

# Multi Drug Resistant Bacteria and Its Antibiotic Susceptibility at Percutaneous Endoscopic Gastrostomy (PEG) Tube Site of Long Term Care Facility Elderly Residents

Reem Mohamed Sabry EL Bedewy

Geriatrics and Gerontology Department, Ain Shams University, Egypt

Corresponding author: Reem Mohammed Sabry EL Bedewy, Tel: 00201119955249; E mail:

[drreem\\_sabry2005@yahoo.com](mailto:drreem_sabry2005@yahoo.com)

## ABSTRACT

**Background:** Percutaneous endoscopic gastrostomy (PEG) is the preferred route of feeding and nutritional support in patients with a functional gastrointestinal system who require long-term enteral nutrition. The objective of this descriptive study was to detect the commonest multidrug resistant bacteria and its antibiotic sensitivity at PEG tube site of elderly residents at long term care facility (LTCF). Forty two long term care facility elderly residents bedridden were having multi drug resistant organisms at percutaneous endoscopic gastrostomy tube site. Informed consent taken from each patient or from his/her guardian, also Ethical committee approval was obtained. Demographic data were collected and comorbidities were established. Culture and sensitivity was done for pus samples from PEG tube site (stoma) and documented multidrug resistant organisms with antibiotic susceptibility to a range of different antibiotic groups. All samples were processed as per standard techniques and bacteria identified by standard biochemical tests. IBM SPSS statistics (version 24, IBM corp., USA, 2016) was used for data analysis. The age ranges from 60 to 79 years with mean 69.19 +/- 7.01 years. 47.6 % of residents in the age group 60-66 y while 52.4% of residents are in the age group 67-80 y. Males were 57.1% while females were 42.9 %, The predominant resistant detected organism in this sample was Klebsiella (57.1%) while E coli accounts for 28.6% and Proteus is 14.3%. The study revealed that klebsiella was highly statistically significant sensitive to Cefepime (CPM), Imipenam (IMP), Ciprofloxacin (CP), and Colistin (CT) and statistically significant resistant to Trimethoprim/Sulfamethoxazole (TS), and tobramycin (tobra.) Whereas Proteus was highly statistically significant resistant to Cefepime (CPM), Colistin (CT), Imipenam (IMP) and highly statistically significant sensitive to Ciprofloxacin (CP), Trimethoprim/Sulfamethoxazole (TS), tobramycin (tobra.). E Coli was found to be highly statistically significant intermediately sensitive to Cefepime (CPM), Colistin (CT), and Tobramycin and highly statistically significant resistant to Ciprofloxacin (CP), Trimethoprim/Sulfamethoxazole (TS). Further studies are recommended on larger numbers of elderly patients to confirm significant findings in this study, try to explain these findings, and make use of them in clinical practice.

**Keywords:** Antibiotic susceptibility, multi drug resistant bacteria, percutaneous endoscopic gastrostomy (PEG) tube, long term care facility, elderly residents.

## INTRODUCTION

Percutaneous endoscopic gastrostomy (PEG) is the preferred route of feeding and nutritional support in patients with a functional gastrointestinal system who require long-term enteral nutrition<sup>1</sup>. The reported rates of complications following percutaneous endoscopic gastrostomy (PEG) tube placement vary from 16 to 70 percent<sup>2-6</sup>.

A large meta-analysis reported a procedure - related morbidity of 9.4% and mortality of 0.53%<sup>7</sup>. Peristomal wound infection is fairly common,

occurring in 5%-25% of cases in cohort studies<sup>8-10</sup>. Resistant organisms causing PEG wound infections are a significant problem with a major clinical impact and data from Lipp A and Lusardi G review is that administration of systemic prophylactic antibiotics for PEG placement reduces peristomal infection<sup>11</sup>. Many patients requiring PEG are elderly with co-morbidities, PEG wound infections caused by an increasing incidence of resistant organisms<sup>5,12</sup>. Residence at a LTCF and older age are both recognized as significant risk factors for harboring Multi drug

resistant gram negative bacteria (MDRGNB) or introducing MDRGNB to hospitals<sup>13</sup>.

**AIM OF THE STUDY**

The objective of this study was to detect the commonest multidrug resistant bacteria and its antibiotic susceptibility at PEG tube site of elderly residents at long term care facility.

**SUBJECTS AND METHOD**

A descriptive study for 42 long term care facility elderly residents bedridden having multi drug resistant organisms at percutaneous endoscopic gastrostomy tube site. Informed written consent was taken from each patient or from his/her guardian if patient condition can not permit giving the consent. The study was done matching research ethics board of Ain Shams university . Demographic data were collected and comorbidities were established. Duration of Stay (DOS) stands for the period in weeks elapsed from admission till start of Isolation for PEG site resistant infection. Culture and sensitivity was done for pus samples from PEG tube site (stoma) and documented multidrug resistant organisms with antibiotic susceptibility to a range of different antibiotic groups. All samples were processed as per standard techniques and bacteria identified by standard biochemical tests. The study was done matching ethical board of Ain Shams university.

**Statistical method:** IBM SPSS statistics (version 24, IBM corp., USA, 2016) was used for data

analysis. Data were expressed as Mean ± SD for quantitative parametric measures in addition to both number and percentage for categorized data. Chi – square test was used to study the association between each 2 variables or comparison between 2 independent groups as regards the categorized data. The probability of error at 0.05 was considered significant, while at 0.01 and 0.001 are highly significant.

**RESULTS**

A sample of 42 elderly bedridden long term care facility (LTCF) residents with multi drug resistant bacteria detected in the pus at their PEG tube site. The age ranges from 60 to 79 years with mean 69.19 +/- 7.01 years. 47.6 % of residents in the age group 60-66 y while 52.4% of residents are in the age group 67-80 y. Males are 57.1% while females are 42.9 %, The predominant resistant detected organism in this sample is Klebsiella (57.1%) while E Coli accounts for 28.6% and Proteus is 14.3%. 50% of klebsiella organisms are in males, 50% in female ,45.8% of klebsiella are in the younger age group (60-66 years) while 54.2% are in the older one (67-80years).50% of klebsiella are in patients with the comorbidity of Road traffic accident (RTA) while the other 50% are with the comorbidity of cerebrovascular stroke (CVS).

Neither age nor sex was statistically significantly correlated to different detected resistant organisms.

**Table (1): Correlation between age and resistant organisms at PEG tube site of bedridden long term care facility elderly.**

**Crosstab**

			Organism			Total
			E Coli	Proteus	Klebsiella	
Age In Years	60-66	Count	6	3	11	20
		%	50.0%	50.0%	45.8%	47.6%
	67-80	Count	6	3	13	22
		%	50.0%	50.0%	54.2%	52.4%
Total		Count	12	6	24	42
		%	100.0%	100.0%	100.0%	100.0%

**Chi-Square Tests**

	Value	P
Pearson Chi-Square	0.072 <sup>a</sup>	0.965

**Table (2): Correlation between sex and resistant organisms at PEG tube site of bedridden long term care facility elderly.**

**Crosstab**

			Organism			Total
			E Coli	Proteus	Klebsiella	
Sex	Male	Count	6	6	12	24
		%	50.0%	100.0%	50.0%	57.1%
	Female	Count	6	0	12	18
		%	50.0%	0.0%	50.0%	42.9%
Total		Count	12	6	24	42
		%	100.0%	100.0%	100.0%	100.0%

**Chi-Square Tests**

	Value	P
<b>Pearson Chi-Square</b>	5.250 <sup>a</sup>	.072

Distributed comorbidities among studied group revealed that 100% of Proteus has comorbidities of diabetes mellitus (DM) + CVS + Dementia while 50% of Klebsiella has RTA, the other 50% has CVS, 50% of E coli has RTA, while the other 50% has cancer colon (P value =0.000).

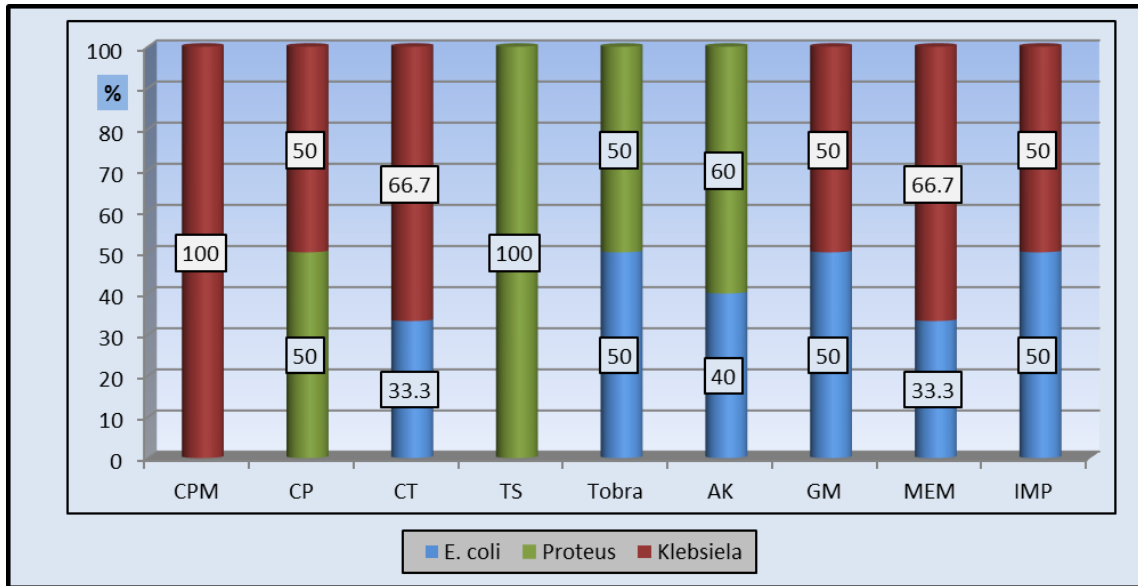
**Table (3): Correlation between comorbidities (diagnosis) and resistant organisms at PEG tube site of bedridden long term care facility elderly.**

**Crosstab**

			Organism			Total
			E Coli	Proteus	Klebsiella	
Diagnosis	RTA	Count	6	0	12	18
		%	50.0%	0.0%	50.0%	42.9%
	cancer colon	Count	6	0	0	6
		%	50.0%	0.0%	0.0%	14.3%
	CVS	Count	0	0	12	12
		%	0.0%	0.0%	50.0%	28.6%
	DM+CVS + dementia.	Count	0	6	0	6
		%	0.0%	100.0%	0.0%	14.3%
Total		Count	12	6	24	42
		%	100.0%	100.0%	100.0%	100.0%

**Chi-Square Tests**

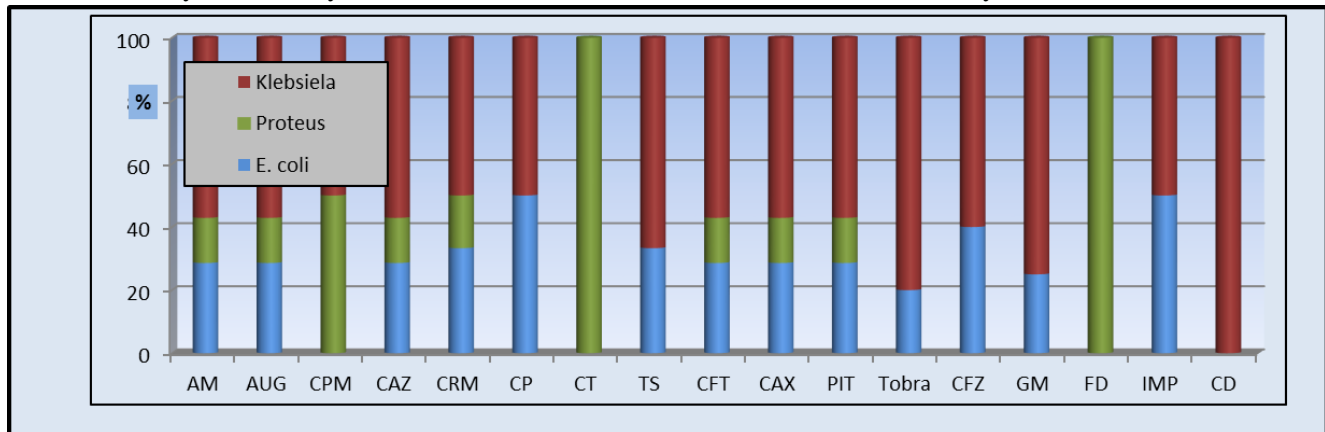
	Value	P
<b>earson Chi-Square</b>	63.000 <sup>a</sup>	0.001



**Figure (1):** Frequency of studied antibiotics as regards their sensitivities.

{CPM (Cefepime), TS (Trimethoprim/Sulfamethoxazole), Tobra.(Tobramycin) , (AK) Amikin, GM (Gentamycin), MEM (Meronam), IMP (Imipenam), CP (Ciprofloxacin), CT(Colistin)}

Klebsiella accounts for 100% of sensitive elderly in the study sample to CPM, 66.7% of sensitive elderly to CT, and MEM, 50% of sensitive elderly to CP,GM, and IMP. Proteus accounts for 100% of sensitive elderly to TS, 60% of sensitivity to AK, and 50% of CP and Tobramycin, whereas E Coli accounts for 50% of sensitivity to Tobramycin, GM, and IMP and 40% to AK 33.3 % of sensitivity to CT and MEM.



**Figure (2):** Frequency of studied antibiotics as regards their resistance.

{AM(Ampicillin), AUG(Augmentin), CPM(Cefepime), CAZ(Ceftazidime), CRM (Cefuroxime), CP (Ciprofloxacin), CT(Colistin), TS(Trimethoprim/Sulfamethoxazole), CFT(Ceftriaxone), CAX(Cefotaxime), PIT(Tazocin), Tobra.(Tobramycin), CFZ (Cefazolin), GM(Gentamycin), FD(nitrofurantoin), IMP(Imipenam), CD(Clindamycin) }.

The study revealed that klebsiella is highly statistically significant sensitive to Cefepime (CPM), Imipenam (IMP),Ciprofloxacin (CP), and Colistin (CT) and statistically significant resistant to Trimethoprim/Sulfamethoxazole (TS), and

tobramycin (tobra.) Whereas Proteus is highly statistically significant resistant to CPM, CT, IMP and highly statistically significant sensitive to CP,TS and Tobra. E coli found to be highly statistically significant intermediately sensitive to

CPM, CT, and Tobramycin and highly statistically significant resistant to CP and TS.

The study revealed that younger age group is statistically significant resistant to CRM, CFZ and highly statistically significant resistant to GM, statistically significant sensitive to CPM, and highly statistically significant sensitive to IMP whereas older age group is highly statistically significant sensitive to GM and statistically significant resistant to CFZ, and highly statistically significant resistant to IMP.

Males are highly statistically significant resistant to CRM, CFZ, GM and highly statistically significant sensitive to IMP, CP, and statistically significant sensitive to TS. While females were highly statistically significant intermediately sensitive to CRM, CFZ, and CP and statistically significant resistant to IMP, and TS, statistically significant sensitive to CT and highly statistically significant sensitive to GM. Klebsiella is highly statistically significant correlated to RTA and CVS. E coli is highly statistically significant sensitive correlated to Cancer colon. Proteus is highly statistically significant correlated with comorbidity of D.M + CVS+ dementia.

Patients with comorbidities of RTA are highly statistically significant sensitive to CPM, CP, CT, and IMP and highly statistically significant resistant to TS, Tobramycin, CFZ. While comorbidities of DM + CVS+ Dementia are highly statistically significant resistant to CPM, CT, and IMP and highly statistically significant sensitive to CP, TS, Tobramycin, and GM. Comorbidities of cancer colon is highly statistically significant sensitive to tobramycin and GM and highly statistically significant resistant to IMP, CP, and CFZ. Comorbidities of CVS is highly statistically significant resistant to tobra., and CPM and highly statistically significant Sensitive to GM, highly statistically significant intermediately Sensitive to CFZ.

100% of studied elderly with comorbidities of Cerebrovascular stroke(CVS) and 66.7% of Road Traffic Accident (RTA) had longer Duration of stay(DOS) (113-490 weeks) while 100% of cancer colon and 100% of comorbidities of Diabetes (DM)+ CVS + Dementia had shorter DOS (0-3 weeks) (p= 0.000).

100% of patients with E Coli and 100% of patients with Proteus had shorter DOS while Klebsiella had longer DOS (p=0.000). 100% of

intermediately sensitive patients to CRM had longer DOS while 50% of resistant patients to CRM had longer DOS (P=0.022).

100% of resistant patients to CT had shorter DOS while 66.7% of sensitive to CT had longer DOS (p=0.002). 100% of sensitive patients to TS had shorter DOS while 66.7% of resistant patients to TS had longer DOS (p=0.002). 100% of sensitive patients to Tobramycin had shorter DOS while 80 % of resistant patients to Tobramycin had longer DOS (p=0.000). 100% of resistant patients to IMP had shorter DOS while 50% of sensitive patients to IMP had longer DOS (p=0.005).

## DISCUSSION

Elderly population is growing worldwide and researches concerning elderly problems are growing also but still lagging. The Centers for Disease Control and Prevention estimates that in the United States, >2 million people become infected with a multidrug-resistant organism (MDRO) each year; subsequently, at least 23,000 die from these infections and from complications resulting from these illnesses<sup>14</sup>. When a group of elderly patients are suffering from a certain life threatening problem; it is pleasure to me to try helping in this problem by recording it and finding explanations and possible solutions to it. This study describes elderly patient resident at LTCFs with resistant bacteria to more than two antibiotic groups or MRSA at PEG tube site. For many worldwide regions, knowledge regarding the scope of the resistance problem is imprecise and unreliable. Surveillance of resistance is an integral part of combating resistance Eckpergasse, 2013.<sup>15</sup>

This study was done to find commonest multi drug resistant bacteria at PEG tube site of bedridden LTCF residents and what still statistically significant sensitive to which antibiotics. Little research data in the same studied topic is available to compare with.

This study revealed that the most predominant resistant detected organism is Klebsiella (57.1%) while E Coli accounts for 28.6% and Proteus is 14.3%. Compared to results of the study of Sanjiv Mahadeva, et.al where resistant organisms detected at PEG tube site are Pseudomonas aeruginosa (38.0%), Klebsiella species (22.5%), methicillin-sensitive Staphylococcus aureus (14.1%), and methicillin-resistant Staphylococcus aureus (11.3%)<sup>16</sup>. In particular, the percentage of

carbapenem resistant *K.pneumoniae* has recently found to be as high as 36.2% among invasive isolates, with most resistant isolates (97%) actually harbouring KPC carbapenemase<sup>17</sup>.

Patients with comorbidities of RTA are highly statistically significant sensitive to CPM, CP, CT, and IMP. This sensitivity may be explained by highly statistically significant correlation of RTA to klebsiella which is highly statistically significant to CPM, CP, CT, and IMP. On the otherhand comorbidities of RTA is highly statistically significant resistant to TS, Tobramycin, CFZ. This resistance may be explained by klebsiella resistance to TS, and Tobramycin. Patients with comorbidities of DM + CVS+ Dementia are highly statistically significant resistant to CPM, CT, and IMP and highly statistically significant sensitive to CP, TS, Tobramycin, and GM. These significant sensitivities and resistances may be explained by Proteus sensitivity and resistance as Proteus is highly statistically significant correlated to comorbidities of DM + CVS+ Dementia. Comorbidities of cancer colon is highly statistically significant sensitive to tobramycin and GM and highly statistically significant resistant to IMP, CP, and CFZ. These significant sensitivities and resistance may be explained by E Coli sensitivity and resistance as E Coli is highly statistically significant correlated to comorbidities of cancer colon.

If antibiotics are indicated for treatment of these PEG site infections it can be as follow:

If Klebsiella: consider CPM, IMP, CP or CT and avoid TS, and tobramycin .

If Proteus: consider CP, TS, Tobramycin and avoid CPM, CT, and IMP.

If E Coli: consider CPM, CT, and Tobramycin, and avoid CP, and TS.

If male: consider IMP, CP or TS, avoid CRM, CFZ, and GM.

If female: Consider giving CT and GM, avoid CRM, CFZ, CP, IMP, and TS.

If RTA comorbidity: consider CPM, CP, CT, and IMP, avoid TS, Tobramycin, and CFZ.

If comorbidities of DM + CVS+ Dementia: consider giving CP, TS, Tobramycin, and GM avoid CPM, CT, and IMP.

Comorbidities of cancer colon: consider giving Tobramycin and GM, avoid IMP, CP, and CFZ.

Comorbidities of CVS : consider giving GM and CFZ, avoid Tobramycin, and CPM.

## RECOMMENDATIONS

Clinically, based on significant results in current study, physicians can predict multi drug resistant type and subsequent antibiotic choice for PEG tube site infected LTCF elderly residents.

Further studies are recommended on larger scale of elderly patients to confirm significant findings in this study, try to explain these findings and make use of them in clinical practice.

## REFERENCES

1. **Ata A Rahnemai-Azar, Amir A Rahnemaiazar, Rozhin Naghshizadian, Amparo Kurtz, and Daniel T Farkas [2014].** World J Gastroenterol. , 20(24): 7739–7751. doi: 10.3748/wjg.v20.i24.7739 Percutaneous endoscopic gastrostomy: Indications, technique, complications and management .
2. **Taylor CA, Larson DE, Ballard DJ et al. [1992].** Predictors of outcome after percutaneous endoscopic gastrostomy: a community-based study. Mayo Clin Proc ., 67:1042.
3. **Larson DE, Burton DD, Schroeder KW, DiMagno EP [1987].** Percutaneous endoscopic gastrostomy. Indications, success, complications, and mortality in 314 consecutive patients. Gastroenterology,93:48.
4. **Blomberg J, Lagergren J, Martin L et al. [2012].** Complications after percutaneous endoscopic gastrostomy in a prospective study. Scand J Gastroenterol. , 47:737.
5. **Raha SK, Woodhouse K [1994].** The use of percutaneous endoscopic gastrostomy (PEG) in 161 consecutive elderly patients. Age Ageing, 23:162.
6. **Keung EZ, Liu X, Nuzhad A et al. [2012].** In-hospital and long-term outcomes after percutaneous endoscopic gastrostomy in patients with malignancy. J Am Coll Surg., 215:777.
7. **Wollman B, D'agostino HB, Walus-Wigle JR et al. [1995].** Radiologic, endoscopic and surgical gastrostomy; an institutional evaluation and meta-analysis of the literature. Radiology, 197:699-704..
8. **Lumen W, Kwek KR, Loi KL et al. [2001].** Percutaneous endoscopic gastrostomy – indications and outcomes of our experience at Singapore General Hospital. Singapore Med J., 42:460-465.
9. **Lee JH, Kim JJ, Kim YH et al. [2002].** Increased risk of peristomal wound infections after percutaneous endoscopic gastrostomy in patients with diabetes mellitus. Dig Liver Dis., 34:857-861.

- 10. Gencosmanoglu R, Koc D, Tozun N [2003].** Percutaneous endoscopic gastrostomy: results of 115 cases. *Hepatogastroenterology*, 50:886-888.
- 11. Lipp A, Lusardi G [2006].** Systemic antimicrobial prophylaxis for percutaneous endoscopic gastrostomy. *Cochrane Database Syst Rev.*, (4):CD005571.
- 12. Hull M, Beane A, Bowen J, Settle C [2001].** Methicillin-resistant *Staphylococcus aureus* infection of percutaneous endoscopic gastrostomy sites. *Aliment Pharmacol Ther.*, 15:1883—8.
- 13. Jae-Phil Choi a, Eun Ha Cho a, Seung Joon Lee a, Seung Tae Lee a, Myung Sook Koo b, Young-Goo Song c [2012].** Influx of multidrug resistant, Gram-negative bacteria (MDRGNB) in a public hospital among elderly patients from long-term care facilities: A single-center pilot study., *Archives of Gerontology and Geriatrics*, 54 :e19–e22.
- 14. Centers for Disease Control and Prevention [2013].** Antibiotic resistance threats in the United States, 2013. 2014. Available from: <http://www.cdc.gov/drugresistance/threat-report-2013/index.html>
- 15. Eckpergasse [2013].** Global antibacterial resistance: The never-ending story Ursula Theuretzbacher Center for Anti-Infective Agents. 13, 1180 Vienna, Austria *Journal of Global Antimicrobial Resistance*, 1:63–69.
- 16. Sanjiv Mahadeva, Bee-Leng Khoo, Peek-Swan Khoo, Abdul Malik, Ida Hilmi, Choon-Seng Qua, Choon-Heng Wong, Khean-Lee Goh [2008].** Clinical impact and risk factors for percutaneous gastrostomy wound infections due to resistant organisms. *International Journal of Infectious Diseases*, 12 e149—e150.
- 17. Giufrè M, Ricchizzi E, Accogli M, Barbanti F, Monaco M, Pimentel de Araujo F, Farina C, Fazzi P, Mattei R, Sarti M, Barozzi A, Buttazzi R, Cosentino M, Nardone M, Savini V, Spigaglia P, Pantosti A, Moro ML, Cerquetti M [2017].** Colonization by multidrug-resistant organisms in long term care facilities in Italy: a point-prevalence study, *Clinical Microbiology and Infection*, doi:10.1016/j.cmi.2017.04.006