



Research Article

An Analysis of the Effect of Team Situation Awareness on Patient Safety Incidents using Teamwork as the Intervening Variable

Ristiya Galih Paramita^{1*} | Terivenna Wijaya² | Djazuly Chalidyanto³ | Akas Yekti Pulih Asih⁴

¹Student of Departemen of Health Policy and Administration, Faculty of Public Health,, Universitas Airlangga Surabaya, Indonesia

²Department of Health Policy and Administration, Faculty of Public Health, Universitas Airlangga Surabaya, Indonesia

³Department of Public Health, Faculty of Health, Universitas Nahdlatul Ulama Surabaya, Indonesia

***Corresponding Author:**

Ristiya Galih Paramita, Department of Health Policy and Administration, Faculty of Public Health, Universitas Airlangga Surabaya, Indonesia.

Email: ristiyagalih2@unusa.ac.id

DOI: 10.33086/mtphj.v8i1.5635

Article History:

Received, January 28th, 2024

Revised, March 19th, 2024

Accepted, March 24th, 2024

Available Online: March 29th, 2024

Please cite this article as:

Paramita, et al., "An Analysis of the Effect of Team Situation Awareness on Patient Safety Incidents using Teamwork as the Intervening Variable" Register: Medical Technology and Public Health Journal, Vol. 8, No. 1, pp. 81-90, 2024

ABSTRACT

The definition of Patient Safety Incidents (PSIs) refers to specific occurrences that unintentionally happen and result in, or potentially lead to, injuries in patients if not prevented. PSIs require special attention, especially in healthcare settings. According to the report collected by the Hospital Patient Safety Committee of the Surabaya Orthopedic and Traumatology Hospital from 2018 to 2021, there were 177 patient safety incidents recorded. This study aims to analyze the effect of Team Situation Awareness (TSA) on Patient Safety Incidents through Teamwork at Surabaya Orthopedic and Traumatology Hospital. The variables identified for analysis are Team Situation Awareness (TSA) and Teamwork. Because this study was conducted over a specific time period, it follows a cross-sectional design and is an analytical observational study. Path analysis was employed to analyze the data. The measurement revealed that TSA resulted in 64.3% of work units being categorized at level 2 (comprehension), and for Teamwork, 64.3% of the works units were categorized as "Good". The results of the Path Analysis using SmartPLS 4.0 showed the effect of TSA was significant with a p-value of <0.05, and TSA's effect on Teamwork was also significant with a p-value of <0.05. Based on the path analysis (SEM-PLS), it was found that TSA indirectly affected PSIs through Teamwork, with a significant indirect effect having a p-value <0.05. Team Situation Awareness indirectly influenced PSIs through Teamwork. One approach to reducing the frequency of PSIs is to improve Team Situation Awareness (TSA) within each work unit at Surabaya Orthopedic and Traumatologic Hospital.

Keywords: Patient Safety Incidents, PSIs, team situation awareness, TSA, teamwork

INTRODUCTION

Patient Safety Incidents, or PSIs, are defined as specific circumstance that inadvertently occurs and, if not prevented, may lead to patient harm, as stated in Indonesia's Republic number 11 on 2017. An unintended event or condition that results in or has the potential to cause injury to a patient and should have been prevented is referred to as a patient safety incident. This includes



near misses, unexpected occurrences, non-injury events, and prospective injury conditions. (Amanian et al., 2020; Madden et al., 2018; Martin et al., 2019). Available evidence suggest that 134 million adverse events due unsafe care occur in hospitals in low-and-middle income countries, contributing to around 2,6 million deaths every year. According to recent estimates, the social cost of patient harm can be valued at US\$ 1 trillion to 2 trillion a year (WHO, 2021).

In Southeast Asian countries such as Malaysia, the Ministry of Health Malaysia reported in 2013 on patient safety incidents (England, 2015). While in Indonesia, the Hospital Patient Safety Committee reported that from 2006 to 2011, there were 877 patient safety incidents. Based on the report collected by the Hospital Patient Safety Committee (*KKPRS*) of the Surabaya Orthopedic and Traumatology Hospital from 2018 to 2021, there had been 177 patient safety incidents with the following types of incidents: near miss at 49%, No-harm at 32%, and Adverse Events at 18%. Near miss incidents had the highest proportion of 88 cases (49%) from 2018 to 2021.

The aim of this study is to investigate the impact of Team Situation Awareness (TSA) on Patient Safety Incidents through Teamwork at Surabaya Orthopedic and Traumatology Hospital. Based on the data above, researchers aim to determine whether team situation awareness affects the incidence of patient safety incidents through teamwork in hospitals or in other health services.

MATERIAL AND METHODS

As this was an analytical observational study with a cross-sectional design, it was conducted during a specific time period. The population in this study comprised 14 work units that directly provided services to patients. From each of these work units, informants were selected using the proportional stratified random sampling method with the Slovin formula, in a total of 106 informant who had worked in the same work unit for more than or equal to 1 year at Surabaya Orthopedic and Traumatology Hospital. The independent variable in this study is Team Situation Awareness (TSA), while the dependent variable is Patient Safety Incidents (PSIs). To gather data, the researcher analyzed Patient Safety Incidents from January to March 2023 at Surabaya Orthopedic and Traumatology Hospital. The intervening variable in the study is teamwork. Measurement of Team Situation Awareness (TSA) was done by presenting a patient safety incident case, and the researcher conducted an assessment using a questionnaire that had been created to assess the awareness of the work unit's situation. The Team STEPPS questionnaire, a perception questionnaire that has been translated into Indonesian and modified to meet the demands of the study, was used to measure teamwork in work units. The questionnaire can be evaluated using five dimensions, including team structure, leadership, situation monitoring, mutual support, and communication. While leadership points have been quantified in prior studies on supervision, researchers did not utilize leadership to measure teamwork in this study. Additionally, the researcher used a direct method employing SAGAT questionnaire, measuring team situation awareness by presenting a case of an incident and assessing how the staff in the work unit responded. The assessment was carried out by the researcher to obtain scores for the indicators. Endsley (1995) defines Situation Awareness (SA) as a three-level hierarchical model: perception (Level 1), comprehension (Level 2), and projection (Level 3). Schulz et al. (2013) stated that direct measures of subjective awareness can be objectively or subjectively derived. The validation and reliability test of the questionnaire has been conducted at Muji Rahayu Hospital. In this study, Path analysis using the SEM PLS method with SmartPLS 4.0 was employed to analyze the data.

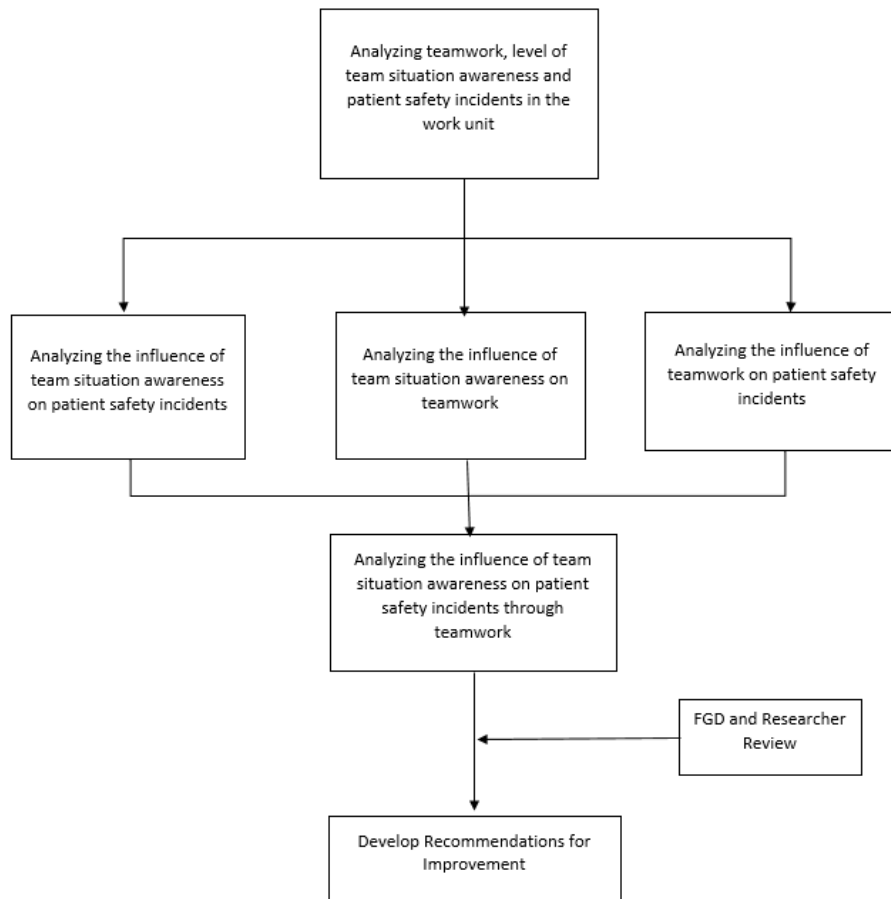


Figure 1. Teamwork Flowchart

In this study, the researcher will first analyze the relationship between Team Strategies and Tools to Enhance Performance and Patient Safety Incidents in each work unit, along with the influence of TSA on teamwork and teamwork on patient safety incidents. Researcher will process these three sets of data to analyze the impact of TSA on the level of patient safety incidents through teamwork. Finally, we will discuss the results through the Focus Group Discussion (FGD) method to recommend improvement efforts in hospital services.

RESULTS AND DISCUSSION

Team Situation Awareness (TSA)

Sensing the elements in the environment within a volume of time and space, understanding their significance, and projecting their status in the near future are all components of situation awareness. (Endsley, 1988).

Table 1. Overview of Team Situation Awareness (TSA) Levels in Work Units at Surabaya Orthopedic and Traumatology Hospital in 2023

No.	Department / Work Unit	Total Score	Category / Level
1	Admission and medical record	36	2
2	Outpatient Service	20	1
3	Laboratory	27	2
4	Radiology	35	2
5	Emergency	20	1

6	Pharmacy	25	2
7	Inpatient Service	33	2
8	Medical Rehabilitation	41	3
9	Surgery & CSSD	18	1
10	Anesthesiology	41	3
11	ICU	27	2
12	Nutrition	29	2
13	Cleaning Service	35	2
14	Security	31	2

Table 2. Frequency Distribution of Team Situation Awareness in Work Units at Surabaya Orthopedic and Traumatology Hospital in 2023

Level Category	Frequency	Percentage (%)
Level 1 (<i>Perception</i>)	3	21,4
Level 2 (<i>Comprehension</i>)	9	63,4
Level 3 (<i>Projection</i>)	2	14,3
Total	14	100

Tables 1 and 2 demonstrate that the majority of work units in RSOT are at level 2 of team situation awareness (comprehension). The percentage of all units in the frequency distribution is as high as 64.3%. Endsley (1995) stated that Situation Awareness at Level 2 involves comprehending the significance of present elements in relation to the operator's goals, beyond just being aware of their presence. When Level 1 elements are combined to form patterns with other elements, known as gestalt, the decision-maker forms a holistic understanding of the environment, comprehending the significance of objects and events.

Teamwork

Teamwork is the collaborative effort of a group to achieve a common goal or to complete a task in the most effective and efficient way possible (Fernandez, 2008). Early thinking about teamwork was largely linear, evidenced by conceptual models adopting what is known as an input-process-output (IPO) approach to depicting teamwork performance effectiveness (Weaver et al., 2017).

Table 3. Overview of Teamwork in Work Units at Surabaya Orthopedic and Traumatology Hospital in 2023-

No.	Department / Work Unit	Total Score	Category
1	Admission and medical record	108	Good
2	Outpatient Service	93	Poor
3	Laboratory	110	Good
4	Radiology	101	Good
5	Emergency	102	Good
6	Pharmacy	88	Poor
7	Inpatient Service	97	Poor

8	Medical Rehabilitation	118	Good
9	Surgery & CSSD	95	Poor
10	Anesthesiology	102	Good
11	ICU	103	Good
12	Nutrition	107	Good
13	Cleaning Service	95	Poor
14	Security	106	Good

Table 4. Frequency Distribution of Teamwork in Work Units at Surabaya Orthopedic and Traumatology Hospital in 2023

Category	Frequency	Percentage (%)
Good	9	64,3
Poor	5	35,7
Total	14	100

Table 5. Frequency Distribution of Teamwork by Dimension in Work Units at Surabaya Orthopedic and Traumatology Hospital in 2023

No	Teamwork Demension	Good		Poor		Total	
		n	%	n	%	n	%
1	Team Structure	13	92,9	1	7,1	14	100
2	Situation Monitoring	11	78,6	3	21,4	14	100
3	Mutual Support	10	71,4	4	28,6	14	100
4	Communication	13	92,9	1	7,1	14	100

Based on tables 3 and 4, teamwork at the Surabaya Orthopedic and Traumatology Hospital, in general, is in the good category, with the frequency distribution showing that the majority of work units (64.3%) exhibit good teamwork. Poor teamwork is found in five work units: Outpatient service, Pharmacy, Inpatient Service, Surgery & CSSD, and Cleaning Service. The results from the previous table, which are further analysed in the teamwork assessment, are illustrated in table 5. It can be seen that the value of team structure and communication are the sub-variables with the highest values, at 92.9% in the good category, while the lowest value sub-variable is mutual support at 71.4%.

Analysis of the Relationship of Team Situation Awareness (TSA) to Teamwork

Team Situation Awareness (TSA) refers to having an awareness of the abilities of your teammates, the tasks assigned to the team as a whole, and the current situation or context. This level of awareness reduces the likelihood of situational invisibility, meaning that if a teammate suddenly becomes unable to complete their tasks, it is more likely that the cause is due to their situation rather than their skill level (Ouverson et.al.,2021).

Table 6. The Relationship of Team Situation Awareness (TSA) to Teamwork at Surabaya Orthopedic and Traumatology Hospital in 2023

Team Situation Awareness (TSA)	Teamwork				Total	
	Good		Poor		n	%
	n	%	n	%		
Level 3	2	100,0	0	0,0	2	100,0
Level 2	6	66,7	3	33,3	9	100,0
Level 1	1	33,3	2	66,7	3	100,0
Total	9	64,3	5	35,7	14	100,0

Based on Table 6, work units that have a team situation awareness (TSA) level 2 exhibit a good teamwork category with a score of 66,7%, while work units with a team situation awareness (TSA) level 1 show poor teamwork with the same score of 66.7%. Therefore, the researcher concludes that work units with good TSA levels have a relationship with the formation of good teamwork within the unit. According to Coolen et.al. (2019) during medical team simulations, measuring SA can be used to train and assess prioritization, shared mental models, and leadership, thereby improving teamwork in healthcare settings.

Analysis of the Relationship between Teamwork and Patient Safety Incidents

In public health, The quality of teamwork within the healthcare system impacts our experiences and outcomes (Rosen, 2018). It is important to realize that the relationship between teamwork and outcomes in a healthcare system is similar to that in other industries. However, in healthcare, teamwork has an additional role to play. Workers involved in patient safety incidents can become victims of preventable patient harm as well (Rosen, 2018).

Table 7. The Relationship between Teamwork and Patient Safety Incidents at Surabaya Orthopedic and Traumatology Hospital in 2023

Teamwork	PSIs				Total	
	Low		High		n	%
	n	%	n	%		
Good	7	77,8	2	22,2	9	100,0
Poor	2	40,0	3	60,0	5	100,0
Total	9	64,3	5	35,7	14	100,0

Table 7 shows that teamwork in the good category correlates with low patient safety incidents, accounting for 77.8%. This data indicates that work units in Surabaya Orthopedic and Traumatology Hospital with low safety incidents are those with good teamwork. This finding aligns with previous research conducted at the Bekasi Regional General Hospital and Bhayangkara Palembang Hospital, which also emphasized the significant impact of teamwork and patient safety culture and perceptions of patient safety reporting (Arini et al., 2018; Febriansyah, 2020). This prior research is consistent with the results of the analysis at the Surabaya Orthopedic and Traumatology

Hospital, where the number of patient safety incidents is dependent on the quality of teamwork in the work unit.

Analysis the effect of Team Situation Awareness (TSA) on Patient Safety Incidents through the Teamwork

In healthcare, situation awareness (SA) is one of the most prominent non-technical skills and serves as a foundation for appropriate clinical decision-making, implicating optimal healthcare providers (HCPs) performance, patient safety, and positive outcomes (Despins, 2018).

Table 8. SEM PLS Path Analysis of Team Situation Awareness (TSA) on Patient Safety Incidents through Teamwork

Variable	Loading Factor	Composite Reability	Colliniarity Test (Teamwork)	Colliniarity Test (PSIs)
Team Situation Awareness (TSA)	>0,7	0,795	2,022	-
Teamwork	>0,7	0,750	-	-
Patient Safety Incidents	>0,7	0,880	-	1,000

Table 8 indicates that every variable satisfies the requirements for path analysis. All variables have a loading factor value greater than 0.7. Additionally, the composite reliability value demonstrates that the test findings indicate that all variables have values greater than 0.7 based on the composite reliability value. For the collinearity test results, all variables have a VIF value greater than > 0.2 and less than 5. These results from the table analysis align with another supporting study, which was conducted previously at Dr. Iskak Tulungagung Hospital. It concluded that there is an influence of teamwork on reporting patient safety incidents (Antoninda & Indasah, 2023).

Table 9. Inner Model Results with Significant Results Between Variables

Relationship Between Variables	Primary Sample (O)	T-Statistics ((O/STDEV))	P-Values
Team Situaion Awareness (TSA) --> Teamwork	+0,161	2,646	0,041
Team Situaion Awareness (TSA) --> PSIs	-0,054	2,064	0,001
Teamwork --> PSIs	-0,589	2,483	0,013

Table 9 illustrates the relationship between variables through the bootstrapping process. The T-statistic value of the association between TSA and teamwork exceeds the critical value (2.646 > 1.960), and the p-value is lower than α (0.041 < 0.05). The researcher notes the magnitude of each variable's effect. It is found that TSA has a positive and substantial effect on teamwork, as the original sample estimate value is positive at 0.161, indicating a positive direction of association between TSA and teamwork.

The T-statistic value of the association between TSA and PSIS is higher than the critical value (2.064 > 1.960), and the p-value is less than the significance level (0.001 < 0.05). The direction of the association between TSA and PSIS is negative, as indicated by the initial sample estimate value of 0.054. Given that the relationship between TSA and PSIS is unfavourable, it is determined that TSA significantly and negatively affects patient safety incidents.

Meanwhile, the relationship between teamwork and PSIS has a T-statistic value greater than (2.483 > 1.960), and the p-value is smaller than α (0.013 < 0.05). The initial sample value estimate, which is 0.589, is negative, indicating a negative correlation between PSIS and teamwork. This leads to the conclusion that patient safety occurrences are significantly and negatively impacted by teamwork.

In previous research, Safira & Damayanti (2020), stated that a well-organized organizational communication climate and teamwork in the hospitals can reduce the number of patient safety incidents and improve the patient safety culture. Therefore, this statement also supports results that are in line with current research.

Table 10. Effect Results and Parameter Coefficients

Relationship Between Variables	Direct Effect	Indirect Effect (through Teamwork)
Team Situation Awareness (TSA) --> PSIs	-0,054	-0,182
Teamwork --> PSIs	-0,076	-
Team Situation Awareness (TSA) --> Teamwork	+0.136	-

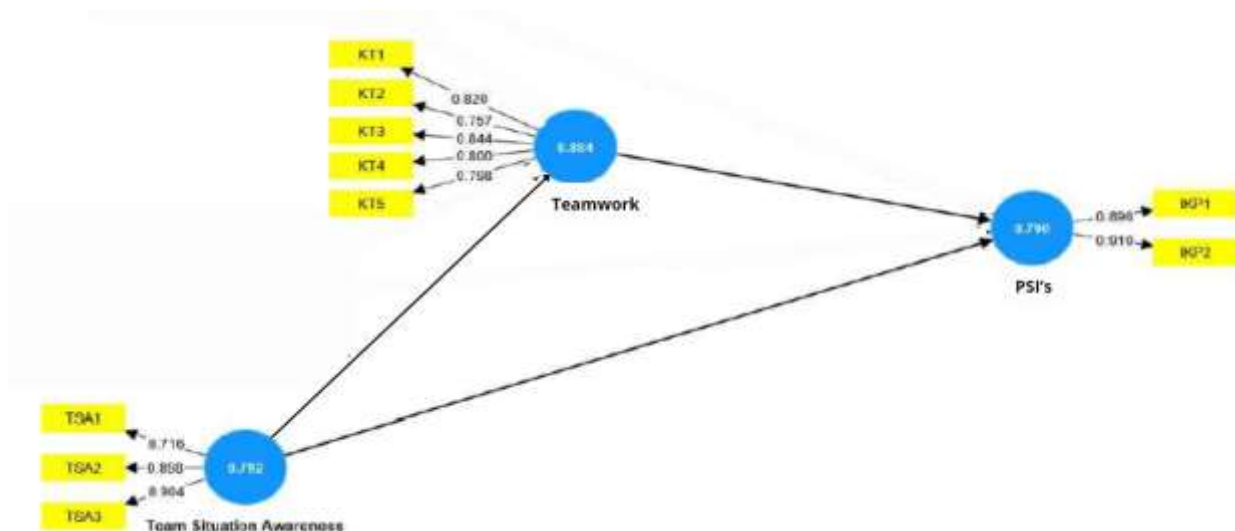


Figure 2. SEM-PLS Diagram

Based on the table above (Table 10) and figure 1, the indirect effect value of TSA on PSIs through teamwork is -0.095. This indicates that TSA can indirectly reduce PSIs through teamwork. Effective teamwork does not occur naturally or magically (Weaver, et al., 2017). Therefore, by increasing TSA in the service unit, teamwork can also be improved, leading to the minimization of patient safety incidents. The role of teamwork is significant in creating a patient safety culture (Febriansyah et. al., 2020). They suggest that hospital management must involve the active participation of each team member in improving patient safety culture.

CONCLUSION AND SUGGESTION

In this study, it's evident that TSA can indirectly reduce the occurrence of PSI through good teamwork. It is hoped that in the future, all work units can have a high team situation awareness (TSA) value in providing team situation awareness (TSA) in providing services to patients at the Surabaya Orthopedic and Traumatology Hospital, thereby improving teamwork and ensuring the proper implementation of patient safety programs. Researchers have proposed several ways to

improve team situation awareness (TSA) in a work unit. These include having the unit head periodically discuss potential risks that could lead to patient safety incidents, increasing the level of supervision by the unit head based on the study's findings, addressing strategic issues, and implementing Focus Group Discussions (FGDs) with hospital management.

Furthermore, enhancing collaboration by developing team-building exercises utilizing Team STEPPS training simulations can foster structure, situation monitoring, support, and communication among teams. The researcher hopes that further research can be conducted more broadly by involving other factors not examined in this study, such as leadership, which was not included in the data analysis of this study.

ACKNOWLEDGEMENT

I acknowledge the Surabaya Orthopaedic and Traumatology Hospital for granting permission to use the data. The views and opinions expressed in this paper are those of the authors and do not necessarily reflect those of the hospital.

CONFLICT OF INTEREST

The authors have stated that there are no conflicting interests in this study.

REFERENCES

- Amaniyani, S., Faldaas, B. O., Logan, P. A., & Vaismoradi, M. (2020). Learning from patient safety incidents in the emergency department: a systematic review. *The Journal of Emergency Medicine*, 58(2), 234–244. DOI: [10.1016/j.jemermed.2019.11.015](https://doi.org/10.1016/j.jemermed.2019.11.015)
- Antoninda, DB., Indasah. (2023). Team Work, Openness of Communication and Working Period for Reporting Patient Safety Events at the Regional General Hospital dr. ISKAK Tulungagung. *Journal Of Nursing Practice*. 6 (2), 168-175. ISSN: 2614-3488 (print); 2614-3496 (online)
- Arini, T. P., Yulia, S., & Romiko. (2018). Hubungan Kerjasama Tim Dengan Penerapan Budaya Keselamatan Pasien di Ruang Rawat Inap Rumah Sakit Bhayangkara Palembang Tahun 2018. *Masker Medika*, 6(2), 406–416
- Coolen, Ester., Draaisma, Jos., Loeffen, Jan., (2019). Measuring situation awareness and team effectiveness in pediatric acute care by using the situation global assessment technique. *European Journal of Pediatrics*. 178, 837-850, <https://doi.org/10.1007/s00431-019-03358-z>
- Despins, LA. (2018). Advancing Situation Awareness Research. *West J Nurs Res*. 40 (3), 303–4. <https://doi.org/10.1177/0193945917729177>
- Endsley, M. R. (1995). Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 37(1), 32–64. doi:10.1518/001872095779049543
- Endsley, Mica R. (1988). Design and Evaluation for Situation Awareness Enhancement. *In Proceedings of the Human Factors Society Annual Meeting*, 32(2), 97-101. DOI:[10.1177/154193128803200221](https://doi.org/10.1177/154193128803200221)
- England, N. H. S. (2015). Patient safety incident reporting continues to improve. *England: Author*
- Febriansyah, Kusumapradja, R., Ahmad, H. (2020). The Role of Teamwork in Improving Patient Safety Culture. *JMMR*, 9 (1): 41-52. DOI : <https://doi.org/10.18196/jmmr.91115>
- Fernandez, R., Kozlowski, SWJ., Shapiro, MJ., Salas, E. (2008). Toward a definition of teamwork in emergency medicine. *Acad Emerg Med* 15(11), 1104-12. doi: 10.1111/j.1553-2712.2008.00250.x

- Global patient safety action plan 2021-2030: Toward eliminating avoidable harm in health care. (2021). Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO.
- Madden, C., Lydon, S., Curran, C., Murphy, A. W., & O'Connor, P. (2018). Potential value of patient record review to assess and improve patient safety in general practice: a systematic review. *European Journal of General Practice*, 24(1), 192– 201. DOI: [10.1080/13814788.2018.1491963](https://doi.org/10.1080/13814788.2018.1491963)
- Ouverson, K.M., Ostrander, A.G., Walton, J., Kohl, A., Gilbert, S.B., Dorneich, M.C., Winer, E., Sinatra, A.M., (2021). Analysis of Communication, Team Situational Awareness, and Feedback in a Three-Person Intelligent Team Tutoring System. *Front. Psychol.* 12: 553015. doi: 10.3389/fpsyg.2021.553015
- Peraturan Menteri Kesehatan Republik Indonesia Nomor 11 Tahun 2017 Tentang Keselamatan Pasien.
- Rosen MA, DiazGranados D, Dietz AS, Benishek LE, Thompson D, Pronovost PJ, Weaver SJ. (2018). Teamwork in healthcare: Key discoveries enabling safer, high-quality care. *Am Psychol*, 73(4), 433-450. doi: 10.1037/amp0000298. PMID: 29792459; PMCID: PMC6361117.
- Safira, U.H., Damayanti, N. A. (2020). The Correlation between organizational Communication Climate And Teamwork About Patient Safety Incidents at a Private Hospital. Airlangga University : *European Journal of Molecular & Clinical Medicine*. ISSN 2515-8260
- Schulz, C. M., Endsley, M. R., Kochs, E. F., Gelb, A. W., & Wagner, K. J. (2013). Situation awareness in anesthesia: concept and research. *Anesthesiology*, 118(3), 729–742. DOI:10.1097/aln.0b013e318280a40f
- Weaver S. J, Benishek L. E, Leeds, Ira, Wick E.C. (2017). *The Relationship Between Teamwork and Patient Safety*. Springer International Publishing Switzerland. DOI: 10.1007/978-3-319-44010-1_5