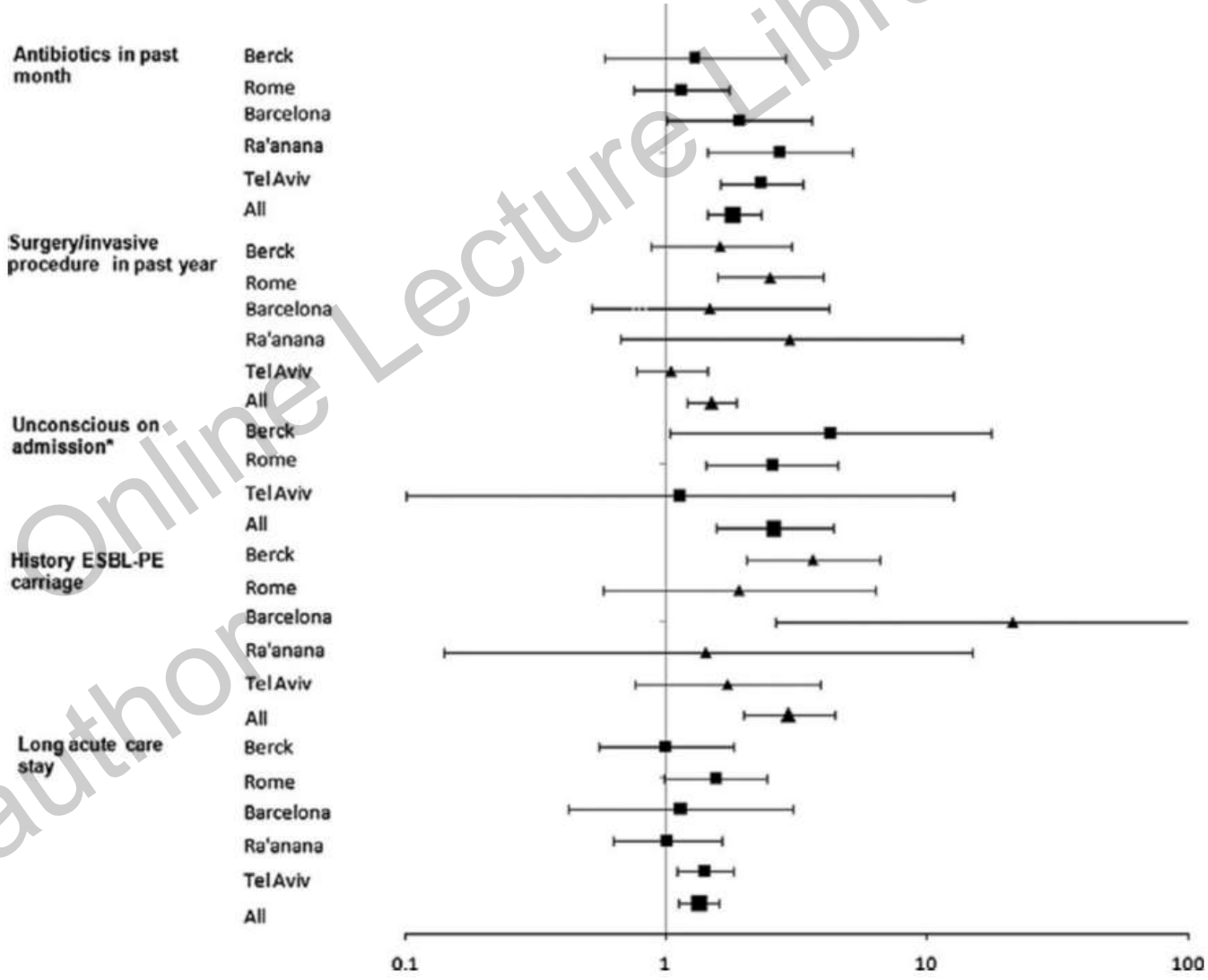
	Baseline phase
	N=1476
age (years) , mean (SD)	64.8)20.0(
female sex	742)50.3%(
Poor functional status on admission	411)30.2%(
ESBL+ at start of phase	373)25.3%(
Charlson score on admission > 2**	291)19.8%(
Length of stay (days), mean (SD)	47.1)48.7(
monthly ward-level antibiotic use (DDD), mean (SD)	371)270(
monthly imported MRSA cases per ward, mean (SD)	)1.4(1.6

MOSAR MRSA acquisitions

	Baseline phase				
Study site	**N**	**Positive on admission**	**Negative on admission***	**Acquired****	**Incidence per 1000 patient-days**
France	229	30 (13.1%)	199	39 (19.6%)	3.6
Italy	356	29 (8.1%)	327	53 (16.2%)	2.3
Spain	123	8 (6.5%)	115	18 (15.7%)	2.5
Ra'anana, Israel	283	17 (6.0%)	266	15 (5.6%)	1.4
Tel Aviv, Israel	620	51 (8.2%)	569	50 (8.8%)	4.1
total	**1611**	**135 (8.4%)**	**1476**	**175 (11.9%)**	**2.7**

Risk factors for colonization with extended-spectrum beta-lactamase-producing enterobacteriaceae on admission to rehabilitation centres

2873 patients screened
26% ESBL +on admission
(19-36% between centers)



Bilavsky E. CMI 2013

MOSAR ESBL baseline phase

Study site	N	Positive on admission	Negative on admission	Acquired**	Incidence per 1000 patient-days
France	218	43 (19.7%)	175	32 (18.3%)	4.1
Italy	359	89 (24.8%)	270	91 (33.7%)	5.7
Spain	114	36 (31.6%)	78	31 (39.7%)	7.4
Ra'anana, Israel	284	69 (24.3%)	215	43 (20.0%)	5.2
Tel Aviv, Israel	619	179 (28.5%)	440	122 (27.3%)	14.1
total	**1594**	**416 (26.1%)**	**1178**	**319 (27.1%)**	**7.1**

Transmission dynamics of ESBL-producing *Escherichia coli* clones in rehabilitation wards at a tertiary care centre

A. Adler[1], M. Gniadkowski[2], A. Baraniak[2], R. Izdebski[2], J. Fiett[2], W. Hryniewicz[2], S. Malhotra-Kumar[3], H. Goossens[3], C. Lammens[3], Y. Lerman[4], M. Kazma[1], T. Kotlovsky[1], Y. Carmeli[1] and the MOSAR WP5 and WP2 study groups*

ST (*n*)	ESBL genes (*n*)	PFGE[a] types	Acquisition types (AD, AQ, ND)	Acquisition traced[b]
131 (48)	CTX-M-15 (14)	4	AD-8, AQ-5, ND-1	2
	CTX-M-27 (31)	1	AD-11, AQ-17, ND-3	16
	CTX-M-14,-39,-55 (3)	2	AD-2, AQ-1	1
372 (13)	SHV-5 (12)	1	AD-3, AQ-9	8
	CTX-M-15 (1)	1	AQ-1	0
398 (9)	CTX-M-39 (8)	1	AD-4, AQ-4	2
	SHV-5 (1)	1	AQ-1	0
38 (8)	CTX-M-9, -14, -15, -27	7	AD-4, AQ-4	0
405 (8)	CTX-M-9, -15; SHV-12	6	AD-2, AQ-3, ND-3	1
69 (6)	CTX-M-14 (5)	1	AD-2, AQ-1, ND-2	0
	CTX-M-15 (1)	1	AQ-1	0
648 (6)	CTX-M-14 (5)	2	AD-2, AQ-2, ND-1	1
	CTX-M-15 (1)	1	AD-1	NA
10 (3)	CTX-M-14; SHV-5, -12	3	AD-2, AQ-1	0
410 (3)	SHV-12	2	AD-1, AQ-2	1
216 (2)	SHV-12	2	AQ-1, ND-1	0
354 (2)	CTX-M-2,-15	1	AD-1, AQ-1	0
1196 (2)	CTX-M-2	1	AD-2	NA
1598 (2)	CTX-M-15	1	AD-1, ND-1	NA
Ms[c] (13)	CTX-M-2 (1),-14 (2),-15 (6),-55 (1); SHV-5 (1),-12 (2)	13	AD-6, AQ-5, ND-2	0
Total (125)		AD-52, AQ-59, ND-14		32

ST, sequence type; PFGE, pulse-field gel electrophoresis types; AD, isolated on admission to rehabilitation ward; AQ, acquisition at the rehabilitation ward; ND, not determined; NA, not applied.

[a]Partially presented in Fig. 2.

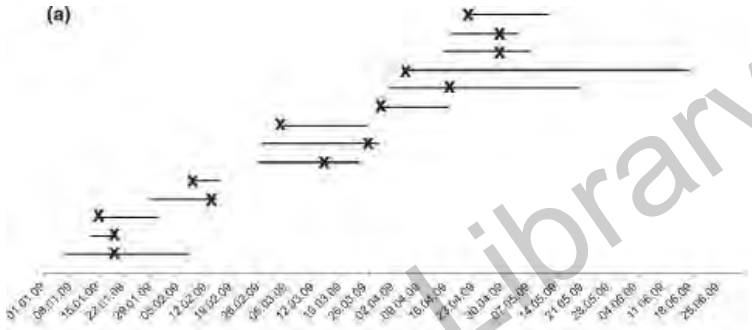
[b]Acquisition source traced to another patient.

[c]Ms, miscellaneous ST (one each): 48, 59, 62, 95, 348, 449, 469, 641, 746, 929, 940, 1596, 1597.

CMI 2012

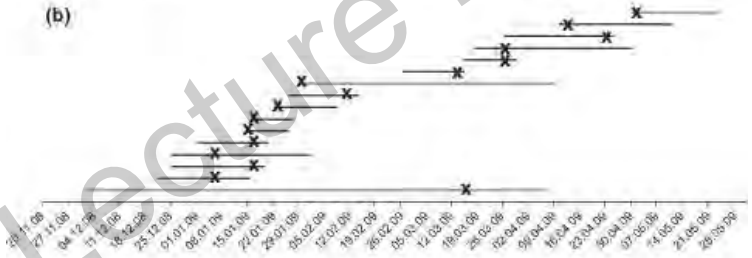
ST131-CTX-M-27, ward A;

6 admissions; 8 acquisitions



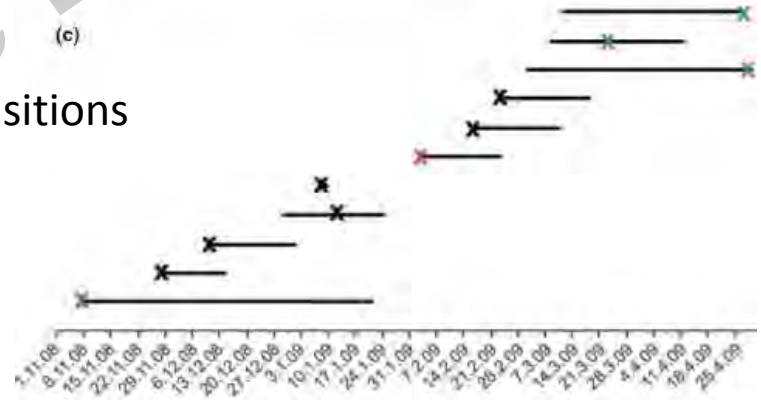
ST131-CTX-M-27, ward B

6 admissions; 8 acquisitions



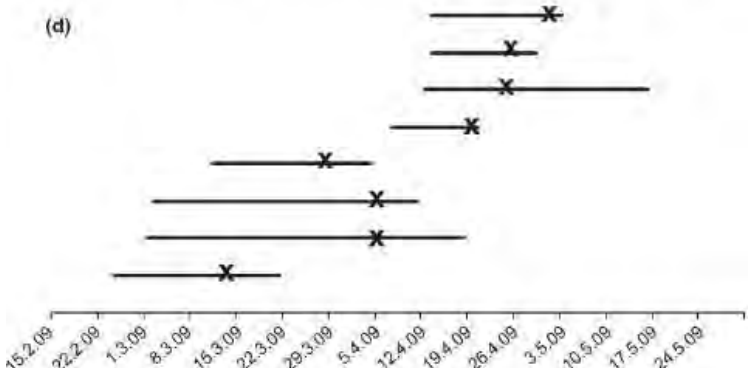
ST131-CTX-M-15, ward B

7 admissions (3 clones); 4 acquisitions
(1 related to the major clone,
3 independent clone)



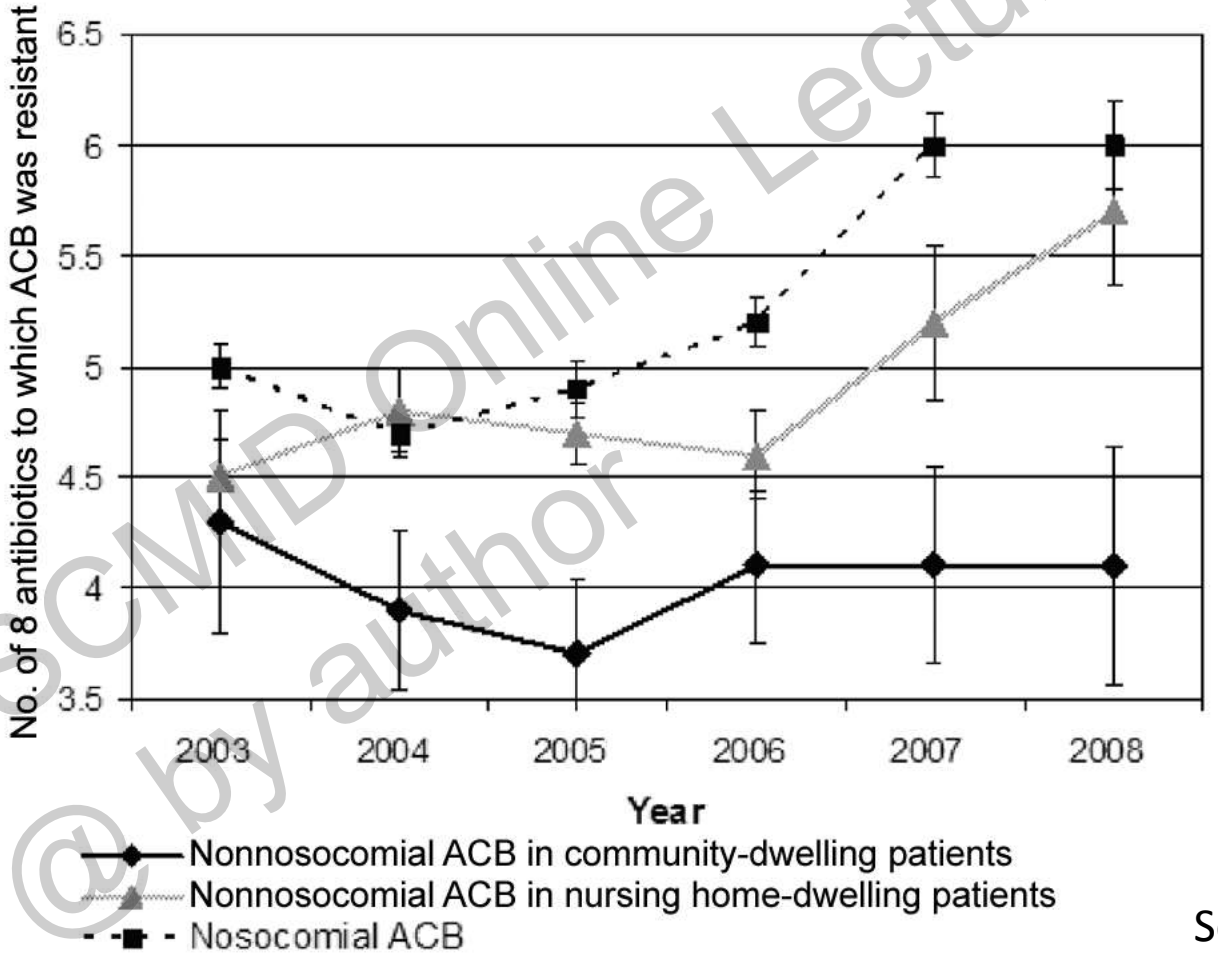
ST372-SHV-5, ward A.

0 admissions; 8 acquisitions



MDR Acinetobacter

Measure	Discharged to home	Discharged to nursing home	Discharged to LTAC or other hospital
No. of patients admitted from the community (homes)	149	77	159



Sengstock DM. CID 2010

CRE

- 251 CR *K. pneumoniae* Ohio/Detroit
  - 99% KPC producers
  - 59% of the patients admitted from LTCF
- 206 patients survived
  - 75% discharged to LTCF

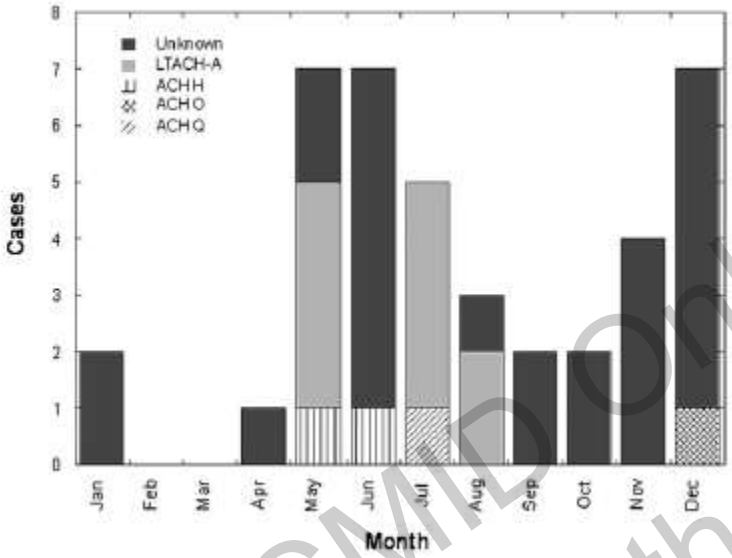
TABLE 1 Demographic characteristics of the patients in this study

Patient characteristic	All	Infected	Colonized
No. (%) from:			
SNF	123 (49)	50 (44)	73 (53)
Home	71 (28)	34 (30)	37 (27)
Another hospital	32 (13)	20 (18)	12 (8)
Long-term acute-care facility	25 (10)	10 (9)	15 (11)

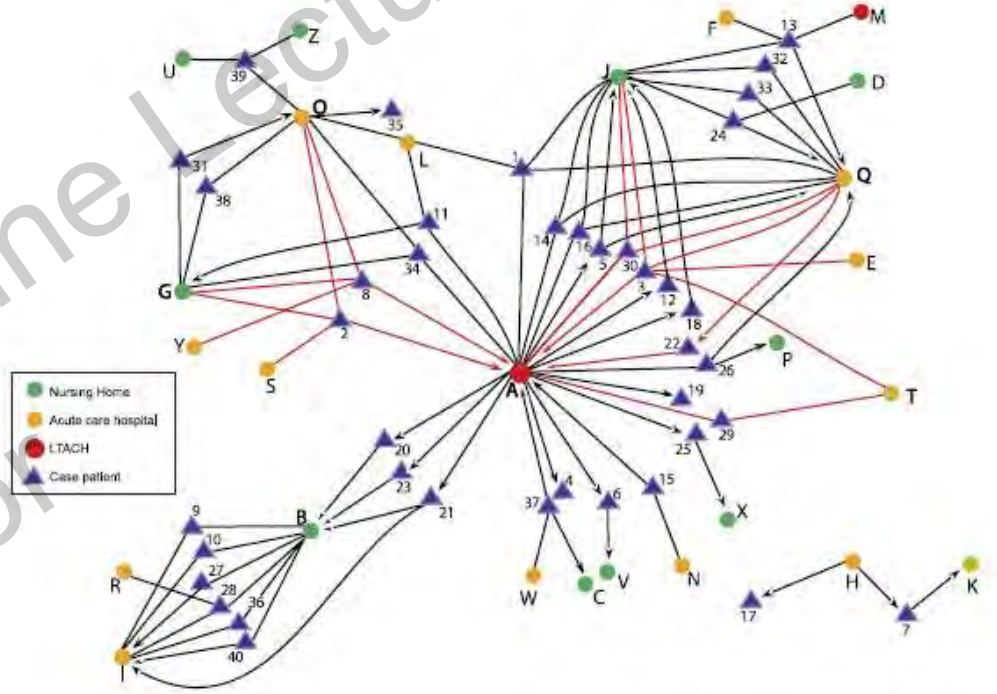
Van Doin D. AAC 2014

Emergence and Rapid Regional Spread of *Klebsiella pneumoniae* Carbapenemase–Producing *Enterobacteriaceae*

Sarah Y. Won,[1,2] L. Silvia Munoz-Price,[3] Karen Lolans,[4] Bala Hota,[4,5] Robert A. Weinstein,[4,5] and Mary K. Hayden[4] for the Centers for Disease Control and Prevention Epicenter Program



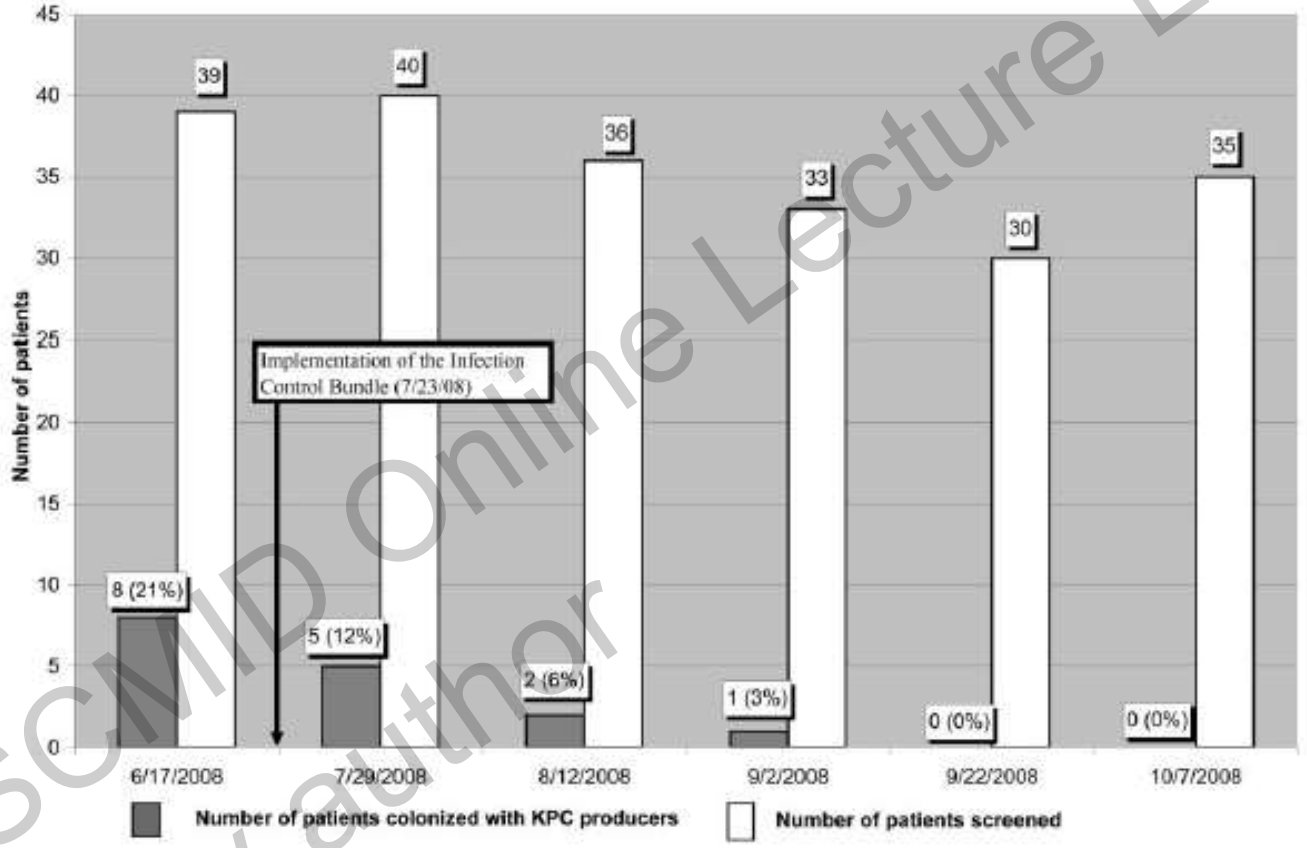
Rapid spread various institutions



Network graph illustrate the central role of LTAC (red)

CID 2011

Successful Control of an Outbreak of *Klebsiella pneumoniae* Carbapenemase–Producing *K. pneumoniae* at a Long-Term Acute Care Hospital



Infection control “Bundle”: isolation, cleaning, HCG baths, education, culture on admission

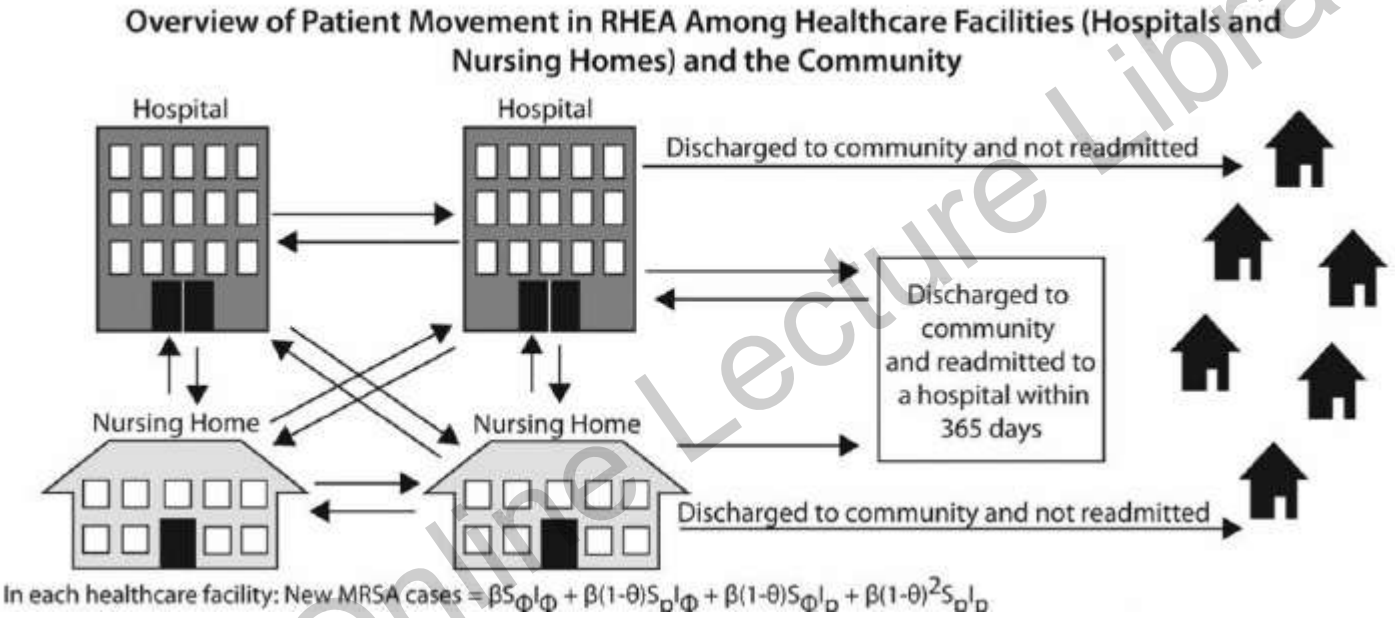
Munoz-Price S. ICHE 2010

Type of ward	2008 (n=1004)	2010 (n=1027)	2013
Skilled nursing care	25.9%	15.6 %	
chronic mechanical ventilation	11.9%	10.9 %	
sub acute	9.6%	7.7 %	
Rehabilitation	2.5%	1.1 %	
TOTAL	**12.5%**	**8.5%**	**<4%**

National intervention in post acute care facilities: 13 large LTCF

	2008	2010	2013
Infection control score	6.7	10.9	14
Strategies for prevention of CRKP			
cohorting patients	10	11	13
dedicated medical equipment	12	13	13
single-use gown	6	12	13
admissions screening	2	9	13
contact screening	5	10	13
Point prevalence carriage	12.5%	8.5%	3.9%

Ben-David D.



Bruce Lee. ICHE 2013

Summary

- Prevalence of carriage of MDROs in LTCFs is much higher than in acute-care hospitals
  - Great variability between institutions and wards
- High rate of transmission of MDROs within LTCFs
  - 10-30% acquisition rates described for MRSA and ESBL
- Bidirectional patients transfer between acute-care and LTCFs
- Successful interventions to control MDROs should be coordinated across the continuum of care
  - Need for sharing information on carriage status
  - Detecting carriers by screening admitted patients
  - Policies and strategies should be established to remove barriers to MDROs carrier transfer form acute to long term care facilities