Multidrug-resistant bacteria - nightmare for the hospital (finances): Detect, contain and reduce LOS

Kersting T[1], Haustein R[2], Irps R[3]
[1] Technical University Berlin, Germany, Section for Hospital Management, [2]IGES Institut GmbH, Berlin, Germany [3]IMC clinicon GmbH, Berlin, Germany

Introduction

Multidrug-resistant (MDR) bacteria have become a global health problem and their containment one of the most challenging tasks for hospital managers. In Germany alone, the incidence of hospital acquired MDR infections is estimated to be at least 60,000 – 90,000 cases per year [1,2]. We performed a health services research analysis to evaluate the impact of MDR infections on length of stay (LOS) and overall costs depending on different patient management approaches. Also, differences in diagnostic patterns for potential MDR bacteria infections were analyzed.

Background

The German DRG system (G-DRG) requires distinct coding of diagnoses, medical procedures and in specific documentation of MDR colonization and infection. All hospitals are legally committed to deliver their relevant performance data annually to the German DRG-institute (InEK); more than 250 hospitals also participate voluntarily in the InEK DRG recalculation process with cost calculation and reimbursement data. This data is published and open for public download and use [3] although in restricted data format; in addition some hospitals independently benchmark their relevant data for management reasons. For documentation of MDR colonization and infection within the DRG system a separate code is available: OPS 8-987 (complex treatment of colonization or infection with multidrug-resistant pathogens resulting in isolation of patient). This procedure is coded about 120,000 times / year in Germany (2011)(4), although routine data analysis of specific sick funds support the hypothesis, that real prevalence for MDR infections might be even higher (5).

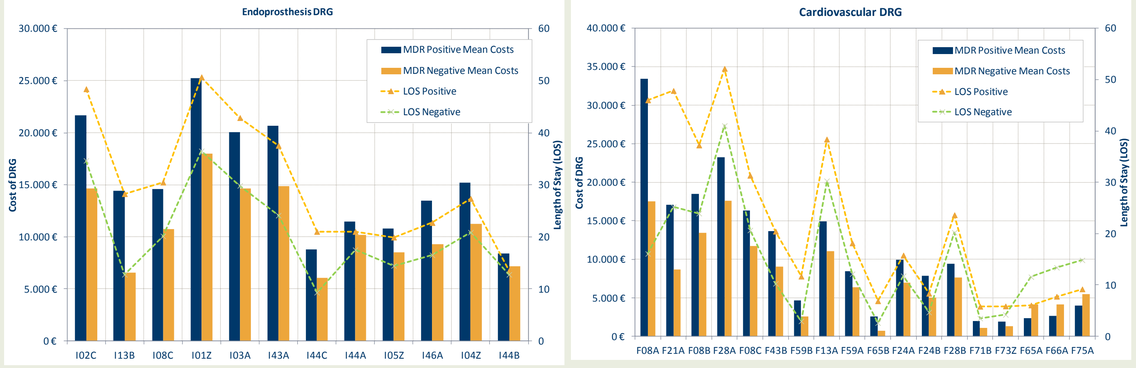
Method

DRG data and cost routine data of 2011 from a benchmark-group of 27 German hospitals reporting their cost calculation data to InEK were analyzed. For a subgroup of those hospitals, LOS and readmission rates were compared between hospitals with traditional diagnostic methods and hospitals using rapid PCR screening technology for MDR infections.

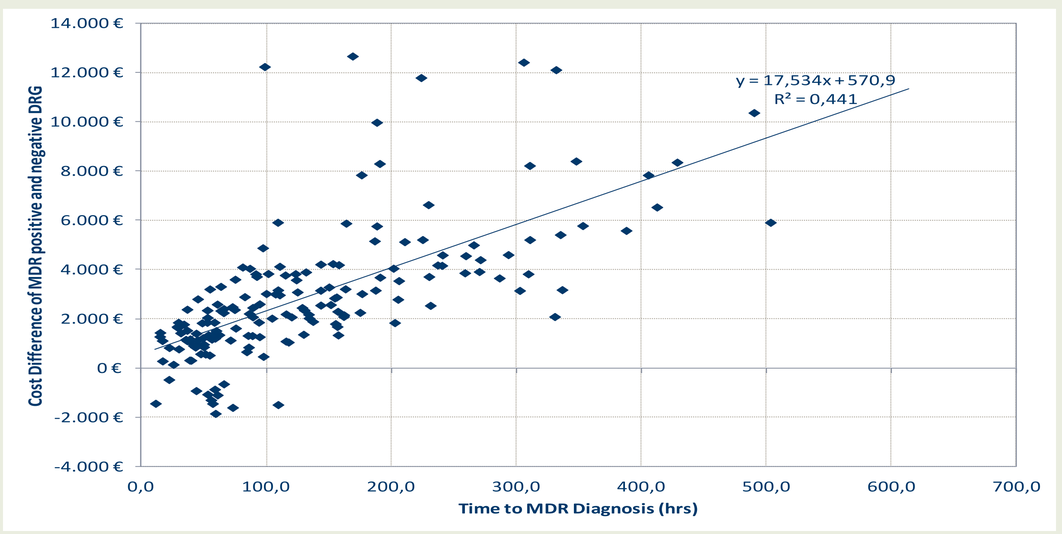
Findings

1. Costs of compared DRGs for 3.1% patients with MDR infections/colonization (n=16,159) were significantly higher than for DRGs in patients without (n=507,157). These findings were independent of treatment in specialized isolation units (0.4%) or with standard measures of isolation in the normal ward (2.7%). Cost for compared DRGs differed by on average 10,052.7 € between the group of non-infected vs. infected/colonized patients in isolation units (95 %-CI 9,626.9 € to 10,478.5 €; p<0.05), and respectively 9,559.9 € between non-infected/colonized vs. infected/colonized in standard measures of isolation in the ward (95 %-CI 8,487.5 € to 10.632,4 €; p<0.05). Cost differences between DRG cases in isolation wards and cases isolated in normal wards were not significant (means: 13,508 € and 14,001 €).
2. Graph 1 and 2 show as an example – for DRGs of hip and knee endoprosthesis procedures and for a typical medical DRG group (non operative: Major Diagnostic Category “F” cardiovascular with all its subgroups) – that MDR negative patients and patients found positive for the presence of MDR bacteria (with code OPS 8-987) have a prolonged length of stay with higher costs.
3. Analysis of all DRG data from the benchmark group showed a strong linear correlation between cost differences of DRGs with and without positive MDR diagnosis and time to MDR diagnosis (Graph 3), indicating that (prolonged) time to MDR diagnosis was a main driver for extended costs.
4. The later presence of MDR bacteria was diagnosed, the higher were costs of hospital stays (mainly driven by costs of isolation, medical treatment and prolongation of hospital stays; significant deviations in costs (and LOS) were found when diagnosis of MDR was obtained later than 72 hours (Graph 4 and 5).
5. For a subgroup of hospitals a more detailed analysis could be performed: in hospitals with implementation of differentiated screening measures and early detection of MDR bacteria by modern PCR technology (Cepheid®) readmission rates for all DRGs were lower compared to hospitals with conventional microbiology testing (LOS – and therefore also derived costs - was lower as well but not statistically significant). This might be interpreted as an indication, that real-time rapid PCR technology use in hospitals not only changes patterns of treatment in patients at risk for MDR infection, but may also contribute to better outcomes and lower costs. Results as presented were not analyzed for statistical significance due to small numbers; further prospective evaluation is desirable in this field.
6. Patients in hospitals using modern PCR screening technology for MDR bacteria were found to be isolated earlier then patients in hospitals using conventional diagnostic methods (Graph 7 and Table 1).

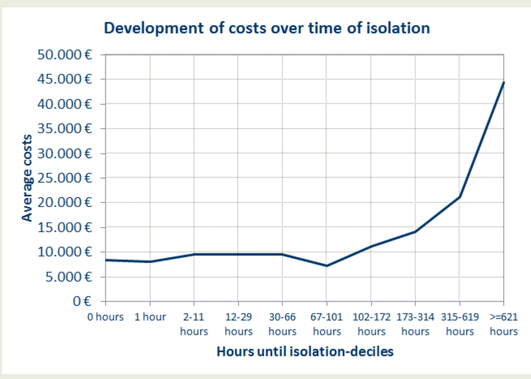
Graph 1 and 2: Example (left) all DRG for endoprosthesis procedures in hip and knee and (right) for a typical medical non operative DRG group (Major Diagnostic Category “F” = cardiovascular with all its subgroups) – how negative and positive MDR bacteria results with code 8-987 result in higher cost and prolonged length of stay.

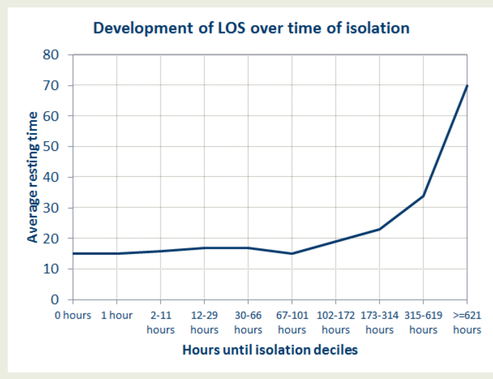


Graph 3: DRG average cost differences between MDR bacteria positive and negative cases by time to diagnosis

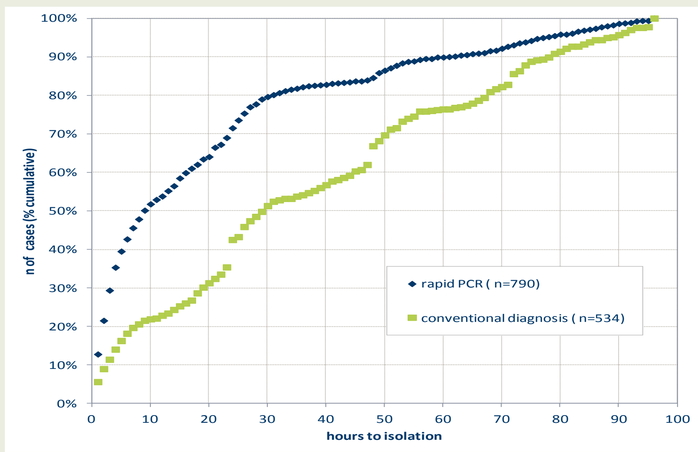


Graph 4 and 5: Development of costs and LOS over time of isolation



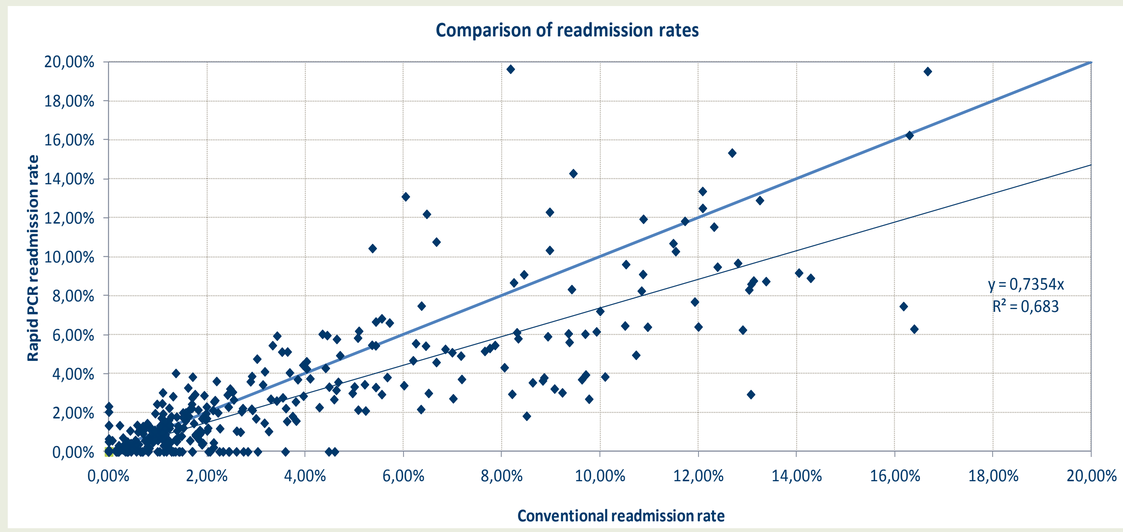


Graph 7 and Table 1: Hours to isolation – PCR vs. conventional diagnosis for DRG with MDR diagnosis (cumulative); numbers in table cut-off at 24 hours



hours to isolation	n of cases (PCR)	n of cases (conventional)	% PCR	% PCR (cum.)	% conventional	% conventional (cum.)
1	101	30	12,8%	12,8%	5,6%	5,6%
2	69	18	8,7%	21,5%	3,4%	9,0%
3	62	13	7,8%	29,4%	2,4%	11,4%
4	47	14	5,9%	35,3%	2,6%	14,0%
5	33	12	4,2%	39,5%	2,2%	16,3%
6	25	10	3,2%	42,7%	1,9%	18,2%
7	23	8	2,9%	45,6%	1,5%	19,7%
8	18	5	2,3%	47,8%	0,9%	20,6%
9	18	5	2,3%	50,1%	0,9%	21,5%
10	13	2	1,6%	51,8%	0,4%	21,9%
11	9	1	1,1%	52,9%	0,2%	22,1%
12	7	4	0,9%	**53,8%**	0,7%	**22,8%**
13	11	3	1,4%	55,2%	0,6%	23,4%
14	10	5	1,3%	56,5%	0,9%	24,3%
15	16	5	2,0%	58,5%	0,9%	25,3%
16	11	4	1,4%	59,9%	0,7%	26,0%
17	9	4	1,1%	61,0%	0,7%	26,8%
18	8	10	1,0%	62,0%	1,9%	28,7%
19	11	8	1,4%	63,4%	1,5%	30,1%
20	5	6	0,6%	64,1%	1,1%	31,3%
21	19	6	2,4%	66,5%	1,1%	32,4%
22	6	6	0,8%	67,2%	1,1%	33,5%
23	14	10	1,8%	69,0%	1,9%	35,4%
24	20	38	2,5%	**71,5%**	7,1%	**42,5%**

Graph 6:Comparison of readmission rates for DRGs in hospitals with rapid PCR vs. conventional microbiology



Conclusion

Costs derived from DRGs in patients with MDR bacteria were significantly higher than for DRGs in patients without. A strong correlation of difference of costs of DRGs and LOS for MDR positive and negative group of patients was found, indicating that LOS was the main driver for increased costs.

The later the presence of MDR bacteria was identified, the higher costs were found. Increased costs could be attributed to isolation, medical treatment and prolonged length of stay. Hospitals utilizing rapid PCR technology (Cepheid ®) for early detection of MDR bacteria had lower costs, shorter LOS and lower readmission rates.

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IGES Institut GmbH | Friedrichstraße 180 | 10117 Berlin | Germany
www.iges.de
TU Berlin AwB | Fasanenstraße 1 | 10623 Berlin | Germany
www.awb.tu-berlin.de