

The Effect of Length of Stay (LOS) on Infection Rates in the Medical Intensive Care Unit (MICU).

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Introduction

Over 12 years, nosocomial infection rates and LOS declined in a medical intensive care unit (MICU). When computer-simulated pathogen transmission showed that LOS was an important determinant, we studied the contribution of the falling LOS to the observed decline in nosocomial infection rate.

Methods

From 1/1990 to 10/2002 surveillance was done using the definitions of the National Nosocomial Surveillance System. Data were available for 148 of 153 months. For regression analysis the dependent variable was a modified total infection rate (MTIR) which excluded surgical site infections. A square root transformation normalized the distribution of MTIR. Independent variables were the number of months since 1/1990, LOS, and the fractions of each month's patient-days in which urinary catheters, central lines, and ventilators were used. LOS was estimated as monthly patient-days of care / number of arrivals.

Figure 1. Monthly mean LOS in the MICU- 1990 to 2002

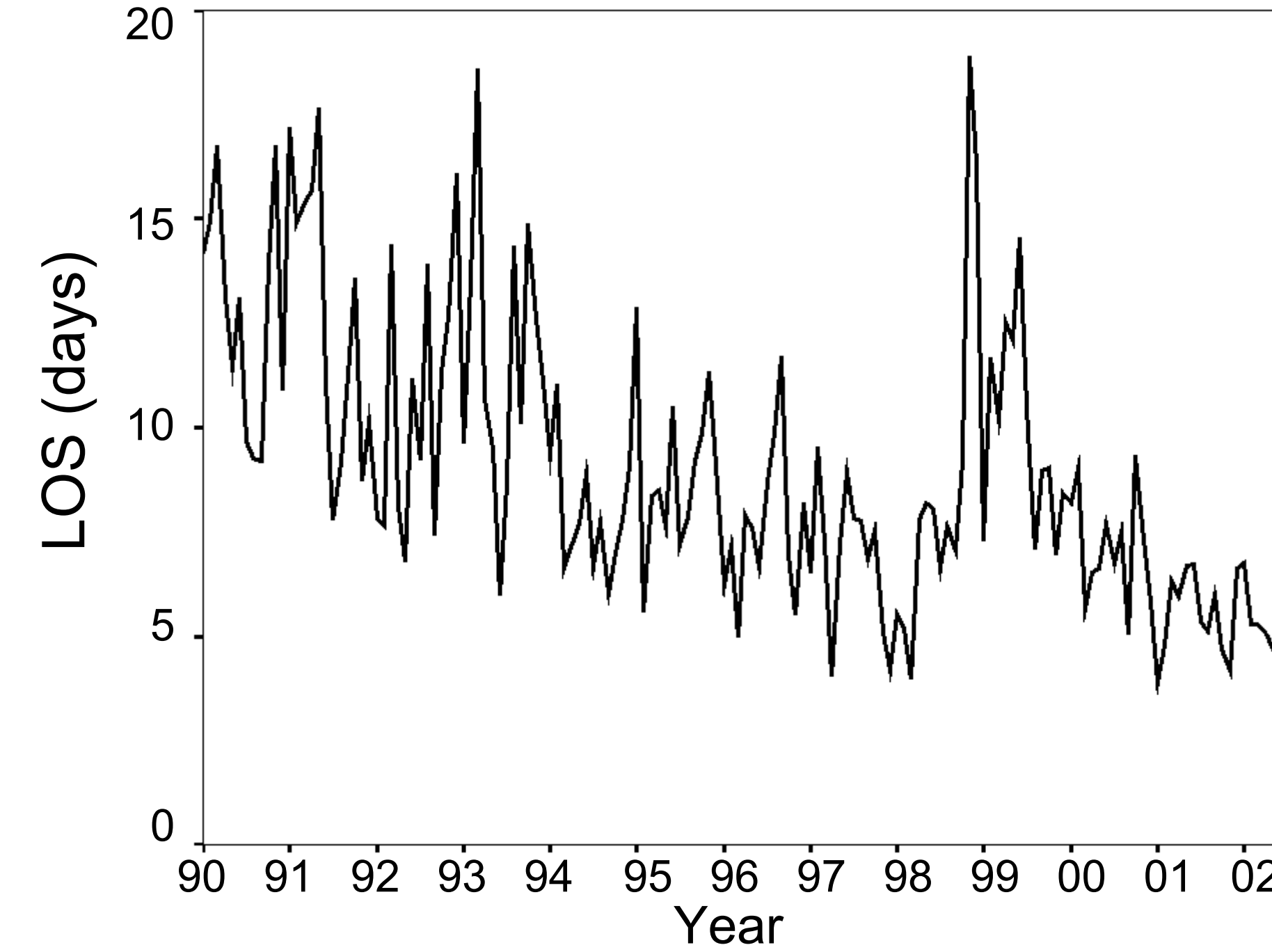


Figure 2. Monthly MTIR in the MICU- 1990 to 2002

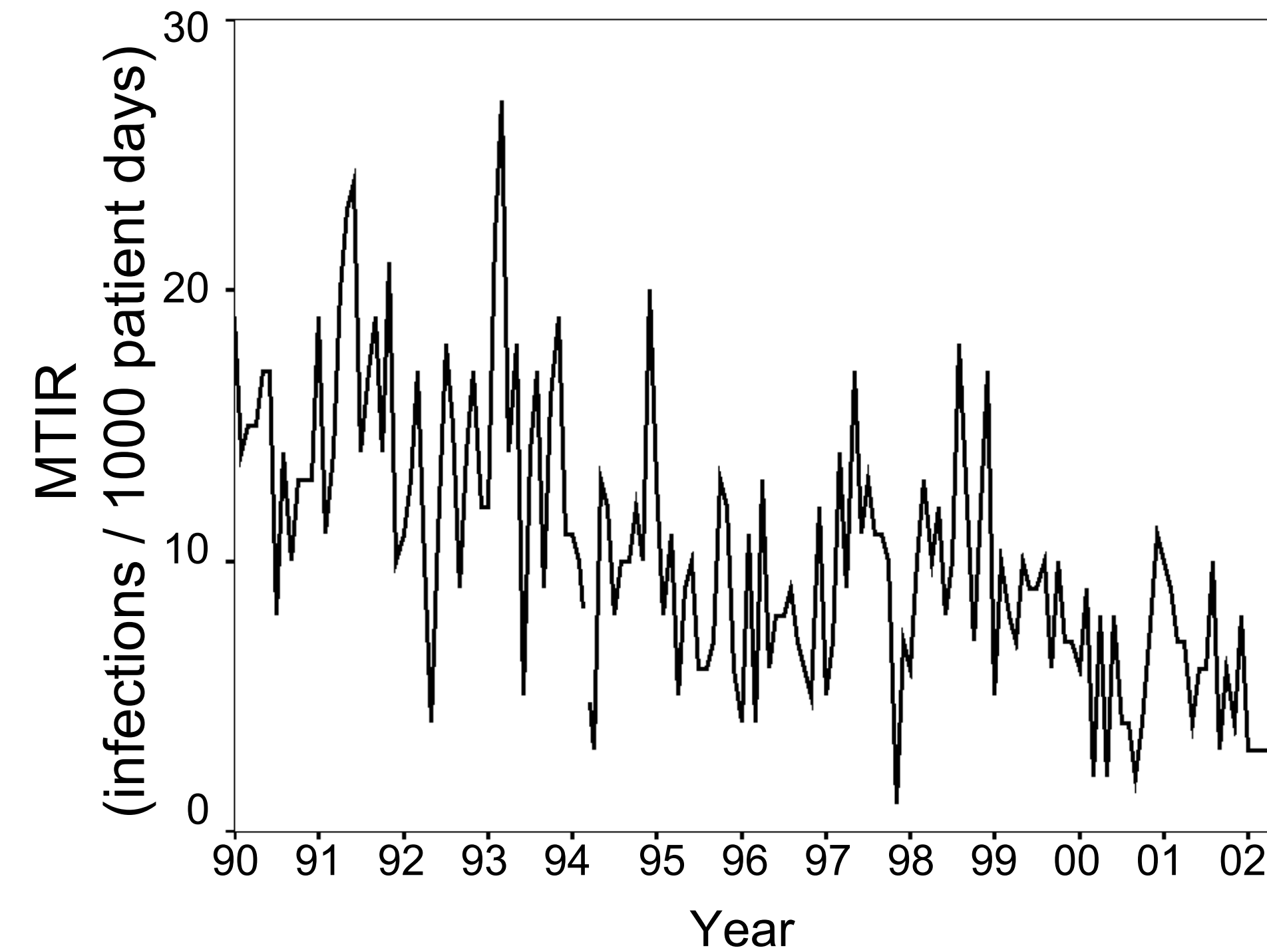


Figure 3. Correlation of MTIR and date (1990-2002)

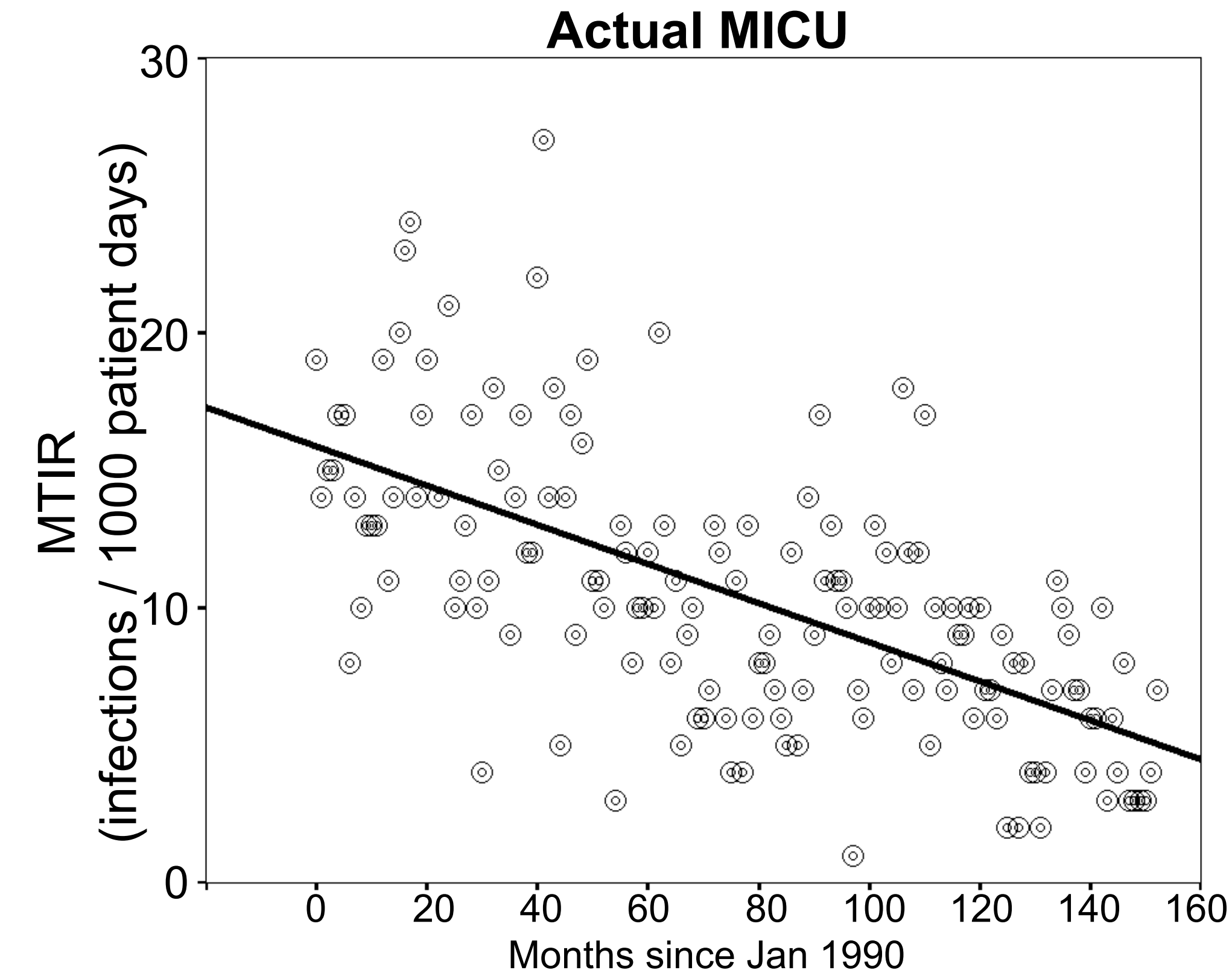
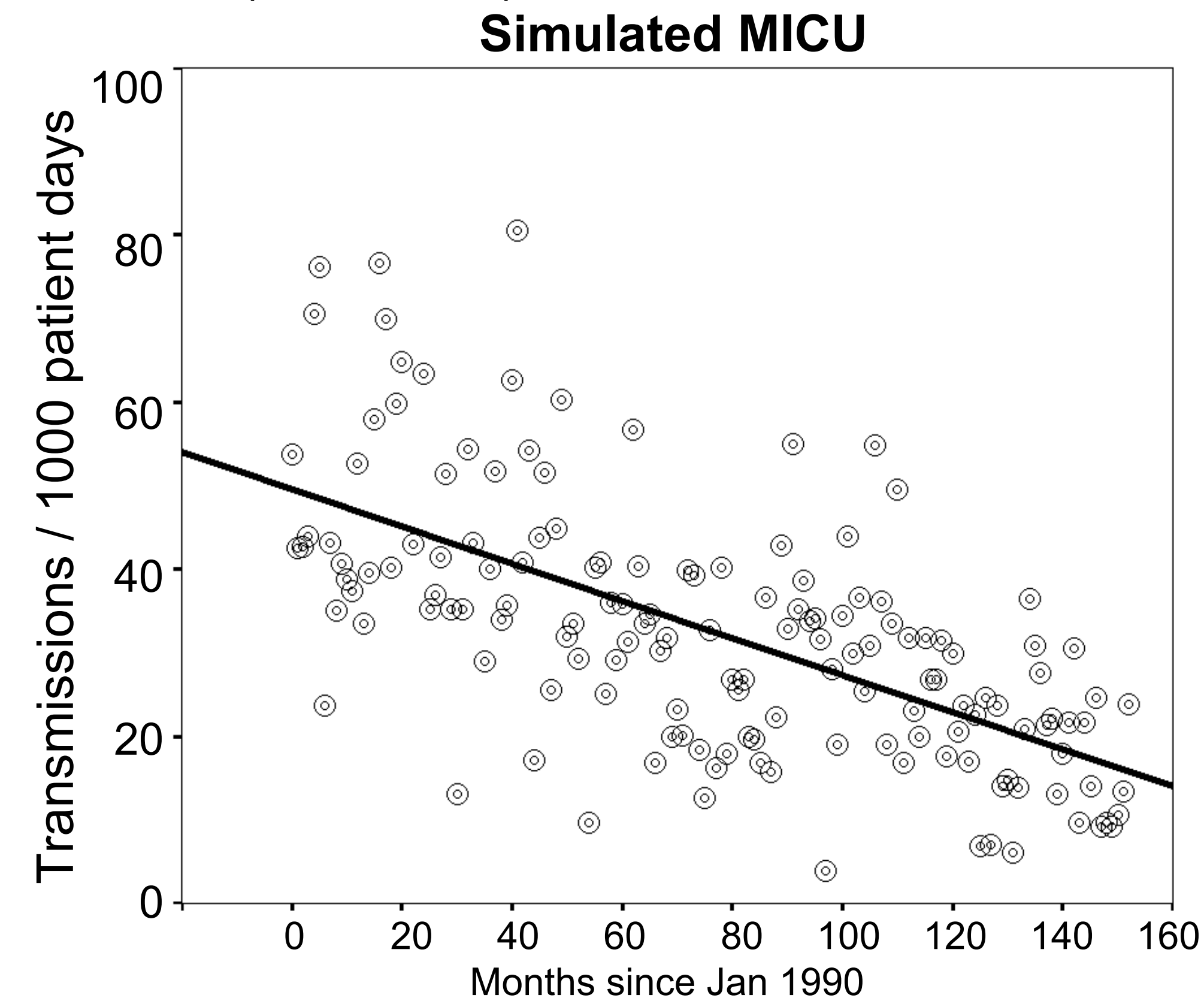


Figure 4. Correlation of transmission rate and date (1990-2002)



Results

Regression of MTIR on calendar time yielded a model with $R^2=0.406$ ($F(1,147)=99$, $p < 0.001$) (Figure 3). Adding LOS as a second variable increased R^2 to 0.470 (LOS $F(1,146)=17.5$, $p < 0.001$), indicating that after adjusting for secular trend, LOS accounted for 10.7% of the residual variation in monthly rates.

Adding the monthly intensity of ventilator, catheter, and line days produced a model with $R^2= 0.511$ and reduced the percent residual variation associated with LOS to 2.9%. Of the intensity indicators, only the fraction of ventilator days was significantly associated with MTIR.

Table 1. Linear regression of the normalized MTIR using calendar time, LOS, and fractions of days per month with catheter (CathFrac), venous line (LineFrac), and ventilator use (VentFrac).

Factors in Model	R ²	Residual SS	Pct decrease in residual SS	F	P
Calendar Time + LineFrac + CathFrac + VentFrac+ LOS	.511	137.9	2.9	4.46	<0.05
Calendar Time + LineFrac + CathFrac+ VentFrac	.496	142.1	Reference		
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Calendar Time + LOS + VentFrac	.501	140.7			
Calendar Time + LOS + LineFrac + CathFrac	.473	148.8			
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Calendar Time + LOS	.470	149.6	10.7	15.7	<0.001
Calendar Time + VentFrac	.485	145.2	13.3	19.5	<0.001
Calendar Time + CathFrac	.412	165.9	0.9		NS
Calendar Time + LineFrac	.406	167.5	0.0		NS
Calendar Time	.406	167.5	Reference		

Figure 5. Scatterplot matrix of MTIR, LOS, and fractions of days per month with catheter, venous line, and ventilator use.

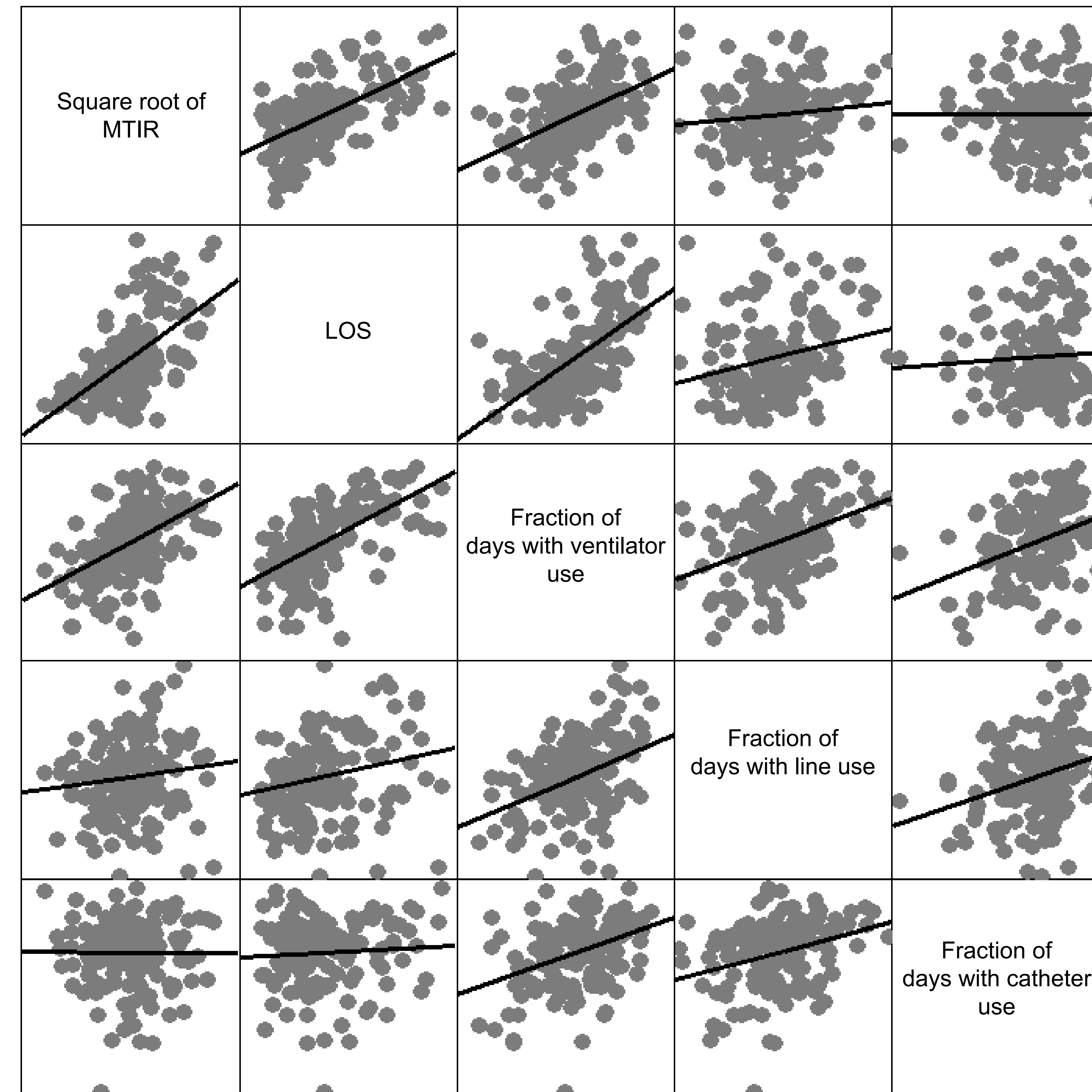
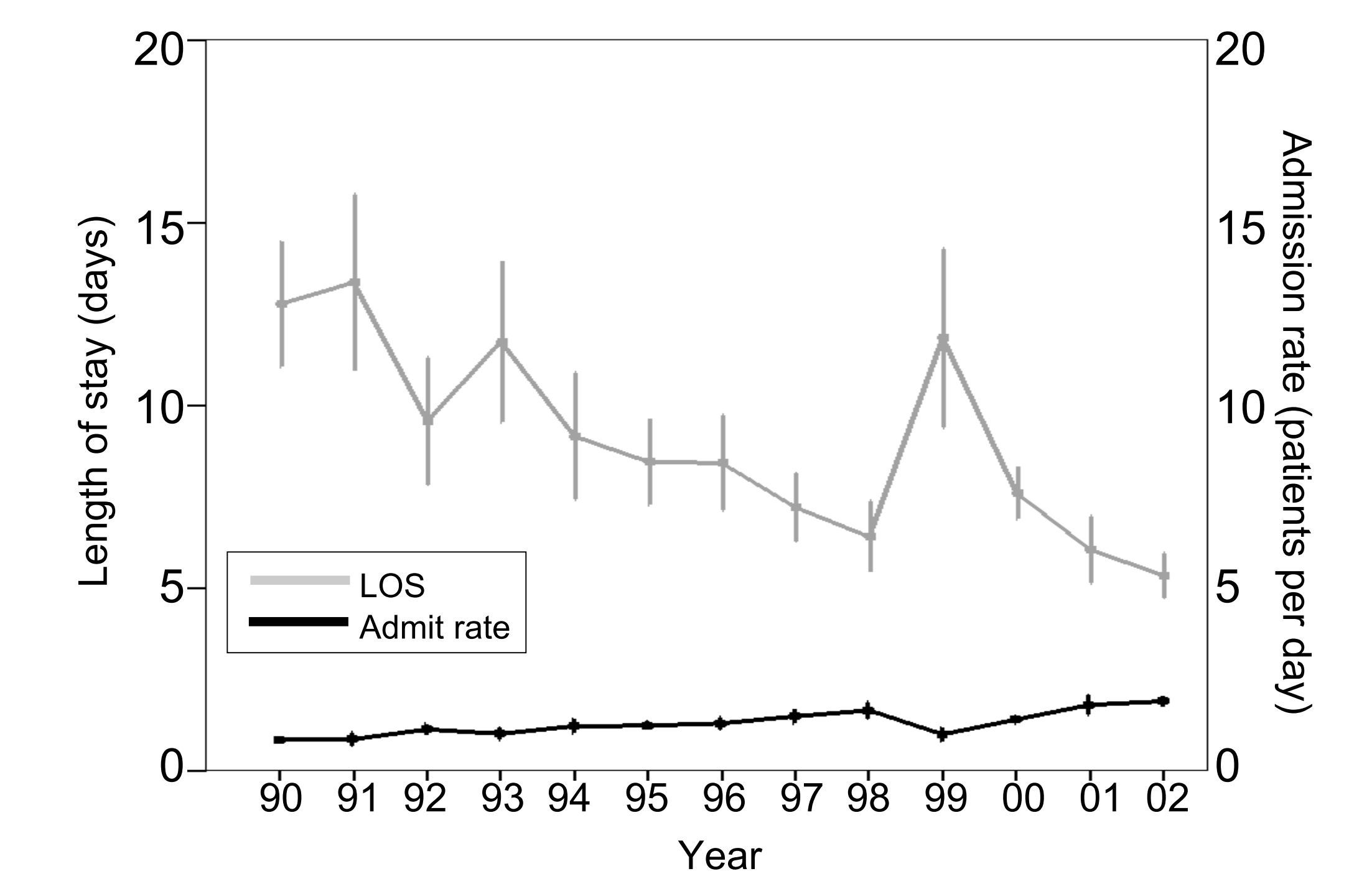


Figure 6. LOS and admission rate according to year



Conclusions

Length of stay in the MICU is a significant predictor of the incidence of nosocomial infections and computer modeling suggests a causal role. Much of the observed decline was due to reduced use of ventilators, but even after adjustment for secular trend and intensity of device use, LOS remained a statistically significant independent predictor and accounted for 2.9% of the residual variation.

For further information

Please contact robert.holzman@med.nyu.edu. More information on this and related projects can be obtained at www.med.nyu.edu/informatics

