The Impact of Social Interaction, Academic Achievement, and Cognitive Flexibility Levels on Clinical Reasoning: Statistical Discourse Analysis

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To cite this article:

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Article Info	Abstract
	This study aims to analyze the impact of intern physicians' social interaction during teamwork, their cognitive flexibility and academic achievement on clinical reasoning. The study, designed through sequential exploratory mixed method, was carried out with 20 intern physicians working in 4 teams. The process of how they approach to the case was recorded. The verbal interactions made during the discussions in the teams were analyzed, the discourses obtained from the videos were coded and modelled by regression. In addition, the cognitive flexibility and academic achievement levels of intern physicians were also included in the regression modelling. The results showed that, according to the initial signs and symptoms of the first period of the case (when uncertainty was high), the team members informing each other resulted in success in clinical reasoning. Although guiding in the first period was not very effective, excessive guiding in the second period played a negative role in clinical reasoning. In the second period, ignoring, reminding, and suggesting had a negative impact on clinical reasoning. Our study demonstrated that academic achievement and cognitive flexibility levels of the students in teamwork has a positive impact on the quality of clinical reasoning. Moreover, for effective clinical reasoning, the quality of discourses in the team is more important than how many discourses are created during the discussions.

Introduction

In accordance with andragogy and learner-centred paradigms, one of the most common approaches used in medical education is problem-based learning (PBL) (Servant Miklos, 2019). Although PBL has various types of implementations (case-based, project-based, etc.) and may be structured at different levels (Moesby, 2004), it has some common key characteristics in terms of learner-centeredness, small group/team learning, educators as facilitators or guides, problems as a starting point for learning and a tool to develop clinical problem-solving skills, knowledge acquisition through self-directed learning (Barrows 1996). When these characteristics are put together, medical students should develop certain skills such as communication, collaborative inquiry, critical thinking, creative problem solving, decision-making and clinical reasoning (CR).

Clinical reasoning (CR) can shortly be defined as "diagnostic problem solving" process (Schwardz & Elstein, 2004) during which a physician encounters a patient and tries to understand the possible causes of the patient complaints or abnormal conditions he or she has, makes diagnosis, and takes the actions to be able to manage the case (ten Cate, 2017). The basic principles of CR include the following (Irfan, 2019):

1. Try to come up with a provisional diagnosis using the data of the patient.
2. Determine the severity of the illness and make a comparison between the data of the patient and your provisional diagnosis.
3. Improve the diagnosis through further data from the literature and previous clinical examination.
4. Have further investigation based on this working diagnosis.
5. Go over the diagnosis according to the investigations and treatment responses.
6. Have a thought-provoking monologue so that your colleagues can correct any faulty models of thinking.

Since CR, which is an essential skill in health professions (Cambron Goulet et al. 2019; Higgs & Jensen, 2019), is a complex process which allows the physicians to combine scientific knowledge, clinical experience and critical thinking considering all the information they have about the patient (Rutter & Harrison, 2020), it requires the use of higher-order thinking skills (Laverty & Thompson, 2020). Higher-order thinking skills

involve effortful, nonalgorithmic thinking, judgments about complex problems, and consideration of multiple solutions through self-regulation of knowledge construction (Hmelo & Ferrari, 1997; Richards et al., 2020). Similarly, cognitive flexibility (CF) is another multidimensional process which involves processing multiple pieces of information at the same time, generating multiple ideas, considering alternatives, and altering or changing plans to adjust to a particular situation or context (Stevens 2009). CF involves selecting the knowledge to adaptively fit the needs of understanding and decision-making in a situation; therefore, it depends on having a diversified repertoire of ways of thinking (Spiro, 1988). As CF helps individuals make adaptive responses to complex phenomena (Spiro et al., 2003), it is a very important term used in medical education.

Considering the uncertain conditions in the diagnosis and treatment process of a patient, we can conclude that medical students need to develop higher-order thinking skills for their profession. This type of development depends on the curriculum and strategies used to encourage learners to take responsibility for their own learning through engagement (Theobald and Ramsbotham 2019) and social interaction through effective teamwork.

As physicians often work in teams in clinical settings, learning in teams and teamwork is another crucial competence that intern physicians should develop (Rachael et al. 2010). In addition, learning in teams has a positive impact on students' CR skills (Jost et al., 2017). In teamwork, during which group members have an active and constructive cooperation and communication the distribution and exchange of information among group members is of great importance for an efficient CR process (Fürstenberg et al., 2019). This type of engagement during teamwork is a form of social interaction, and the language used in that kind of interaction is viewed as discourse (Rachael 2008). In other words, discourse can be described as the process team members put effort to understand each other and reach a consensus (Bossche et al., 2006). In process of discourse, students collaboratively inquire, elaborate, and evaluate each other contributions to have a common understanding about an issue (Lu et al., 2011). This study aims to analyze the impact of social interaction among intern physicians during teamwork, their cognitive flexibility (CF) and academic achievement (AA) levels on their clinical reasoning (CR) skills.

Method

This research is a correlational study examining the relationships between teamwork, cognitive flexibility (CF), academic achievement (AA) and clinical reasoning (CR) level.

Participant

The purpose of research and how to conduct it was explained to 20 participants (year-6 medical students as intern physicians), who filled out the consent form to voluntarily participate in our study. The participants formed a team of 5 members. The researchers did not interfere with the team formation process.

Data Collection Tools

Intern physicians' discussions on the case were obtained through a structured scenario created by researchers who are experts in the fields of emergency medicine, medical education, and educational sciences. Apart from the researchers, the case was checked by 3 emergency medicine and 2 medical education experts. Then, the case was revised according to the views of the experts (see Appendix 1). Cognitive flexibility (CF) level of intern physicians was determined by the "Cognitive Flexibility Scale" developed by Martin and Rubin (1995) and adapted to Turkish by Altunkol (2011). This Likert type scale consists of 12 items. Validity and reliability results of the adapted scale were provided by Altunkol (2011). AA levels of the intern physicians were obtained from Medical School Student Affairs Office. The GPA (grade point average) scores of the intern physicians (by the time the study started) were used as their AA level.

Process

-        A case was created by the researchers to collect data for the clinical reasoning (CR) process.
-        Two emergency medicine specialists and an educational scientist were consulted regarding the case (Validity and Reliability Issues).
-        The case was revised according to experts' views.

- To start the research, Clinical Research Ethics Committee's approval was received. (Ethical Issues in Scientific Research).
- Intern physicians were informed about the research. (Ethical Issues in Scientific Research).
- 20 intern physicians who volunteered to participate in the study were decided (Ethical Issues in Scientific Research).
- Intern physicians were asked to form teams of 5 members (the researchers did not interfere with this process).
- The same case was given to 4 teams at the same time and the videos were recorded in four different rooms.
- Before the teamwork, intern physicians were informed about what researchers expect them to do.
- Intern physicians were given 30 minutes to discuss about the case.
- This 30-minute period was divided into 3 periods of 10 minutes.
- In the first period, according to the case given, intern physicians were in charge of the emergency department at a city district hospital. The symptoms of the case given were described as the first cycle of the clinical case (see Appendix 1). The teams worked on the case for 10 minutes, and then were asked to discuss and write down their preliminary diagnoses by stating the reasons for each diagnosis, the anamnesis findings to distinguish this diagnosis from other preliminary diagnoses, physical examination findings and further examinations they may ask for.
- In the second period, according to the case, intern physicians are in charge of the emergency department of a university hospital in a city. The patient was still complaining about the same problem, and so the patient came to the university hospital where the intern physicians work.
- In the second period, intern physicians worked for 10 minutes on additional symptoms and extra information presented to them. Intern doctors were not allowed to change the preliminary diagnoses they made in the first period (while they were in charge of the city district hospital). Given the new symptoms and extra information, the intern physicians were asked to discuss and write down about whether their preliminary diagnoses are still the same or have changed by stating the reasons.
- In the third period, while the patient was still in the university hospital emergency room, some additional information was presented to the intern physicians (see Appendix 1). In addition, in accordance with the latest information provided, the intern physicians were asked to discuss and write about "the final diagnosis for the patient and why they think so", "what should be done to evaluate the diagnosis process of the patient and to better manage this process".
- The whole process was video recorded with professional microphones to enhance the quality of the voice of participants (Validity and Reliability Issues).
- The recordings were put into a text format by the researchers (describing the gestures, mimics, and humors) (Validity and Reliability Issues).
- Each team assigned one member to read the question from the paper. These members read the questions in each period. In other words, considering the case had three periods and four teams, totally 12 questions were read. These discourses were coded as "reading questions" and were excluded from the analysis.
- There were a few incomprehensible discourses realized during listening and transcribing the audio recording. These discourses were coded as "incomprehensible" and were excluded from the analysis.
- After "incomprehensible discourses" and "reading questions" were excluded from the analysis, remaining 625 discourses were coded and analyzed.
- Discourses were coded by researchers. Coding was carried out as follows:

Intern 1: Let's focus only on inferior MI (Suggesting)
Intern 2: Okay (Confirming)
Intern 1: Why did we focus on inferior MI? If we look at it, the patient is 64 years old (Guiding)
Intern 1: Advanced age factor… (Providing Additional Information)
Intern 3: There is effort, and pain while walking (Guiding)
Intern 2: There is pain. OK... There is breathing (Providing Additional Information)
Intern 1: There is also dyspnea (Providing Additional Information)
Intern 2: He has dyspnea… Epigastric region… (Confirming)
Intern 1: Yes (Confirming)
Intern 3: In my opinion, not totally recovered with drugs… (Guiding)
Intern 1: Yes, exactly (Confirming)

- Apart from the researchers, discourses were independently coded by 5 different experts (3 emergency medicine specialists, 1 qualitative research expert especially in discourse analysis, and 1 educational scientist). Qualitative codes (suggesting, confirming, guiding, etc.) given to the discourses were converted into numerical

code and code consistency was calculated through Krippendorff Alpha coefficient. The consistency level was measured as .87 (Krippendorff, 2004) (Validity and Reliability Issues).

-        Very few inconsistent codes were found between the codings performed by the external experts and the researchers. A panel was held on which final code would be given to these preliminary codes. In this panel, the final code to be given was determined through discussion (Validity and Reliability Issues).

-        The teams' responses regarding the case were scored according to the CR scoring criteria (see Appendix 1).

-        The codes related to discourses, the CR scores obtained from the teams' approach to the case, AA, and the scores the intern physicians got from the CF scale were transferred to the statistical package program.

Data Analysis

The case on which intern physicians work and clinical reasoning (CR) process consisted of three periods. First period was the discussion of preliminary diagnoses, reasons, anamnesis, and further examinations they may ask for; second period was the discussion about whether the preliminary diagnoses made in the first period were getting stronger with newly added information and symptoms; the third period was the final diagnosis in the light of the new information and symptoms and the discussions in the first two periods. In each period, new information was added to the case and the discussion took on a new dimension. Therefore, discourses were divided into three (discourses in the first, second and third period). The impact of the discourses on CR was taken into regression modelling for three periods separately. Linear regression was used as CR, which is the output variable, is a success grade and is a continuous variable as well as cognitive flexibility (CF) and academic achievement (AA) as predictor variables. However, discourses in predictor variables are categorical (informing, responding, correcting, etc.). Therefore, discourses were included in the regression model as dummy (dichotomous) variable (Keith, 2019; Warner, 2008). In the regression analysis, autocorrelation (multicollinearity) analysis was performed between predictors. Variance Inflation Factor (VIF) values were very close to 1. So, it was decided that there was no autocorrelation between the predictors (Demaris, 2004; Pedhazur, 1997).

Results

The quantity and types of discourses in each team, and CR scores obtained from the teams were separately analyzed for each period. The results are displayed in Table 1. The following are the results obtained according to discourses that emerged in the CR process in four teams:

-        The quantity of discourses in the team is not a guarantee of success in CR. High CR scores were observed both in the team with a high number of discourses and in the team with a low number of discourses. On the other hand, the team with the lowest CR score was the one which had the highest number of discourses (219).

-        It was found that the team with the highest CR score used informing in the first and second period. Other teams did not use informing.

-        The team with the lowest CR score was the one that mostly used confirming (15.1%) and suggesting (15.1%) in the first period. The same team was the one that used suggesting (16.7%) most in the second period.

-        The team with the highest CR score was the one that used guiding (31.3%) most in the first period. The same team was the one that used guiding (20.5%) less than other teams in the second period. The teams which had the lowest score in CR continued to use guiding more (35.2% and 41.9%). In the last period, the team with the highest score in CR and the team with the third high score continued to use excessive guiding (33.3%).

-        The team with the highest CR score in the second period was the one that used objecting (22.7%) and confirming (20.5%) most.

-        The team with the lowest CR score in the last period was the one that used reminding (13.6%) most.

CF and AA levels of the participants were analyzed. The results are summarized in Table 2.

The lowest score obtained from the CF scale was 12, and the highest score was 72. Achievement scores were given out of 100. The data revealed that high CR scores were obtained in the teams with high CF and AA levels. In each period, the level of CF, AA, and CR of discourse in the teams were individually analyzed. The regression analysis results are summarized in Table 3.

Table 1. Discourse types and CR scores within periods

Period	Discourse		Group 1 f (%)	Group 2 f (%)	Group 3 f (%)	Group 4 f (%)
1	Informing		4(8.3)	---	---	---
	Responding		1(2.1)	1(0.8)	6(5.7)	---
	Correcting		1(2.1)	3(2.5)	7(6.6)	---
	Providing Additional Information		4(8.3)	13(11)	14(13.2)	1(4)
	Ignoring		1(2.1)	7(5.9)	7(6.6)	---
	Reminding		---	---	1(0.9)	2(8)
	Objecting		---	8(6.8)	2(2.8)	---
	Confirming		7(14.6)	22(18.6	16(15.1)	---
	Suggesting		9(18.8)	14(11.9)	16(15.1)	5(20)
	Asking Question		3(6.3)	24(20.3)	13(12.3)	12(48)
	Asking Question + Informing		---	---	---	---
	Asking Question + Guiding		1(2.1)	---	---	---
	Guiding		15(31.3)	26(22)	23(21.7)	5(20)
		Total	48(100)	118(100)	106(100)	25(100)
2	Informing		3(6.8)	---	---	---
	Responding		1(2.3)	1(2.1)	3(5.6)	---
	Correcting		---	4(8.5)	1(1.9)	3(9.7)
	Providing Additional Information		2(4.5)	10(21.3)	4(7.4)	2(6.5)
	Ignoring		1(2.3)	1(2.1)	3(5.6)	---
	Reminding		---	---	2(3.7)	3(9.7)
	Objecting		10(22.7)	5(10.6)	1(1.9)	2(6.5)
	Confirming		9(20.5)	6(12.8)	5(9.3)	2(6.5)
	Suggesting		3(6.8)	6(12.8)	9(16.7)	3(9.7)
	Asking Question		6(13.6)	4(8.5)	7(13)	3(9.7)
	Asking Question + Informing		---	---	---	---
	Asking Question + Guiding		---	---	---	---
	Guiding		9(20.5)	10(21.3)	19(35.2)	13(41.9)
		Total	44(100)	47(100)	54(100)	31(100)
3	Informing		1(2.6)	---	---	1(3.7)
	Responding		---	---	5(8.5)	2(7.4)
	Correcting		---	2(7.4)	3(5.1)	---
	Providing Additional Information		3(7.7)	8(29.6)	6(10.2)	1(3.7)
	Ignoring		3(7.7)	1(3.7)	2(3.4)	---
	Reminding		---	---	8(13.6)	1(3.7)
	Objecting		5(12.8)	1(3.7)	4(6.8)	---
	Confirming		5(12.8)	4(14.8)	5(8.5)	---
	Suggesting		5(12.8)	5(18.5)	5(8.5)	5(18.5)
	Asking Question		4(10.3)	2(7.4)	8(13.6)	6(22.2)
	Asking Question + Informing		---	---	---	2(7.4)
	Asking Question + Guiding		---	---	---	---
	Guiding		13(33.3)	4(14.8)	13(22)	9(33.3)
		Total	39(100)	27(100)	59(100)	27(100
	General Total		*131*	*192*	*219*	*83*
	Clinical Reasoning Score		16	14	10	13

Table 2. CF and AA scores of the interns in teams

Teams	Intern	CF	AA	Team Cog. Flexibility $\overline{X}$ (S)	Team Achievement $\overline{X}$ (S)	Team CR Score
1	Intern 1 (Male)	59	76.27			
	Intern 2 (Female)	52	71.26			
	Intern 3 (Female)	49	77.08	52 (5.95)	75.34 (2.77)	16
	Intern 4 (Female)	43	78.14			
	Intern 5 (Female)	45	78.14			
2	Intern 6 (Male)	55	74.63	49.55 (4.92)	76.29 (3.31)	14
	Intern 7 (Male)	49	81.86			

	Intern 8 (Female)	52	72.45					
	Intern 9 (Female)	48	81.09					
	Intern 10 (Female)	43	74.48					
	Intern 11 (Male)	49	72.62					
	Intern 12 (Female)	48	71.19					
3	Intern 13 (Female)	45	71.06	47.06 (1.66)	72.24 (2.23)	10		
	Intern 14 (Male)	48	70.90					
	Intern 15 (Male)	45	77.69					
	Intern 16 (Female)	47	69.27					
	Intern 17 (Male)	46	72.64					
4	Intern 18 (Female)	46	74.62	49.95 (5.4)	72.81 (2.55)	13		
	Intern 19 (Male)	59	71.02					
	Intern 20 (Female)	49	77.08					

Table 3. The prediction level of the discourses, CF, AA on CR in three different periods

Period	Predictor Variables	β (95% CI)	t	p	R	R^2	Model ANOVA F (p)
1	Constant	-17.45 (-22.59, -12.31)	-6.68	<0.0001	0.62	0.39	12.75 (<0.0001)
	Informing	2.79 (0.95, 4.64)	2.99	0.003			
	Responding	-1.15 (-2.50, 0.19)	-1.69	0.093			
	Correcting	-0.92 (-2.09, 0.26)	-1.53	0.127			
	Providing Additional Information	-0.23 (-1.03, 0.57)	-0.57	0.571			
	Ignoring	-0.24 (-1.28, 0.81)	-0.45	0.653			
	Reminding	-0.77 (-2.88, 1.34)	-0.72	0.472			
	Objecting	-0.09 (-1.27, 1.08)	-0.16	0.876			
	Confirming	0.07 (-0.66, 0.79)	0.18	0.855			
	Suggesting	0.16 (-0.57, 0.89)	0.43	0.668			
	Asking Question + Guiding	0.93 (-2.68, 4.54)	0.51	0.612			
	Guiding	0.21 (-0.44, 0.86)	0.64	0.522			
	Cognitive Flexibility	0.17 (0.12, 0.22)	7.05	<0.0001			
	Achievement	0.29 (0.23, 0.36)	9.37	<0.0001			
2	Constant	-14.79 (-21.67, -7.93)	-4.26	<0.0001	0.64	0.41	9.40 (<0.0001)
	Informing	1.69 (-0.55, 3.95)	1.49	0.138			
	Responding	-2.13 (-3.93, -0.33)	-2.34	0.020			
	Correcting	-0.98 (-2.48, 0.52)	-1.29	0.198			
	Providing Additional Information	-0.91 (-2.06, 0.24)	-1.56	0.121			
	Ignoring	-2.02 (-3.81, -0.22)	-2.22	0.028			
	Reminding	-1.95 (-3.75, -0.14)	-2.12	0.035			
	Objecting	0.33 (-0.83, 1.49)	0.57	0.571			
	Confirming	0.03 (-0.57, 0.63)	0.25	0.886			
	Suggesting	-1.43 (-2.53, -0.32)	-2.55	0.012			
	Asking Question	-0.72 (-1.84, 0.40)	-1.27	0.206			
	Guiding	-1.14 (-2.07, -0.22)	-2.44	0.016			
	Cognitive Flexibility	0.16 (0.11, 0.21)	5.79	<0.0001			
	Achievement	0.28 (0.19, 0.36)	6.71	<0.0001			
3	Constant	-24.59 (-33.08, -16.12)	-5.73	<0.0001	0.68	0.41	8.97 (<0.0001)
	Informing	1.63 (-1.17, 4.44)	1.15	0.252			
	Responding	-0.986 (-2.66, 0.68)	-1.17	0.245			
	Correcting	-0.98 (-2.86, 0.91)	-1.02	0.309			
	Providing Additional Information	0.30 (-0.95, 1.56)	0.48	0.632			
	Ignoring	1.39 (-0.36, 3.16)	1.57	0.119			
	Reminding	-1.25 (-2.79, 0.29)	-1.60	0.112			

Objecting	0.10 (-1.35, 1.56)	0.14	0.887
Confirming	0.35 (-0.95, 1.66)	0.54	0.594
Suggesting	-0.29 (-1.33, 0.74)	-0.56	0.575
Asking Question	0.03 (-1.17, 1.22)	0.04	0.967
Asking Question + Informing	-0.79 (-3.58, 1.99)	-0.56	0.574
Guiding	0.29 (-0.74, 1.33)	0.56	0.575
Cognitive Flexibility	0.19 (0.12, 0.26)	5.63	<0.0001
Achievement	0.38 (0.27, 0.48)	7.11	<0.0001

The results revealed that informing in the first period, CF, and AA positively predicted CR. The highest impact among these were providing additional information. When the level of informing, CF and AA increased, the level of successful CR also increased. In the second period, the results of the analysis showed that responding, ignoring, reminding, suggesting, guiding, cognitive flexibility, achievement predicted CR. On the other hand, responding, ignoring, reminding, suggesting and guiding negatively affected CR. When these variables increased, the level of successful CR declined. However, as CF and achievement increased, successful CR increased as well. The analysis results for the third period showed that only CF and achievement predicted the quality of CR.

Conclusion and Discussion

Our study was conducted to analyze the impact of social interaction among intern physicians during teamwork, their cognitive flexibility (CF) and academic achievement (AA) levels on successful clinical reasoning (CR). To our knowledge, ours is the first study in medical education discussing how students' CF and AA level during teamwork affect CR skills. In addition, another result that made this study original was the finding that not the quantity but the quality of the discourses in the team is important for successful CR. According to the first symptoms and findings about the case in the first period (when the uncertainty was high), informing each other in the team brought success in CR. Making more suggestions and confirming may have prevented the team from focusing on the case. Although guiding in the first period was not very significantly effective, over guiding in the second period played a negative role in CR. Because the second period (with additional information, decreasing uncertainty level) was the period of questioning, inquiry and judging preliminary diagnoses. Therefore, ignoring, reminding, and suggesting in the second period may have caused negative impact on CR. In the second period, the team discussed the preliminary diagnoses first, and focused on which preliminary diagnosis was weakened and strengthened while trying to reach a diagnosis through additional symptoms and findings. The team that wrote the reasons for the strengthening or weakening of the preliminary diagnosis and focused on discussing the findings instead of making new suggestions.

AA and CF in each period had a positive impact on a successful CR. Especially the third period was the one during which adequate level of discussion was made about the case and information saturation was reached. Therefore, the team needed to reach the final diagnosis and evaluate the process. CF and AA enabled this period to result in success although on previous study (Fürstenberg et al., 2019) analyzing the impact of AA on CR in medical education showed that achievement level of the students had no effect on the quality of CR. However, our study showed some similar results with various studies regarding the positive impact of AA (Elvén, 2019; Groves et al., 2003; Kim & Ko, 2015; Kuiper & Pesut 2004) and of CF (Durning et al., 2015; Simmons, 2010) on CR. Similarly, our study results also correlate with the results of the previous studies (Benner et al., 1997; Boaden & Leaviss 2000; Shafaroodi et al., 2014; Smith et al., 2008) that examine the impact of teamwork on CR. However, CF is not a common variable that has been studied in context of clinical practice or CR, which also makes this study authentic.

Our study revealed that academic achievement (AA) and cognitive flexibility (CF) levels of the students in teamwork has a positive impact on the quality of clinical reasoning (CR). Moreover, it was concluded that, for successful CR, the quality of discourses in the team is more important than how many discourses are created during the discussions. Future research may focus on the teams in which students with high and low AA levels or high and low CF levels work together in the same team. In addition, how students with high CF or vice versa affect others in the team would be another piece of research to see the impact of these conditions on CR. Also, a similar type of research may be conducted in different clinics or by including other healthcare professionals in the teams of doctors. Because doctors are the members of a team as a healthcare professional and this team may not always consist solely of doctors in clinical settings.

Limitations and Future Research

This study had several limitations that should be noted. First, the sample size was small (20 intern physicians-5 members in 4 teams). Second, the case given to the intern physicians was related to emergency department only. However, the emergency department is one of the four departments (emergency, internal medicine, gynecology and pediatrics) in which intern physicians can encounter most cases/patients upon graduation. Third, the time allocated for the discussion of the case was limited to 30 minutes (3 periods, 10 minutes for each period).

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in JESEH journal belongs to the authors.

Ethical Consideration

This study was approved by Çanakkale Onsekiz Mart University Clinical Research Ethics Committee (No: KAEK-27/2019-E.1900170534). All participants of the study gave their written consent for participation.

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Appendix

Period 1 (10 minutes)

The woman is 64 years old and has severe shortness of breath!
Suna, who is 64 years old, set out to go to the shopping mall on foot at 14:30 after lunch. On the way, she felt a pain in her stomach, making her difficult to breathe. So, she had to stop walking. Then, she took the medicine she was given to use when she had heartburn and pain. Her pain did not still subside. She changed her mind and decided to go back home which is very close, and she went to bed. At 17 o'clock, the severity of her pain increased, spread to her back, and shortness of breath reappeared. Shortness of breath increased when lying down. When her shortness of breath increased, she called her husband and asked him to take her to the hospital. Her husband drove her wife, Suna, to Ayvacık State Hospital.

Please write down the possible preliminary diagnoses for this patient, the reasons leading you to this diagnosis, and anamnesis, physical examination and examination information that can confirm this preliminary diagnosis and distinguish it from other diagnoses.

Expected Responses
In case the students write a complete response for preliminary diagnoses related to pneumonia, aortic dissection, myocardial infarction (MI), pulmonary edema, pericarditis, pericardial tamponade, pulmonary embolism, peptic ulcer, the reasons for these diagnoses, and anamnesis, physical examination and further examinations which is required for differential diagnosis, they can get 7x4=28 points from this section.

Period 2 (10 minutes)

Suna, who was brought to Ayvacık State Hospital by her husband, was welcomed by Dr. E. S. in the emergency service. The doctor took the patient's ECG and used PA Chest X-ray. Based on the examinations, Suna was diagnosed with pneumonia. The doctor sent the patient home by prescribing antibiotic and gastroprotective treatment.

On the following day, Suna was brought to ÇOMÜ Faculty of Medicine Emergency Department by her husband after her respiratory distress complaints increased and her pain became evident in the chest area. When the patient entered the emergency service, she was agitatedly shouting and asking for help, and constantly saying that she was afraid of dying. The patient could not lie on her back, was having difficulty breathing, breathing noisily, she had a cough, and was saying that she was expectorating.

In line with these new symptoms and findings, have your preliminary diagnoses changed? Which has become a priority? Why? Please write what you think and state your reasons in the table.

Expected Responses
With the new information given, if the students write that the probability of "Pneumonia", which is one of the preliminary diagnoses that should be made in the previous period, didn't change and the reason; the probability of "aortic dissection" increased and the reason; the probability of "MI" increased and the reason; the probability of "pulmonary edema" increased and the reason; the probability of "pericarditis" increased and the reason; the probability of "pericardial tamponade" increased and the reason; the probability of "pulmonary embolism" increased and the reason, the probability of "peptic ulcer" decreased and the reason, they can get 1 point for writing a correct answer for the probability (whether increased or decreased) and 1 point for writing the correct reason. So, they can get 7x2=14 points in total.

Period 3 (10 minutes)

Dr. T.E took the patient to the Emergency Service's green zone at ÇOMÜ Faculty of Medicine and examined her.

Patient History
Medical Record

diagnosed with hypertension 10 years ago.

diagnosed with diabetes mellitus 6 years ago
diagnosed with hyperlipidaemia 6 years ago
gastrointestinal system (GIS) bleeding 2 years ago

Medication

Oral antidiabetic, antihypertensive drugs, cholesterol medicine

Previous Surgical Operations

Caesarean

Family History

None

Physical Examination Findings

The skin is cold, pale, over-sweaty, moderate acrocyanosis.
Pulse: 110/min., rhythmic
Respiration: 26/min.
Fever: 36,6°C
Blood Pressure: 150/100
Widespread crepitant rales in both lungs up to upper zones during auscultation S3 present in the heart during auscultation
on the ECG taken in the emergency service:
Sinus rhythm
7mm R waves in V1, 1 mm S wave, 1 mm ST depression, Spiked T wave
R dominance in V2.
On chest X-ray:
The heart is larger than normal, aeration disorder suggesting bilateral pneumonic infiltration

In accordance with these findings, what is/are your final diagnosis/diagnoses for the patient, explain why? What do you think of the management of the patient's diagnostic process? Are there any problems you have noticed? What would your suggestions be for better management of this process?

Expected Responses
"Posterior MI" and "pulmonary edema" should be written as final diagnoses. If two answers are written, 4 points can be obtained from this section.