

# Impact of Multidisciplinary Collaborative Intervention on Isolation Implementation in the Prevention and Control of Multidrug Resistance Infection—A Retrospective Study

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## Research

**Keywords:** multidisciplinary collaborative intervention, issuance of isolation orders, MDRO infection and colonization, implementation rate

**Posted Date:** June 12th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-34699/v1>

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# Abstract

**Background:** Isolation is important in the prevention and control of infection with multidrug-resistant organisms(MDROs) but implementation is weak. We aim to analyze the impact of multidisciplinary collaborative intervention on isolation in multidrug-resistant organism(MDRO) infection and determine the factors affecting the implementation of isolation measures.

**Methods:** A retrospective analysis of the issuance of isolation orders for 1338 patients with MDRO infection and colonization in 10 months before and after multidisciplinary collaborative interventions carried out on November 1, 2018 at a teaching tertiary hospital in central China. Univariate analysis and multivariate logistic regression analysis were used to analyze factors affecting isolation implementation.

**Results:** The overall issuance rate of isolation orders was 66.12%, which increased from 33.12% before the intervention to 75.88% after the intervention ( $P < 0.000$ ). The multidisciplinary collaborative intervention ( $OR = 0.154$ ) is a promoting factor for the issuance of isolation orders, in addition to Length of stay(LOS)  $> 15d$  ( $OR = 0.459$ ) and department ( $P < 0.05$ ).

**Conclusions:** Multidisciplinary collaborative interventions related to isolation can promote doctors to issue isolation orders in accordance with regulations.

## Background

MDRO infections seriously threaten the lives and health of patients and bring great pressure to hospital clinical treatment and infection management, it also brings a heavy economic burden to the medical and health systems all over the world [1, 2]. Therefore, it's important to take effective measures to prevent and control the spread of MDROs [3].

The primary mode of spreading MDRO is contact, so an effective measure to control MDRO infections is contact precaution [4]. Since 1996, the US Centers for Disease Control and Prevention (CDC) has stated in its guidelines that MDRO infection control should comply with standard precautions and transmission-based precautions [5]. Standard precautions apply to the health care of all hospitalized patients. Isolation precautions are recommended to implement for all patients with MDRO infections and colonization [6–8]. However, this recommendation is based only on the general consensus reached on the understanding of biological communication mechanisms. There is insufficient research on the implementation of isolation precautions, especially lacking in quantitative evidence [9–10]. There is still much to discuss. First, the recommendation and practical implementation of isolation precautions vary considerably [11–12]. Then there is no consensus as to the most effective infection prevention and control(IPC) measures to reduce transmission of MDROs [7].

Since the occurrence and spread of MDROs involve multiple disciplines and departments, the establishment of a multi-disciplinary collaborative team is of great significance for the prevention and control of MDROs. At present, the multidisciplinary team (MDT) is widely used in hospitals and medical

centers in developed countries. Experts from different disciplines provide patients with diagnosis and treatment services for a certain disease [13], especially in cancer care. [14]. Previous studies have proven that MDT can improve clinical outcomes and coordinate services [15–16]. For example, the adoption of a multidisciplinary collaborative management model in the field of prevention and control of MDROs can lead to a significant decrease in the infection rate of MDRO, including a significant increase in the implementation rate of isolation measures [17]. However, there are few studies on interventions specifically for isolation prevention and control measures [9], and there is also a lack of research on the factors affecting the implementation of isolation measures for medical personnel.

MDRO colonized and infected patients are potential sources of nosocomial infection [18], and it is difficult to distinguish between MDRO colonization and infection in daily work [19], so it is also important to take isolation precautions for MDRO colonized patients, but most of the existing research only considered MDRO infected patients and patients with colonization were ignored.

This study considered both MDRO colonized and infected patients to discuss the implementation of their isolation precautions, as well as the analysis of the effects and influencing factors of multidisciplinary collaborative intervention measures on doctors issuing isolation orders, to provide evidence-based evidence for promoting the implementation of isolation measures to reduce the transmission of MDROs.

## **Methods**

### **Research design**

This study conducted a retrospective study based on a tertiary teaching hospital in Hubei province of China, the hospital take a multidisciplinary collaboration interventions to control MDROs on November 1, 2018, we analyze the issuance of isolation orders for 1338 patients with MDRO colonization and infection in ten months before and after the interventions carried out, whether the patient adopts isolation measures is also compared to analyze the influencing factors of isolation implementation.

### **Multidisciplinary Collaborative Intervention**

In November 2018, to manage the prevention and control of MDROs better, the hospital organized and established a multidisciplinary collaborative group based on the updated Chinese consensus on prevention and control of MDROs (Chinese experts' consensus on prevention and control of multidrug resistance organism healthcare-associated infection.) [20]. The group including clinical experts and clinical microbiologists who are responsible for guiding the inspection, identification, early warning, monitoring and isolation of MDRO infection and colonization cases, and the person in charge of the Medical Service, Nursing Department and Hospital Infection Management Section is responsible for supervising and guiding the implementation of MDRO isolation precautions.

A multidisciplinary group meeting conducted once a month. The heads of each department performed statistical analysis on their respective isolation implementation or monitoring and summarized the problems in the work before the meeting. During the meeting, the team leader announced the clinical isolation implementation status of each department and pointed out several clinical departments with poor isolation implementation. The group discussed and analyzed the relevant issues and worked out solutions. After the meeting, the heads of clinical departments organized the solutions into a report and published it to each department and supervised the implementation.

Joint rounds carried out quarterly, on-site case analysis is conducted for key departments and departments with low isolation implementation rates, to discuss specific problems in isolation implementation, and to improve isolation implementation plans.

## **Data Collection**

The bacteria detected in the MDRO infection and colonization was limited to 5 species: Staphylococcus aureus, Acinetobacter baumannii, Pseudomonas aeruginosa, Klebsiella pneumoniae, and Escherichia coli.

The collected variables include the dependent variable as the rate of issuance of isolation orders, the independent variable is intervention, the other control variable including the department, length of stay(LOS), infection susceptibility factors, specimen, infected site, gender, age.

## **Statistical analysis**

A descriptive analysis of the implementation of isolation before and after the intervention. Univariate analysis and multivariate logistic regression analysis to analyze affecting factors of isolation implementation. Continuous variables are described as mean and standard deviation, and compared using student t test or Mann-Whitney U test as appropriate; categorical variable description is the number and percentage of isolation orders issued for each category, calculated using a chi-square test or Fisher's exact test as appropriate. Variables with  $P < 0.05$  in Univariate analysis were considered potential independent variables and included in a multivariate logistic regression analysis. The unordered multi-classification variable sets the dummy variable with "Other" as the reference group, the results are expressed as odds ratio (OR) and 95% confidence interval (95% CI). All tests were two tailed, and significance was set at  $p$  value  $< 0.05$  in multivariate analysis. All statistical analysis was performed using SPSS software (version 21.0).

## **Results**

### **Implementation rate of isolation before and after intervention**

The total isolation implementation rate of 1338 patients with MDRO infection and colonization was 66.12%. Before the multidisciplinary collaborative intervention, 459 isolated medical orders should be issued, 152 isolated medical orders were actually issued, with an implementation rate of 33.12%. After multidisciplinary collaborative intervention, 879 isolated medical orders should be issued, and 667 isolated medical orders were issued, with an implementation rate of 75.88%. Failure to isolate the patients all, but after the intervention, the implementation rate of isolation orders increased significantly ( $P < 0.000$ ).

## **Univariate Analysis Of Isolation Implementation Rate**

Univariate analysis showed (Table 1) that age, gender, MDRO infection or colonization had no significant effect on the isolation implementation rate ( $P > 0.05$ ), the specimen, infection site, whether LOS exceeds 15 days, whether to take intervention measures, different departments and susceptibility factors have a significant impact on the isolation implementation rate ( $P < 0.05$ ).

Table 1  
Univariate analysis of isolation implementation rate

Variables		Issue(N = 819)	Unissue(N = 519)	Implementation rate(%)	P value
Age/years		50.23 ± 19.05	49.23 ± 19.33		0.353
Gender	male	564	367	60.58	
	female	255	152	62.65	0.474
Intervention	no	152	307	33.12	
	yes	667	212	75.88	0.000
Type	infection	422	239	63.84	
	colonization	397	280	58.64	0.051
LOS	0-15d	83	93	46.86	
	> 15d	736	426	63.31	0.000
Department	Surgical	137	90	60.35	
	Medical	35	50	41.18	
	Pediatric	16	12	57.14	
	ICU	514	277	64.98	
	Others	117	90	56.52	0.000
Specimen	Sputum	358	206	63.48	
	Fiber bronchoscope irrigation solution	135	73	64.90	
	Blood	82	41	66.67	
	Secretion	50	45	52.63	
	Others	194	154	55.75	0.024
Infection site	Respiratory system	414	229	64.39	
	Blood system	75	38	66.37	
	Urinary system	40	27	59.70	
	Abdomen and digestive system	50	28	64.10	
	Others	240	197	54.92	0.020

Variables		Issue(N = 819)	Unissue(N = 519)	Implementation rate(%)	P value
Susceptibility factors	Intrusive operation	554	277	66.67	0.000
	Basic illness	8	2	80.00	
	Intrusive operation + Basic illness	7	2	77.78	
	Others	250	238	51.23	

## Multivariate Logistic Regression Analysis Of Isolation Implementation Rate

Introduce variables that are significant in univariate analysis into the logistic regression model. The analysis result shows intervention, department and LOS more than 15 days are independent influencing factors of the isolation implementation rate.

Table 2

Multivariate logistic regression analysis of influencing factors of isolation implementation rate

<b>Variables</b>	<b>B</b>	<b>S.E,</b>	<b>Wals</b>	<b>P-value</b>	<b>95% CI</b>	
Intervention	-1.864	.134	194.143	0.000	0.119	0.202
Gender	-.095	.138	0.479	0.489	0.694	1.191
Age	-.002	.003	0.206	0.650	0.992	1.005
LOS(> 15days or not)	-.781	.185	17.815	0.000	0.319	0.658
Department			16.215	0.003		
Surgical	0.076	.221	0.118	0.731	0.700	1.663
Medical	1.002	.300	11.172	0.001	1.514	4.905
Pediatric	-0.080	.187	0.182	0.670	0.640	1.332
ICU	-0.233	.476	0.239	0.625	0.312	2.014
Specimen			5.416	0.247		
Sputum	-0.610	.353	2.974	0.085	0.272	1.087
Fiber bronchoscope irrigation solution	-0.556	.253	4.814	0.028	0.349	0.942
Blood	-0.490	.634	0.599	0.439	0.177	2.120
Secretion	-0.336	.283	1.412	0.235	0.411	1.244
Infection site			2.745	0.601		
Respiratory system	0.250	.317	0.619	0.431	0.689	2.390
Blood system	0.091	.643	0.020	0.887	0.311	3.862
Urinary system	-0.396	.324	1.498	0.221	0.357	1.269
Abdomen and digestive system	-0.285	.310	0.843	0.358	0.409	1.382
Susceptibility factors			6.156	0.104		
Intrusive operation	-0.297	.141	4.469	0.035	0.564	0.979
Basic illness	-1.276	.867	2.166	0.141	0.051	1.527
Intrusive operation + Basic illness	-0.193	.830	0.054	0.816	0.162	4.192

## Discussion

The isolation implementation rate is still unsatisfactory. The overall isolation implementation rate of this study was 66.12%, 33.12% before intervention, and 75.88% after intervention, both of which were lower

than the standards for isolation in the United States. Compared with research by Xu Chuan [21] (the isolation order issuance rate was 75.1% before the intervention, 95.36% after the intervention) and Liang Yanfang [22] (the isolation order issuance rate was 74.07% before the intervention, 98.48% after the intervention), their isolation implementation rate was higher than our research mainly because we included not only Patients with MDRO infection, but also colonized patients. Before the intervention, the number of colonized patients was more than the infected patients (269vs190) but the implementation rate was lower (30.9% vs 36.3%); after the intervention, the number of colonized patients was less than the infected patients (408vs471) but the implementation rate was higher (77% vs74.9%), the application effect of multidisciplinary collaborative intervention on colonized patients is better than that of infected patients, which reflects the necessity of the study to include colonized patients. However, in the actual implementation of isolation prevention and control measures, medical personnel generally do not attach importance to colonized patients as high as infected patients, resulting in a relatively low probability of colonization patients being taken isolation measures (58.64% vs 63.84%), so the overall isolation implementation rate after intervention in this study is still low. In addition, due to the low baseline level of isolation implementation rate before intervention, the isolation implementation rate after intervention is still not high in the short term, but the increased rate is the highest among the three studies, indicating that this study has achieved great intervention results from the perspective of the increase in isolation implementation rate. Research hospital should continue to strengthen the implementation of isolation measures for patients with MDRO infection and colonization.

Multidisciplinary collaborative intervention can increase the implementation rate of isolation. After taking multidisciplinary collaborative interventions, the implementation rate of issuing isolation orders is significant ( $P < 0.000$ ). A meta-analysis [16] on the effects of multi-disciplinary collaborative intervention on the prevention and control of multi-drug resistant infections included eight RCTs, four of them reported the implementation of contact isolation precautions for patients with MDRO infection, the results show that the implementation rate of isolation in patients with MDT is higher than the control group (OR = 4.40, 95% CI 3.53 to 5.47), therefore, multidisciplinary collaboration mode can significantly improve the isolation implementation rate. There are literatures describing several interventions that have successfully prevented and controlled the spread of MDROs [23–24], although it is not clear which measures are truly effective, there are suggestions that multiple modes of intervention can effectively improve the implementation rate of isolation measures [25–26], thereby reducing the incidence of MDRO infection.

The factors that affect the implementation rate of isolation also include the patients' department. Different departments have different possibilities of causing MDRO infections. For example, surgical patients have more surgical wounds, while medical patients have more invasive procedures, catheterization and mechanical ventilation are important risk factors for multi-drug resistant infections [27–28], especially when the patient is in the ICU, doctors will pay more attention to the isolation and prevention of these patients. An observational study of three locations in the New York City hospital network on contact isolation precautions also found that in the ICUs, the compliance rate of all isolation prevention and control measures was significantly higher than that of non-ICUs [12].

LOS more than 15 days also affect the isolation implementation rate because the LOS is related to MDRO infection. On the one hand, patients with more hospital stays have more serious condition, with low immunity and more invasive procedures, which increases the possibility of MDRO infections. On the other hand, MDRO infection will prolong the hospital stays of patients [28]. A study on the impact of hospital infections on the LOS in 68 hospitals in China found that MDRO infection increased the average LOS by one day, and the maximum number of days for CR-PA infection increased by 26 days [29]. Langeveld [30] also found that the MDRO group had an average of 25 more hospital stays than the non-resistant group. More hospital stays will not only increase the infection rate, but also increase the mortality rate. Therefore, for patients with more hospital stays, doctors are more likely to take isolation prevention and control measures.

Our study has several limitations. Firstly, our research is single-centered. Then, our intervention patients come from different periods, there may be time or other confounding factors that introduced bias. In addition, this is an observational study that we cannot prove the cause and effect, nor can we speculate whether the patient's clinical outcome has improved through the effect of intervention on the implementation of isolation. Finally, although the implementation rate of isolation measures has been significantly improved in this study, the overall situation is still not ideal, this may be because our study only considered ten months before and after the intervention, and also indicated that there may be medical personnel themselves and external influencing factors but we haven't conducted relevant investigations.

## Conclusions

Isolation is an indispensable procedure in MDRO control, but the implementation rate is far lower than the policy standards; The implementation rate of isolation can be significantly improved by adopting multidisciplinary interventions including isolation measures. Patients staying in the ICU, LOS exceed 15 days, and with different susceptible factors should be properly managed and controlled, which will help increase the implementation rate of isolation.

## Abbreviations

MDRO

multidrug-resistant organism; MDROs:multidrug-resistant organisms; CDC:Centers for Disease Control and Prevention; IPC:infection prevention and control; MDT:multidisciplinary team; LOS:length of stay; OR:odds ratio; 95% CI:95% confidence interval

## Declarations

**Ethics approval and consent to participate**

The study was approved by the Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (IORG: IORG0003571).

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The datasets are available from administrative permissions from the chief of nosocomial department of Tongji Hospital of Huazhong University of Science and Technology, who is one of our authors.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

This work was supported by the National Natural Science Foundation of China (71473098, <http://www.nsf.gov.cn/>). The funders played no role in the process of manuscript preparation.

### **Authors' contributions**

YW conducted the study design, data collection, data analysis, and drafted the manuscript. XL and XZ provided assistance in study design and manuscript drafting. All authors read and approved the final manuscript.

### **Acknowledgments**

The authors would like to thank the National Natural Science Foundation of China for providing research funding and Tongji Hospital for providing the research data. The authors would also like to acknowledge the following individuals who helped collect data: Duan Zhonghong, Wei Ming and Xie Lewei. The authors would also like to thank Xuemei Wang, Qian Zhou for the help of manuscript writing.

## **References**

1. Carrel FR, Founou Luria Leslie, Essack Sabiha Yusuf. Clinical and economic impact of antibiotic resistance in developing countries: A systematic review and meta-analysis. *PloS one*. 2017;12(12). doi:10.1371/journal.pone.0189621.
2. Yam E, Hsu L, Yap E, et al. Antimicrobial Resistance in the Asia Pacific region: a meeting report. *Antimicrob Resist Infect Control*. 2019;8:202. doi:10.1186/s13756-019-0654-8.
3. Cerceo Elizabeth D, Steven B, Sherman Bradley M, Amin Alpesh N. Multidrug-Resistant Gram-Negative Bacterial Infections in the Hospital Setting: Overview, Implications for Clinical Practice, and

- Emerging Treatment Options. *Microbial drug resistance* (Larchmont, N.Y.). 2016;22(5).4. doi:10.1089/mdr.2015.0220.
4. Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in health care settings, 2006. *Am J Infect Control*. 2007;35(10 Suppl 2):165–93. doi:10.1016/j.ajic.2007.10.006.
  5. Health Care Infection Control Practices Advisory Committee  
10.1016/j.ajic.2007.10.007  
Siegel JD, Rhinehart E, Jackson M, Chiarello L. Health Care Infection Control Practices Advisory Committee. 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings. *Am J Infect Control*. 2007;35(10 Suppl 2): S65-S164. doi:10.1016/j.ajic.2007.10.007.
  6. Smith PW, Bennett G, Bradley S, et al. SHEA/APIC Guideline: Infection prevention and control in the long-term care facility. *Am J Infect Control*. 2008;36(7):504–35. doi:10.1016/j.ajic.2008.06.001.
  7. Tacconelli E, Cataldo MA, Dancer SJ, et al. ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients. *Clin Microbiol Infect*. 2014;20(Suppl 1):1–55. doi:10.1111/1469-0691.12427.
  8. Link T. Guideline Implementation. Transmission-Based Precautions. *AORN J*. 2019;110(6):637–49. doi:10.1002/aorn.12867.
  9. Cohen CC, Cohen B, Shang J. Effectiveness of contact precautions against multidrug-resistant organism transmission in acute care: a systematic review of the literature. *J Hosp Infect*. 2015;90(4):275–84. doi:10.1016/j.jhin.2015.05.003.
  10. Durand A, Dupré C, Robriquet L. Should contact precautions for multidrug resistant organism transmission be used? *Réanimation*. 2016;25(3):318–327.
  11. Vuichard GD, Barry C, Henri S, et al. Variability in contact precautions to control the nosocomial spread of multi-drug resistant organisms in the endemic setting: a multinational cross-sectional survey. *Antimicrob Resist Infect Control*. 2018;7:81. doi:10.1186/s13756-018-0366-5.
  12. Clock SA, Cohen B, Behta M, Ross B, Larson EL. Contact precautions for multidrug-resistant organisms: Current recommendations and actual practice. *Am J Infect Control*. 2010;38(2):105–11. doi:10.1016/j.ajic.2009.08.008.
  13. Abdulrahman GO. The effect of multidisciplinary team care on cancer management. *Pan Afr Med J*. 2011;9:20. doi:10.4314/pamj.v9i1.71195.
  14. Fleissig A, Jenkins V, Catt S, et al. Multidisciplinary teams in cancer care: are they effective in the UK? *Lancet Oncol*. 2006;7(11):935–43. doi:10.1016/S1470-2045(06)70940-8.
  15. Sana Waqar K, Nigh L, Sisler, et al. Multidisciplinary performance improvement team for reducing health care-associated *Clostridium difficile* infection. *Am J Infect Control*. 2016;44(3):352–4. doi:10.1016/j.ajic.2015.09.022.
  16. Patricia M, Davidson PJ, Newton T, Tankumpuan, et al. Multidisciplinary Management of Chronic Heart Failure: Principles and Future Trends. *Clin Ther*. 2015;37(10):2225–33.

doi:10.1016/j.clinthera.2015.08.021.

17. Zhang Fangfang Wu, Xiaoqing L, Shujuan, et al. Meta-analysis of the effect of multidisciplinary intervention on the prevention and control of multi-drug resistant bacteria infection. *Chinese Community Doctors*. 2019;35(25):41–3.
18. Boyce JM, Potter-Bynoe G, Chenevert C, King T. Environmental contamination due to methicillin-resistant *Staphylococcus aureus*: possible infection control implications. *Infect Control Hosp Epidemiol*. 1997;18(9):622–7.
19. McConville TH, Sullivan SB, Gomez-Simmonds A, Whittier S, Uhlemann AC. Carbapenem-resistant Enterobacteriaceae colonization (CRE) and subsequent risk of infection and 90-day mortality in critically ill patients, an observational study. *PLoS One*. 2017;12(10):e0186195. doi:10.1371/journal.pone.0186195.
20. Huang Xun D, Zide N, Yuxing, et al. Chinese experts' consensus on prevention and control of multidrug resistance organism healthcare-associated infection. *Chin J Infect Control*. 2015;14(1):1–9.
21. Xu Chuan X, Wei Xu, Min L, Xiaoquan. Effect of multidisciplinary team management on control of multidrug-resistant organism infections. *Chinese Journal of Nosocomiology*. 2018;28(18):2834–8.
22. Liang Yanfang L, Xiaoquan T, Li, et al. Application of Multi-disciplinary Team Mode in the Management of Multidrug-resistant Organism Infection. *Chinese Journal of Social Medicine*. 2019;36(04):402–6.
23. Landelle Caroline P, Leonardo, Harbarth Stephan. Is patient isolation the single most important measure to prevent the spread of multidrug-resistant pathogens? *Virulence*. 2013;4(2):163–71. doi:10.4161/viru.22641.
24. Chantal B, Geoffrey T, Anne S, Marck Patricia Beryl. An integrative review of infection prevention and control programs for multidrug-resistant organisms in acute care hospitals: a socio-ecological perspective. *Am J Infect Control*. 2011;39(5):368–78. doi:10.1016/j.ajic.2010.07.017.
25. Tacconelli E. Screening and isolation for infection control. *J Hosp Infect*. 2009;73(4):371–7. doi:10.1016/j.jhin.2009.05.002.
26. Cooper BS, Stone SP, Kibbler CC, et al. Isolation measures in the hospital management of methicillin resistant *Staphylococcus aureus* (MRSA): systematic review of the literature. *BMJ*. 2004;329(7465):533. doi:10.1136/bmj.329.7465.533.
27. Liu Q, Li W, Du X, et al. Risk and Prognostic Factors for Multidrug-Resistant *Acinetobacter Baumannii* Complex Bacteremia: A Retrospective Study in a Tertiary Hospital of West China. *PLoS One*. 2015;10(6):e0130701. doi:10.1371/journal.pone.0130701.
28. Guo N, Xue W, Tang D, et al. Risk factors and outcomes of hospitalized patients with blood infections caused by multidrug-resistant *Acinetobacter baumannii* complex in a hospital of Northern China. *Am J Infect Control*. 2016;44(4):e37–9. doi:10.1016/j.ajic.2015.11.019.
29. Jia H, Li L, Li W, et al. Impact of Healthcare-Associated Infections on Length of Stay: A Study in 68 Hospitals in China. *Biomed Res Int*. 2019;2019:2590563. doi:10.1155/2019/2590563.

30. van Langeveld I, Gagnon RC, Conrad PF, et al. Multiple-Drug Resistance in Burn Patients: A Retrospective Study on the Impact of Antibiotic Resistance on Survival and Length of Stay. *J Burn Care Res.* 2017;38(2):99–105. doi:10.1097/BCR.0000000000000479.