Clinical Clues / *Klinik İpuçları*

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Standardized Infection Ratio (SIR)

Standardize Enfeksiyon Oranı (SIR)

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Question : *How should standardized infection ratio (SIR) of our clinic be interpreted in the framework of hospital infections?*

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Answer (Dr. Mustafa Hacımustafaoğlu)

Standardized infection ratio (SIR) and its interpretation in assessing healthcare-related infection (hospital-acquired infection): Standardized infection ratio (SIR) is a prominent criterion in standardizing and making comparisons between hospitals to monitor healthcare-related infections (HCRI). SIR can also be used to monitor HCRI ratio of a hospital or unit in time. SIR calculates the number of HCRI observed taking a previously known population (i.e. HCRI ratio in similar hospital/hospitals) as a reference.

SIR= The number of infections observed/The number of infections expected (foreseen)

The number of infections expected is a number calculated on average in similar hospital and similar infection types, and is calculated and reported for the relevant year in the National Hospital-Acquired Infections Surveillance Network Report [Ulusal Hastane Enfeksiyonları Surveyans Ağı Özet Raporu (UHESA)].

For instance, let's consider that ventilator days of the pediatric intensive care unit (ICU) of a university hospital in 2017 is 800 days and the number of ventilator-associated infections (VAI) is 8. Let's say that average VAI rate is reported as 5/1000 ventilator days (general average) for the pediatric ICU of university hospitals in the National Hospital-Acquired Infections Surveillance Network Report for the year 2017. While the number of VAI observed in the pediatric ICU is 8, the number of VAI expected/foreseen must be known to find SIR. If the VAI rate in this pediatric ICU was the same as that of the general pediatric ICUs of universities, the VAI rate in this ICU would be expected to be 5/1000 ventilator days. In other words, it would be expected to develop as 800 x 5/1000= 4 VAI. Actually, that year 8 VAI was monitored in that ICU. In other words, a twofold VAI was monitored as opposed to the expected 4. Thus, SIR is calculated as 8 (the number of infections observed)/4 (the number of infections expected) = 2. In other words, the number of VAI monitored in this ICU is twofolds (100% more).

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Interpreting SIR

SIR >1: the number of infections observed is higher than the number of infections expected/foreseen. This condition suggests the inadequacy of infection control measures in the relevant unit, and causes and solutions must be sought. However, it should also be kept in mind that the difference of surveillance quality in various units may affect the reporting of infections and hence, the SIR. Therefore, similarity in surveillance quality of the hospital in question and the hospitals taken as reference increases SIR value.

SIR <1: the number of infections observed is lower than the number of infections expected/foreseen and implies a more positive situation expressing that infection control measures are adequate. For instance, if SIR= 0.37, the number of infections observed is lower than half of the number of infections expected (63% lower)

SIR= 1: it is understood that similar number of infections is observed in the unit in question to the reference units. The target of the relevant unit from that point on should be to lower SIR in the upcoming periods by further developing infection control measures.

SIR= 0 if there is no infection observed. Even though this is assumed ideal, the quality of the surveillance system must be questioned before reaching this conclusion. Moreover, Infections observed may not be detected for a while in units using very few invasive tools. Prolonging the period of time for reporting can be discussed.

Confidence interval and its interpretation: Confidence interval (CI) express the range the true value is found at a specific confidence level, and generally, 95% confidence level is preferred. 95% CI means that if there was a chance that the observations could be repeated 100 times under the same circumstances, the SIR value of the sample would have any value at the given range in 95 of these repetitions. For instance, if SIR = 2 and 95% CI is set at 1.6-2.7, SIR can be said to always be > 1 and fall within 1.6-2.7. As CI tightens, the precision of the value (estimate) increases and in contrast, the precision of the estimate decreases if CI extends. In general, no matter the SIR value, it can be interpreted that SIR is actually different from 1.0 if 95% CI does not contain 1.0, and it can be interpreted that SIR is not actually different from 1.0 if CI of SIR contains 1.0.

P value (probability value); is used to assess whether or not the number of infection observed is statistically significantly different from the number of infection expected/foreseen in SIR analysis. If p< 0.05, then in general, the difference in question is interpreted as significant.

The interpretation of SIR can be demonstrated practically in an example. The UHESA report related to 2017 SIR of Bursa Uludağ University Health Practice and Research Center Hospital, ICU VAI SIR values were given (Table 1). The number of VAI observed in the pediatric ICU in 2017 was found as 9 and the number of VAI expected was 24.39 (which was written on the table by having the value calculated by UHESA for the re-

Table 1. SIR Report of Bursa Uludağ University Health Practice and Research Center, 2017*

Branş	Observed number	Projected number	SIR	95% confidence interval lower limit	95% confidence interval upper limit	p	Cumulative attributable difference	Series
VAI								
Anesthesia and reanimation ICU	16	48.54	0.33	0.19	0.54	< 0.05 (Significant)	-20.40	1468
Neurosurgery ICU	13	14.37	0.90	0.48	1.55	> 0.05 (Not significant)	2.22	300
Pediatric surgery ICU	1	0.45	0.00	0.00	0.00		0.66	406
Pediatrics ICU	9	24.39	0.37	0.17	0.70	< 0.05 (Significant)	-9.29	1429
General surgery ICU	9	12.75	0.71	0.32	1.34	> 0.05 (Not significant)	-0.56	974
Cardiovascular ICU	14	16.50	0.85	0.46	1.42	> 0.05 (Not significant)	1.62	337
Coronary ICU	1	5.24	0.19	0.00	1.06	> 0.05 (Not significant)	-2.93	1273
Burn unit		0.30	0.00	0.00	0.00		-0.22	845
Total	63	122.54	0.51	0.39	0.66	> 0.05 (Not significant)	-28.90	

* The table was retrieved from reference number 3 and contains data calculated for different ICUs of the relevant hospital by UHESA.
SIR: Standardized infection ratio, VAI: Ventilator associated infections, ICU: Intensive care unit.

levant unit). SIR was found as 0.37 (95% CI; 0.17-0.70 and p< 0.05). Within this framework, it is seen that the number of infections observed in the pediatric ICU of the relevant hospital is lower than expected. SIR is 0.37 and lower than 1.0, and it is understood that less than half (63% less) VAI is encountered in the relevant ICU when compared to other reference ICUs. The fact that both values, where confidence interval is at a tight limit of 0.17-0.70, are lower than 1 and that p value is significantly at 0.05 paves the way for the interpretation that VAI rate is at a positive direction in the relevant ICU and significantly lower than the average of Turkey. However, it should be kept in mind that this positive level should be sustainable and necessary care for infection control to reach much better values should be given.

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