

# ADAPTIVE LEADER AND TEAM BEHAVIOUR IN MEDICAL ACTION TEAMS



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## Abstract

In medical action teams, there often is a high level of stress and pressure. Adapting the behaviours of the team to the situation is crucial to deal with this high level of stress and pressure. This adaption can be seen as a constant process since situations continuously change. To make sure that teams can adapt their behaviour and adapt to the situation, a leader has an important role. Adaptive leadership can therefore be very beneficial for medical action teams. However, up to now, there is not much information about the way adaptive leadership can be beneficial for medical action teams and how this process of adaption works. Therefore, this study will focus on the question: how do a leader and the team adapt their behaviour and communication from the action to the transition phase in medical action teams? This question will be supported by two hypotheses about the differences in communication and the difference in interaction patterns. Subsequently, the effect of the communication and interaction patterns on the performance of the team and the effect on the tenure of the team will be investigated. To answer the research question and test the hypotheses, video material of a medical student team practising Advanced Life Support in a course for their masters Technical Medicine was collected, transcribed and coded. The video-codings were imported into THEME software to analyse and identify the interaction patterns. Next to that, the data is analysed via SPSS with the use of the Mann-Whitney test and the Chi-square test.. The results of this study showed no significant difference in the interaction patterns when comparing the action with the transition phase. This implies that the leader does not adapt his or her leadership. For communication, also no significant difference is found between those two phases. However, the post hoc analysis shows a difference in communication and interaction patterns when the team was performing on higher levels. When the team showed higher levels of performance, the difference between the action and the transition phase was higher. This implies the leader adapts his or her behaviour more strongly when the team is performing on a higher level. The findings of this study can be used for further research on adaptive leadership in medical action teams.

# 1. Introduction

Due to their crucial and highly consequential tasks, it is of great importance that action teams are high-performing. Teams working in a crisis (i.e., events with crucial damage to humans, materials and health) or under circumstances of a crisis are called action teams (Hannah et al., 2009). There are different varieties of action teams, such as military, medical, law enforcement, fire, and crisis response teams (Hannah et al., 2009). The impact of the work performed by these teams is enormous because the performance of these teams can be of vital importance for human lives, which underlines the urgency for a high-performing action team (Zijlstra et al., 2012).

Characteristics of an action team are that the team needs to respond to unexpected situations, it has to improvise, coordinate its actions and react rapidly (Edmonson, 2003). Van der Haar et al. (2017) adds to these characteristics: the ability of the team members to deal with much and often diverse, multi-source information. They have to effectively and quickly process and act upon that information. This is supported by Marks et al. (2000) who mention that action teams have to respond immediately to the changing environment and their surroundings. Hence, thoughtful and well-timed communication is one of the most important drivers of action teams (Rehim et al., 2017).

Other research also found that communication is one of these key factors to obtain an high-performing team (Ellis et al, 2005; Marks et al., 2003;). When there is constant pressure on the team, as is often the case for action teams, and the communication is lacking, there is a higher chance of misunderstandings and conflicts. This makes effective communication essential (Marks et al., 2001). Furthermore, Rehim et al. (2017) states that adapting communication is crucial for action teams. This implies that communication is changing along the situation. Adapting of the communication within action teams is of great importance for the collaboration and performance of the teams. When the team is not reacting to the situation by adjusting the communication, Rehim et al. (2017) state that the collaboration and therefore the performance is lacking. The above results in the fact that team members do not know exactly what the other one is doing or meaning. This may cause loss of motivation, courage and attitude towards the team, which also leads to lower levels of performance (Marks et al., 2001).

Furthermore, research has consistently shown that the actions of the leader in the context of action teams is critical to the performance of the team members and how they communicate

during a crisis situation (Edmonson, 2003; Hannah et al., 2011). It is shown that effective team leadership improves team performance (Rosenman et al., 2014). Research carried out by Klein et al. (2006) confirmed the importance of leadership, since the leader is in charge of providing strategic directions, monitoring the situation and providing hands-on treatment. When the leader does not actively show such behaviour, the performance of the team decreases. There are many different forms of leadership. One of them is adaptive leadership, which is found to be of positive influence on team performance (Khan, 2017). The reason for choosing adaptive leadership in the context of action teams, is that action teams are dealing with unexpected situations and have to react immediately to what is happening for which adaptive leadership can be beneficial. Adaptive leadership is defined by Laur et al. (2021), as an ongoing process with a focus from the leader on the whole situation and using all information coming from multiple directions to improve the situation. This means that adaptive leadership is most of the time a reaction from the leader to the situation. This is essential when it is needed to react to changing and unexpected situations.

To react to the changing situations, the leader needs to change his or her communication as well. According to Yukl & Mahsud (2010), adaptive leadership involves changing communication in the way which is needed to react to those changing situations. This goes for the leader as well as the rest of the team members. This means that not only the communication of the leader is important, but also the interaction within the team to make adaptive leadership work. Hence, when a leader is changing his or her communication, it implies that he or she reacts to the situation. Examining how leaders change their way of communication during a crisis situation can thus provide meaningful insights into whether and how they adapt to the situation. Because of the continuously changing environment of an action team, the use and in-depth insight in how adaptive leadership works can be beneficial (Laur et al., 2021).

A considerable amount of literature has been published in the context of action teams, their way of communicating and effective leadership in this context (Edmonson, 2003; Hannah et al., 2009; Hannah et al., 2011; Rosenman et al., 2014; Weiss et al., 2017). However, the process of how a leader adapts his or her behaviour during a crisis situation as well as the interaction with the team has been underexposed. In doing so, this study responds to the call to investigate another form of leadership in action teams to investigate if this form of leadership is of positive influence on these action teams.

This study, therefore, aims to investigate adaptive leadership communication in such action teams to see how a leader exactly adapts his or her communication, as well as the

interaction within the team. Next to that, having seen that leadership can affect the performance of the team, this study aims to investigate the affect of the performance on medical action teams. Investigating the above in this study attempts to fill the gap of adaption of the leader in a crisis situation by focusing on the question of whether an adaptive leadership process, looked at via communication, is positively influencing the performance of action teams.

To summarize, this research aims to explore if an action team performs better if a leader and the team members adapt their communication accordingly to changing task demands and what this process of adaption looks like. This will be studied based on the research question: *How do a leader and the team adapt their behaviour and interaction in medical action teams?*



## **2. Theoretical framework**

Action teams have a different way of working compared to regular work teams. In the first paragraph, a definition and the characteristics of action teams are discussed. Next to that, the definition of adaptive leadership and the process of adaptive leadership in behaviour are discussed in the light of action teams. Finally, interaction patterns in action teams will be introduced, as a means to explore adaptive leadership.

### **2.1 Action teams**

A definition of action teams that is frequently used is: “Action teams operate as interdependent teams of specialized individuals to accomplish collective tasks and goals, often engaging in intense yet brief periods of performance, which are often repetitive yet conducted in challenging conditions” (Sundstrom, deMeuse, & Futrell, 1990, p.120). Characteristics of an action team are that they; 1) experience high levels of stress and constant team pressure; 2) have to respond to unexpected situations, meaning that they have to improvise and therefore coordinate their actions and react extremely fast (Edmonson, 2003); 3) have to rapidly deal with a big variety of information (van der Haar et al., 2017); 4) are multidisciplinary when it comes to expertise, knowledge and culture (van der Haar et al., 2017); and 5) have to respond immediately to the changing environment (Marks et al., 2000). Next to this, Ishak & Ballard (2012) also state that action teams need to have a certain amount of improvisation skills, since unexpected situations are part of working in an action team. There is not one way to respond to situations, since every situation is different and changes extremely fast, which can result in the need for improvising.

There are action teams in a lot of different sectors like the military, hospitals and fire departments (Hannah et al., 2009). One form of the described action team is the medical action team, for example the trauma, ambulance or surgical team. These teams are mostly interdisciplinary and do not always work with each other, except for emergency calls (Rosenman et al., 2014). The focus of this study is on medical action teams since these teams are operating in impactful situations and are practising a job at the cost of a human’s life, which makes high-performance even more important (Zijlstra et al., 2012).

To understand the way of working of medical action teams even further, the described characteristics are focused on medical action teams. The first characteristic is experiencing high

levels of stress and constant team pressure (Edmonson, 2003). In a medical action team, this can for example be in a trauma room, the ambulance or the emergency care. In these settings, there is always a high level of stress and pressure present. The reason for this high level of stress and pressure is that most of the time, the actions of the medical action team can cost or save a human's life. The next characteristic is having to respond to unexpected situations, meaning having to improvise and therefore coordinating their actions and reacting extremely fast (Edmonson, 2003). In medical action teams, this can occur in the fluctuating condition of the patient. This can change every second and the team then has to improvise and react immediately to the changing condition of the patient. The third characteristic is that medical action teams have to deal with a big variety of information extremely fast (van der Haar et al., 2017). For instance when a patient is arriving at the hospital in an ambulance, where the team is obtaining a great deal of information about the injury and condition of the patient. The fourth characteristic is the multidisciplinary of medical action teams regarding expertise and knowledge (van der Haar et al., 2017). Medical action teams often have a variety of disciplines, such doctors, nurses and anaesthetists, all bringing different expertise and knowledge to the team. The fifth characteristic mentioned is the need to respond immediately to the changing environment (Marks et al., 2000). In a medical action team, this can be of influence in for example an ambulance team when it comes to the changing condition of the patient. When the ambulance team is still on the location of the accident, the environment is constantly changing due to the other health care providers like the firefighters.

According to Klein et al. (2006), the team members of a medical action team have their own routines and protocols on how to react to a situation, including the communication that is appropriate. These routines and protocols are important since they give direction to the medical action team. However, the difficulty of working in a medical action team is that the situation is not staying the same or in control the whole time, which affects the routines and protocols. This results in the fact that working in a medical action team is all about reacting and adapting to the changing situation based on their own knowledge, protocols and routines. This also means that the team members need to adjust their communication when the situation requires a change. In addition, Klein et al. (2006) point out that action teams need to be able to cope with unexpected situations. These unexpected situations are affecting the way of working because the teams need to adjust their communication to the situation (Marques-Quinteiro et al., 2013).

## 2.2 Adaptive leadership and performance

Adapting to situations is of high importance for medical action teams. Effectively cooperating as a team is also crucial in medical action teams (Rehim et al., 2017). In those teams, a leader coordinates actions of all team members to ensure effective cooperation and coping with the situation at hand (Rosenman et al., 2014). It is shown that effective team leadership, which consists of coordination by focussing on planning, cooperation while giving direction and monitoring the team members, improves team performance of medical action teams (Rosenman et al., 2014). According to Yeuning et al. (2012), a lack of leadership has been linked to a loss of performance in acute medical settings. This means that when there is no leadership or erroneous leadership, it affects the performance of medical action teams and therefore also the health of the patient. In medical action teams, there is frequently one leader that has the required knowledge and expertise to lead the team. In a medical action team, this is often the attending surgeon (Klein et al., 2006).

A leader must ensure that the team effectively communicates in all phases of a crisis or emergency situation, especially in a medical action team. This also entails adaptive communication when the task requires to do so. This process is referred to as adaptive leadership. An adaptive leader can do this by “getting on the balcony” (Jefferies, 2017). Meaning that the leader takes a step back and, if needed, creates a new plan of action that matches the situation. In medical action teams, this needs to be done in a split second. The situation is changing and the leader needs to react on that right away, which only gives the leader a couple of seconds to get on the balcony and come up with a new plan. After doing that, adaptive leadership is shown when the leader is reacting to changed task conditions. This means that when the task is changing due to unexpected circumstances such as a change in the state of the patient, the adaptive leader is reacting to that immediately by communicating new tasks to the team members (Xiao et al., 2004). In addition to this definition, Yukl & Mahsud (2010) state that adaptive leadership entails changing behaviour appropriately for this switch in situations, not just randomly change their behaviour. They also point out that just changing your communication as a leader to just change is not adaptive leadership, because the change of the communication has to be relevant for the specific situation of the team. For instance this means that the leader has to come up with a new plan of starting CPR when there is no rhythm, which is the correct way to do it, so it is adaptive leadership. When the leader is giving improper instructions, for example, giving the patient a shot of adrenaline to get back the heart rhythm,

which is not the right solution for the medical condition at that moment, there is no adaptive leadership. So, when the leader is changing the communication and it is appropriate to the situation, it can be called adaptive leadership.

To define and understand adaptive leadership even further, Ramalingam et al. (2020), defined four principles that are relevant with regard to adaptive leadership. These four principles are called the four A's; Anticipation, Articulation, Adaptation and Accountability. Every A can be considered an important element of adaptive leadership. When a leader is only doing the anticipation, it will be called adaptive leadership. However, to make adaptive leadership the most successful, it is recommended to take all four steps to get the best result (Ramalingam et al., 2020). The process of the 4 A's is cyclical, meaning when the final step is accomplished, the steps restart again.

Anticipation means that the leader is reacting to what is happening when it comes to future opportunity's, needs and possibilities. In a medical action team, this can be recognized as for example adjusting to the situation by preparing an operating room. In addition, articulation means that the leader is building upon one shared perception of the ideas of the team members, making sure that all team members agree. This can be perceived by the leader choosing an idea which is implied by one of the team members when the situation is changing. Articulation can be recognized in a medical action team as a short discussion about the best approach with all team members agreeing with the chosen approach. Next, the leader is reacting and implementing change on based on the opinion of the team members. The next A is adaptation. Adaption entails that there must be continuous learning of the situation by scanning the environment and the behaviour of team members and seeing which tasks are required, can be changed and/or improved. In a medical action team, this can be recognized as short conversations of reflection and ideas of how to change the approach next time. The last principle Ramalingam et al. (2020) mentioned is accountability. This principle focusses on getting as much transparency as possible when it comes to how decisions are made. Being open for receiving feedback and giving feedback is important in this step. This can be seen in medical action teams when the team is discussing the next step and are giving each other feedback.

The way of looking at adaptive leadership like Ramalingam et al (2020) did is also used in other studies, which gives it more credibility. One of these studies is the approach of adaptive leadership of Northouse (2016). Both these approaches to adaptive leadership are looking into adaptive leadership as a process. Ramalingam et al (2020) did this with the four A's, Northouse (2016) did this with three elements in the process: situational problems, leader actions and adaptive work. He is focused on the situational problems first, which means reacting to the situation's needs and possibilities. Subsequently, the actions of the leader are mentioned. This can be compared with articulation when preparing an action as a leader by monitoring the ideas of the members. To summarize, both approaches for adaptive leadership focus on the initial scanning of the situational problems and after that acting upon them as a leader. When the action of the leader is completed, the process of a changing situation starts again.

In general, studies have shown that adaptive leadership in various teams leads to higher team performance. According to the study of Khan (2017), adaptive leadership in educational settings is positively related to performance because the flexibility and orientation toward change is visible. Next to that, they found that adaptive leadership is highly motivating for employees, which also results in higher performance of the team. Research on adaptive leadership in the context of data-driven financial sustainability is also positively related to performance of the team (Akhtar et al., 2016). In this context, there is always a lot of pressure and fast-changing situations since it all is about money. In companies that apply adaptive leadership practices, there is more financial sustainability. In this case, financial sustainability is a factor used to examine the performance of the company. The study of Laur et al. (2021) about health care teams also found a positive relationship with adaptive leadership. They state that using adaptive leadership is needed to meet the changes in the condition of the patient. Using adaptive leadership is according to them highly relevant at almost every level of health care to increase the performance and meet the needed level of caretaking for the patient. In medical action teams, a similar effect might be found because it already has been found in three different contexts, education, financial and health. Especially the health care context has a lot of similarities with the medical action teams, which might be a reason for a similar outcome.

According to Heifetz et al. (2004), adaptive leadership is a process, because this type of leadership exists of ongoing change in processes and situations. The change or adaption is never finished, as there is always another moment of change. One study (Woolard, 2018), examined adaptive leadership as a process (as opposed to the previously described studies, which used aggregated survey measures to assess adaptive leadership). In his study, Woolard is exploring

the use of adaptive leadership in management group projects. The development of the group project is a process with changes in the task at hand. Hence, they also argue that adaptive leadership should be regarded as a process of continuously changing and adapting to effectively accomplish the project.

### **2.3 Communication as a means to study adaptive leadership**

To best capture the adaptiveness of leadership to a given situation or task, adaptive leadership should be studied as a process. Since the behaviours of the leader, as well as the team members, are required to adapt from moment to moment, thus observing how they communicate is one way to study adaptive leadership. Being effective in communication is a vital part for medical action teams, since there is no time for lacking communication when there is a patient's life on the table (Rehim et al., 2017). Furthermore, McKinnney et al. (2004) and Apker et al. (2009) are pointing out that communication is of great importance to the success of action teams.

According to Bowles et al. (2017), communication is one of the most impactful tools an adaptive leader can use. The communication of the leader is of high impact on the team members. Not only the communication of the leader, but also the interaction with the team is of great influence to get a high level of effective communication. For an adaptive leader, there are two important communication processes to make the communication effective (Bowles et al., 2017). First, the ability to clarify information for him or herself and make sure that it is clear for the team members. Second, the ability to clearly and accurately exchange the information between the team. These processes can be recognized in the change in communication and interaction patterns of the leader in the team. Research carried out by Govindarajan (2016) and Bowles et al. (2017) provide different examples that give more insight and concrete knowledge about adaptive communication. According to the experiences in different businesses of Govindarajan (2016), adaptive leaders are reacting on the change in the environment, preparing for the change and making the change. This can be recognized in the change of communication of the leader. When reacting to a change, the communication of the leader is changing and next to that the interaction with the team is changing. When there is adaptive leadership, there is a change in this communication and interaction patterns. Govindarajan (2016) found different behaviours of adaptive leaders like: they bet small before getting big, practice planned opportunism and they are courageous. The situations were causing change in those behaviours

which Govindarajan (2016) therefore found to be a sign of adaptive leadership. Bowles et al. (2017) found in their literature study another example of adaptive leadership. Out of their study, they found the importance of adaptive leadership being about involving the team for ideas and solutions, this as in the communication which can be recognized of the leader but also in the interaction with the team members. It may be considered an example when the adaptive leader is asking the team members what their insights are.

Hence, in teams' different tasks require different forms of behaviour and interaction; the different task processes in teams can be observed over time which therefore include different forms of behaviour and interaction. An often-used framework to understand the different task processes in teams is the model developed by Marks et al. (2001). They developed the Recurring Phase Model in which they distinguish between two phases out of different processes, the action phase and the transition phase. "Action phases are periods of time when teams are engaged in acts that contribute directly to goal accomplishment" (Marks et al., 2001, p.360). These actions can be different depending on context and the team. If the team is a trauma team, the actions can be the bed-making. If the team is an ambulance team, the actions can be measured if there is a heartbeat. The action process consists of four activities: monitoring progress toward goals, systems monitoring, team monitoring and backup behaviour and coordination. The second phase is the transition phase. "Transitions phases are periods of time when the teams focus primarily on evaluation and/or planning activities to guide their accomplishment of a team goal or objective" (Marks et al., 2001, p.360). Thus, in this phase, the teams are evaluating their actions and anticipate on their future actions. An example within a medical action team can be that the team is evaluating the situation of the patient and is discussing if they would treat the patient similarly or different next time. The transition process consists of three activities: mission analysis formulation and planning, goal specification and strategy formulation. To manage the ongoing process of adaptive leadership, the different phases of the process of the team need to be taken into consideration. Both in the action phase as well as in the transition phase there are certain tasks mentioned. This difference in the nature of actions required in the action versus the transition phase, implies that a team needs to communicate differently when going from one phase to the other.

As previously mentioned, not only the communication but also the interaction patterns between the leader and the rest of the team members can be essential; i.e., when a leader adapts his or her communication accordingly, the team members are also required to adapt their communication to match the situation. Otherwise a less optimal way of communication



remains, which might not lead to optimal performance of the team. Bowles et al. (2017) states that the communication of the leader and the interaction between the leader and the team members also affect the performance of the team. Furthermore, Govindarajan (2016) is mentioning that the communication of the leader as well as the interaction between the team members and the leader are important. DeRue (2011) investigated the interaction between leaders and followers and reported that it is a complex adaptive process. In addition, the interaction patterns are part of the communication between the team and the leader. This indicates that he also agrees with Bowles et al. (2017) and Govindarajan (2016) that the interaction between the leader and the rest of the team affects performance.

## **2.4 Aim of the study**

Based on theoretical implications and findings from previous research, it is found that adaptive leadership is a process which can be observed by the communication and interaction patterns of the team. However, in previous research, the added value of adaptive leadership to medical action teams has not been studied. Therefore, this study will attempt to answer the question: *How do a leader and the team adapt their behaviour and interaction patterns from the action to the transition phase in medical action teams?* To find the answer, the following hypotheses will get tested: *H1: There is a change in communication of the leader from the transition phase towards the action phase. H2: There is a change in interaction patterns of the adaptive leader and the team members from transition phase towards the action phase.* Next to this, previous studies found that adaptive leadership in behaviour and interaction is influencing the performance of a team. This question will also be researched in this study by a descriptive post hoc analysis. This post hoc analysis is performed for the question: do we see more adaptive behaviour with regard to the leaders' behaviour as well as the teams' interaction patterns if they work together for a longer period, the team's tenure. Previous studies mentioned that working together for a longer period can be an indicator for more adaptive leadership.



### **3. Research design and methods**

#### **3.1 Research design and participants**

To answer the research question, an exploratory study was conducted based on a secondary dataset. The data was gathered in cooperation with the faculty of Behavioural, Management and Social Sciences (BMS) and the Experimental Centre of Technical Medicine (ECTM). The ECTM is a part of the University of Twente where Technical Medicine students are trained for different actions via simulation cases with lifelike situations and materials. This simulation takes place in the simulated Intensive Care Unit or the simulated Operation Room. The secondary data was used in the form of videos of medical student teams performing and practising Advanced Life Support and performance scores (which are scored by the teachers). In this research, there were three main theoretical concepts: interaction patterns, adaptive leadership and performance. The interaction patterns between all students, leaders and other students were observed to see if there is adaptive leadership and how these patterns are related to the performance of the medical teams. In the research, interaction patterns were the independent variable and adaptive leadership and performance were the dependent variable.

To conduct the research, 87 students participated. These students were all Technical Medicine master's students. For the course Advanced Life Support (ALS), they had to do a simulation in teams of four students. This simulation existed of six rounds. During the first four rounds, the teams could practice with the simulation. The fifth round was a practice exam, and the sixth and final round was the real exam. All the six rounds of all students were recorded. Thus, there were videos of every student team six times. For the simulation, the 87 respondents were divided into 22 groups. Every student has to act as the leader once in the practising rounds. To answer H1 and H2, 1 group was examined, also named team 1. This team is observed since the focus of this study is on the process. This makes following one team through their process beneficial.

## **3.2 Methodology**

### **3.2.1 Team Performance**

To measure the team performance, a scoring list from Gibson et al. (2009) was used which is developed to measure this team's effectiveness and performance. In the scoring list there is a Likert-scale from 1 to 7, with four different subjects on the scale: this team is consistently a high-performing team, this team is effective, this team makes few mistakes and this team does high-quality work. To score with this scoring list, two of the teachers were trained. Next to the training, they got a manual with explanations and they got divided over the groups so each one assessed half of the students.

### **3.2.2 Simulators and equipment**

The study took place at the University of Twente. A simulated Intensive Care Unit and operation room were created. The used rooms were located in the Experimental Centre for Technical Medicine. These simulators are a Human Patient Simulator (ICU) or mobile METIman Patient Simulator, which simulated a lifelike situation of advanced life support. To further treat the patient the right way, the room is provided with all the needed equipment. The room has an Infinity patient monitor where the teams can follow the vital medical functions of the patient like the pulse rate and blood pressure. There is also a Phillips defibrillator in the room, which the teams can use to give the patient an electric shock to get a normal heart rhythm.

### **3.2.3 Recording materials**

Video recordings were made using three ceiling mounted cameras with the METIvision system to record all rounds. The videos of the camera have all been coded with the focus on leadership and communication.

## **3.3 Procedure**

At first, the research was authorized by the Ethical Committee of the University of Twente. After this approval, the students were asked to participate in the study. In the first lecture, the students got information about the research, the objective and how the research is going to be conducted. When the students agreed with participation, they had to fill in an informed consent form. The course of Advanced Life Support exists of three parts: the theoretical lessons, the practical lessons and the final assessment. In the theoretical lessons,

students learned for example how the patient monitor works, how to interpret results and about different treatments. In the practical lessons, the students practiced with a case in one group, just like the practice exam. Every round, another group member was randomly assigned as the team leader, the medication nurse (responsible for all the medicines) and two CPR administrators (giving chest compression and controlling the airway). In the end, there was the final assessment with all of the simulation technology where students get a case and perform to get a grade. The teachers were present in all parts of the course.

For the final exam, the group of students received a randomly selected emergency case. There were eight possible scenarios, these scenarios were supposedly located in or outside the hospital. All the scenarios had in common that there was a need for CPR (shock or non-shock therapy). The students were not informed about the scenario of the case before the exam. The cases were all on the same difficulty level with one extra difficult factor. When the scenario was outside the hospital, the difficulty factor could be interruption by a family member or the press. Before the session started, the case was explained to the team leader. The team leader explained the case to the rest of the students and delegated the tasks. During this moment of data collection, two researchers were present in the room and the two evaluators were in the simulation room to evaluate.

### **3.4 Transcription and coding**

To answer the main question of this study, firstly, all videos were transcribed. Within the transcription, every communication behaviour was coded via a composed codebook. With these codes, the communication behaviours of the students were recognised so they can be compared in the data analysis.

#### **3.4.1 Transcription**

To transcribe the data of the video, the transcription software of ATLAS.TI was used. The videos were watched and the text was typed into ATLAS.TI.

### 3.4.2 Coding

To code the transcripts, a codebook was compiled. The codebook, which consists of ten codes, can be seen in Table 1. To build up the codebook, three different studies and related codebooks were used. Firstly, the codebook of Hooigeboom and Wilderom (2020) was put next to the first transcript and the transcript is coded with this codebook. This study and codebook were chosen because the study focusses on the study of interaction patterns within teams. The first six codes were gathered from this study by checking all the codes in the transcription. Codes that did not occur in the way Hooigeboom and Wilderom (2020) described them, were eliminated. To add some more depth to behaviour in the codebook, the study of Kolbe et al. (2013) and their codebook was used. Their study also focused on action teams and their working behaviours. Again, the procedure from the codebook of Hooigeboom and Wilderom was used. The codebook was used to code the first transcription and all codes were checked. Next, the codes were compared to the codes from Hooigeboom and Wilderom (2020) to make them mutually exclusive. The seventh, eighth and ninth codes in the codebook were therefore used from the codebook of Kolbe et al. (2013). The last code in the codebook was derived from the study of Rico et al. (2021). They also studied behavioural interaction patterns in teams, and therefore this was suitable for this research. This code was chosen because it was filling up the gap while coding the transcripts. This gap was identified since there were sentences which were not suitable for the codes so far and therefore not coded yet. To complete the codebook and to make it completely suitable, the last code of Rico et al. (2021) was added. The codebook can be found in Table 1.

Table 1 Codebook

<b>Coded behaviour</b>	<b>Definition</b>	<b>Example</b>
Correcting	Imposing disciplinary actions; Presenting team members with a “fait accompli”	“No, 100 thousand”
Directing	Dividing tasks among team members (without enforcing them); Determining the current direction	<i>“Ilse, will you feel the pulse this way when we go to do the rhythm check?”</i>
Informing Structuring	Giving factual information Structuring the meetings; Changing the topic; Shifting toward the next point	<i>“There is no breathing” “we’re about to do another rhythm check”</i>
Agreeing	Agreeing with something; consenting with something; reacting at a comment with an agreeing opinion	<i>“Yes, through with compressions indeed” No rhythm indeed”</i>
Disagreeing	Contradicting with team members	<i>“But we can’t just cut off compressions, can we?”</i>
Summary	Team members are summarizing the status	<i>“So, in the meantime, what we already know, the patient has .”</i>
Information request	If one team member directly asks another member for information and confirmation	<i>“I have to put in an infusion too?”</i>
Information related talking to the room	If a team member appeared to address a communication not to a specific team member but to the room at large	<i>“I do 10 ml 100 micrograms per ml adrenaline”</i>
Answering	Answering to a question or situation without giving an opinion or adding new information	<i>“Yes” “No” “Okay” That is pretty high”</i>

The codes then were doubled. All codes were mentioned with an L in front of the code, such as *ldirecting*, are sentences said by the leader. All codes mentioned with an F in front of the code, such as *finforming*, are sentences said by one of the other team members, the followers.

### 3.5 Data analysis

#### 3.5.1 Phase allocation

To start the data analysis, the text was divided into two phases, the action phase and the transition phase. This has been done based on the article of Marks et al. (2001). In Figure 1 there is an example of how these phases can be divided in the text. This division was needed to answer the hypothesis.

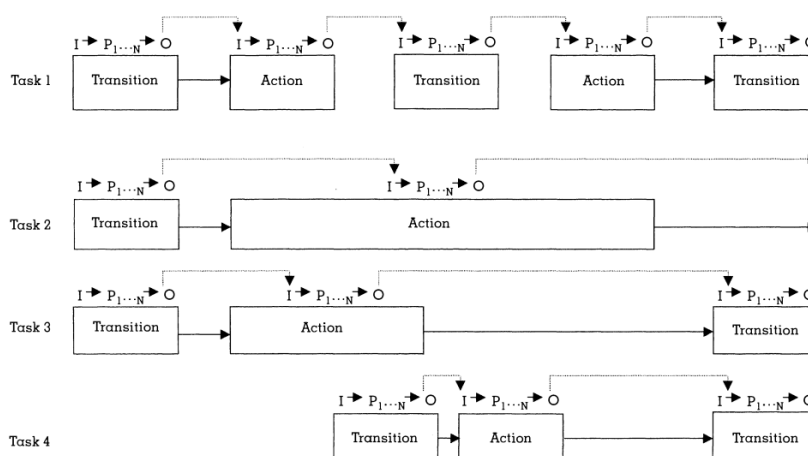


Figure 1. Example of division between action and transition phase. Derived from Marks et al. (2001).

#### 3.5.2 Communication

To analyse the data of the communication, a cross table is made and a chi-square test was carried out. Firstly, the data is put in the statistical program SPSS. The frequencies of all shown behaviours are displayed divided into the two phases, action and transition. The Chi-square test is chosen because, with this test, there can be measured if groups significantly differ from each other. So, in this study, the Chi-square test can compare if the behaviours in the action phase are the same or different from the behaviours in the transition phase. According to Singh et al., (2013) is the working of a chi-square test: “This goodness-of-fit test compares the observed and expected frequencies in each category to test either that all categories contain the same proportion of values or that each category contains a user-specified proportion of values”. Additionally, a Mann-Whitey- U test is conducted to measure the differences between both groups.

### 3.5.3 T-pattern analysis

To get more insight in the difference in communication between the action and the transition phase, interaction patterns are analysed. This analysis was done by using the software THEME. This software looks for patterns which cannot be spotted easily. The program looks for combinations of behaviours in communication that happen regularly and are not a coincidence. It first looks at simple small patterns of two or three behaviours. After this first analysis, the program is searching for more complex patterns, these patterns can for example exist of a couple of smaller patterns together. To let the software analyse the patterns, the data needed to be imported first. To do so, a category table and a syntax file with the behaviours had to be made so THEME could read the data.

A category table, also called a variable-value table of a vvt file, has to be made. The THEME software needs this file to recognise which categories the data includes. The file contains three categories, the actors, timestamp and communication type. Actors A to D called students and had to be on top of the file. The timestamp is below the actors, the b stands for beginning and the e stands for ending. Timestamp b indicates the beginning of a quote and e indicates the ending of a quote. The last category is the communication type, corresponding with the codes from the codebook. A short example of this vvt file is shown below. The whole vvt file is shown in Appendix B.

**Actors**

Astudent

Bstudent

Cstudent

Dstudent

**B\_e**

B

E

**Communication type**

Fcorrecting

Fdirecting

Lcorrecting

Ldirecting

.....

After finishing the vvt file, the syntax file was made. In this file all coded behaviours are noted in a particular way. A separate document was made for both phases in every video and for the phases in all videos together. To ensure that the software could read the data, the

document had a specific way of writing. The file had two columns. In the first row, the time is displayed, this is the time when the coded behaviour was taking place. In the second column, the event at that moment in time is displayed. This event has to be written with the number of the actor, if it is the beginning or the ending of the behaviour and the coded behaviour. The beginning of the whole file needs to start with time 0 and event empty. The end of the whole file needs to be the last time and needs a written “&” in the column of event, so that the program could recognise the end of the file. A short example of this syntax file is shown below.

time	event
0	:
1	astudent,b,lsummary
2	astudent,b,ldirecting
3	bstudent,b,finforming
4	cstudent,b,finforming
5	astudent,b,ldirecting
6	&

All files were imported into the THEME software. After this, the THEME software is asked to fill in some parameters. These parameters were needed to run the analysis. For instance a frequency requirement of three, meaning that a pattern needs to occur at least three times before it will be noted as a pattern. The significance level is set at .05, which gives a probability requirement of 95%. After filling in these parameters, the software runs the analysis.

To compare the interaction patterns in the action and the transition phase, there are different data points that can be compared out of the analysis of the software. When doing so, a difference between the action and the transition phase may imply the presence of adaptive leadership. The first data point used to see if there is a difference in the phases is the *number of different patterns*. This number shows how many patterns there are in the communication and can be compared in the action and the transition phase. The next data point is the *number of*



*pattern occurrences*. This number shows the total amount of patterns that occur in the communication. The data point *patterns length* says something about the number of events that the pattern exists of. So that when the pattern length is high, the patterns are longer and more complex in that phase. Along with the point of pattern length, the point *mean pattern length* is analysed, which gives an idea of how long the patterns can be on average. The next data point is the *mean of pattern levels*. This point gives information about how complex the patterns are. When the pattern just exists of two events occurring after each other, it is a simple short pattern. The pattern can also exist of more layers with the combination of for example 6 events to make a pattern, making it a complex pattern. The data point *number of loops* gives information about the recurring behaviour in a pattern. When the same behaviour is recurring in the pattern, it is called a loop.

The data points mentioned above are mostly about the patterns occurring out of the behaviours. Next to that, the analysis of the THEME software gives information about the actors in the patterns. The data point *mean number of actors* provides insight in the number of actors present in the pattern. *Mean number of actor switches* shows how many times there is a switch between actors in the patterns. *The number of single-actor patterns* shows how many patterns there are, consisting of just one actor. *The number of multi-actor patterns* shows the number of patterns where there were more actors involved. In Table 1 a summary of the used data points for analysis is displayed. In Appendix C, the complete overview of the used parameters and the labels can be found.

*Table 2 Parameters out of the THEME software analysis*

<i>Parameters</i>
Number of different patterns
Number of pattern occurrences
Patterns length
Mean of pattern length
Mean number of pattern levels
Number of loops
Mean number of actors
Mean number of actor switches
Number of single-actor patterns
Number of multi-actor patterns

### **3.6 Post Hoc analysis**

A post hoc analysis was done twice. Firstly, to find out if the performance of the team is influenced by the adaptivity. Secondly, to find out if the phase the team was in the, first practice versus exam, so the team`s tenure, is influenced by the adaptivity. This analysis was trying to see if there was a difference between both phases and was done via a descriptive analysis of the team performance and the first practice and the exam.

#### **- Team performance**

The performance scores of the teams were derived from the scoring lists the teachers used. The teams were scored on four different aspects: the team is a well-performing team, the team is effective, the team makes few mistakes and the team does high-quality work. These aspects were all scored between 1 and 7. 1 being very inaccurate and 7 being very accurate. The four scores of the team were added up to a final performance score. The performance scales can be found in Appendix A.

#### **- Team`s tenure: First practice and exam**

To analyse the difference in adaptivity between the first practice and the final exam, a descriptive analysis was conducted. The frequency of all behaviours in the action phase and the transition phase were compared in both videos by comparing the frequencies of the behaviours and patterns to see if there is a difference. Subsequently, the analysis of the THEME software between the first practice and the final exam were compared.

## 4. Results

### 4.1 Change in communication

Hypothesis 1 claimed a change in communication of the leader between the transition phase and action phase. Both a Mann Whitney U test and a Chi-square test were conducted to see if there is a significant difference between the behaviours in the transition phase and the action phase. In Table 3 the results of these tests are displayed. Out of the Mann Whitney U test, the behaviour Lsummary ( $U = 3.5, p = .017$ ) is the only behaviour with a significant difference in the action phase compared to the transition phase. In the Chi-square test, Lagreeing ( $p = .010$ ) is the only behaviour with a significant difference between the action and transition phase. Two out of the eight behaviours with a significant difference in two different tests is not enough to confirm the hypothesis. This means that hypothesis 1 is rejected. There is no significant evidence that there is a change in behaviour, when it comes to communication, of the leader in the transition phase compared to the action phase.

**Table 3**

*Behaviors Displayed by the Leader for the Transition vs. Action phase*

Behaviors	Frequency		$p$	
	Transition phase	Action phase	Mann-Whitney U	Chi-square
Ldirecting	59	46	.293	.122
Lsummary	18	3	.017*	.062
Lstructuring	29	25	.570	.609
Linformationrelatedtalkingtotheroom	33	24	.421	.151
Linformationrequest	36	41	.809	.059
Lanswering	24	41	.126	.059
Linforming	14	14	.604	.099
Lagreeing	22	17	.685	.010*

\* $p < .05$

### 4.2 Change in interaction patterns

Hypothesis 2 stated a change in interaction patterns in the transition phase as compared to the action phase. In Table 4 the overview of all numbers of the Mann Whitney U test are displayed. Based on this test, there can be concluded that there is no significant difference in interaction patterns when it comes to comparing the transition and the action phase. This means that hypothesis 2 is rejected.

**Table 4***Patterns of Communication Transition vs. Action phase*

Parameters	Frequency		<i>p</i>
	Transition phase	Action phase	Mann-Whitney U
Number of different patterns	81	130	.810
Number of pattern occurrences	463	407	.873
Patterns length	55	59	.810
Mean of pattern length	13,98	13,78	.810
Mean number of pattern levels	7,78	7,54	.688
Number of loops	43	29	.685
Mean number of actors	10,78	9,84	.128
Mean number of actor switches	4,97	4,11	.150
Number of single-actor patterns	29	28	.418
Number of multi-actor patterns	97	57	.872

\**p*<.05

## 4.3 Post Hoc Analysis

### 4.3.1 Higher performing teams

For the assumption that there is a bigger difference in action versus transition phase in higher performing teams, the communication as well as the interaction patterns are analysed. In Table 5 the relation of the behaviours, the performance and the action and transition phase are displayed. The results show that the performance is getting higher in every practice round, with the performance scores being the highest in the last video and the lowest in the first video.

The median score on the performance scales is 5.1. This means that videos 1,2 and 3 are below the median so corresponding with low performing teams and videos 4,5 and 6 are above the median so corresponding with higher performing teams.

Subsequently, a difference between the frequencies of the behaviours in the action phase and transition phase was investigated. The differences in numbers are displayed in Figure 2. The high-performing teams together have a higher difference (68), than the lower performing teams together (64). This indicates that the difference in high-performing teams is higher, which implies more adaptive leadership. However, the total difference is small.

The same analysis was done for the interaction patterns. Table 6 shows the parameters of the patterns in the videos (V), again split up into T (transition phase) and A (action phase). In Figure 3, the differences in the frequencies are displayed. The high-performing teams together have a higher difference (297,86), than the lower performing teams together (111,56). This indicates that the difference in high-performing teams is higher, which implies more adaptive leadership

Overall, both the behaviours and the interaction patterns show a bigger difference in high-performing teams between both phases, indicating more adaptive leadership in high-performing teams compared to lower performing teams.

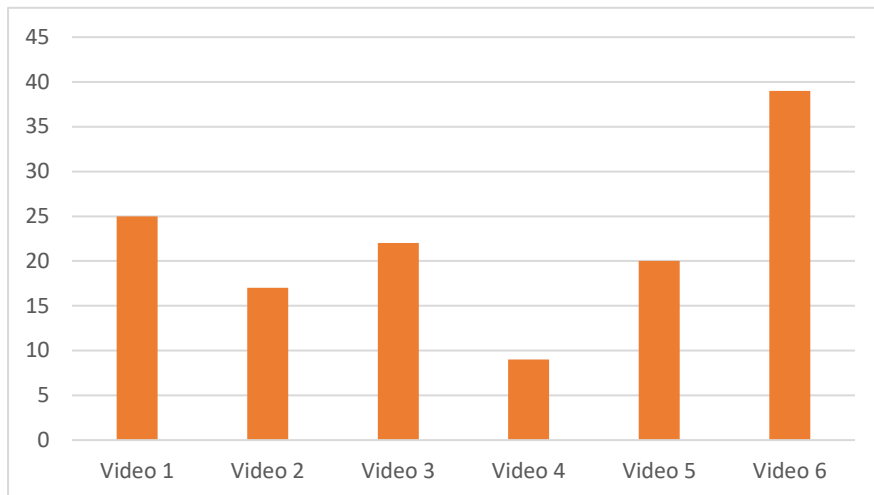


Figure 2: Differences in frequency of communication behaviours action phase vs transition phase

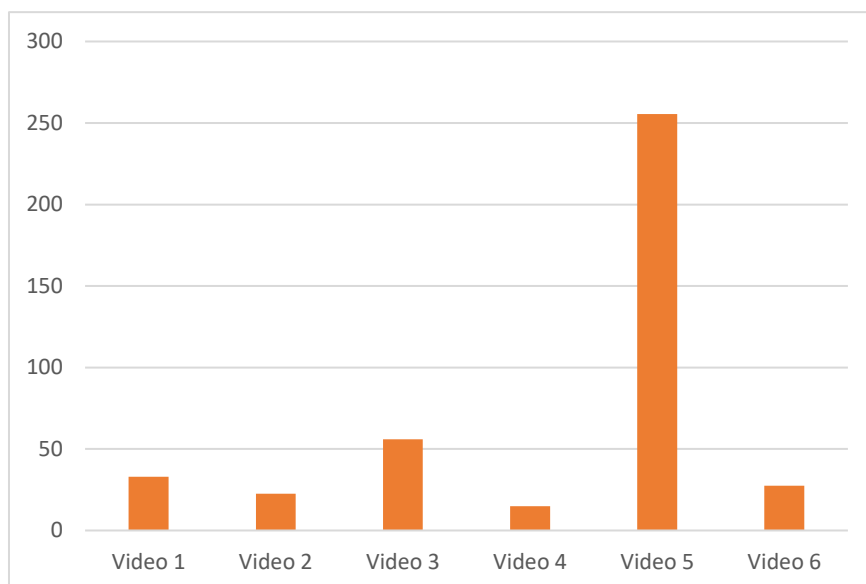


Figure 3: Differences in frequency of communication patterns action phase vs transition phase

**Table 5***Frequency of Behaviours in High or Low Performing Teams Split up in Transition and Action phase*

Videos	Behaviors	Performance (1-7)	Frequency		
			Transition phase	Action phase	Difference
1	Ldirecting	1.5	11	15	4
	Lsummary		2	0	2
	Lstructuring		4	1	3
	Linformationrelatedtalkingtotheroom		2	2	0
	Linformationrequest		4	5	1
	Lanswering		2	12	10
	Linforming		1	3	2
	Lagreeing		0	3	3
2	Ldirecting	2.5	14	5	9
	Lsummary		1	1	0
	Lstructuring		1	2	1
	Linformationrelatedtalkingtotheroom		5	3	2
	Linformationrequest		1	0	1
	Lanswering		2	5	3
	Linforming		1	1	0
	Lagreeing		2	1	1
3	Ldirecting	4.5	5	6	1
	Lsummary		3	0	3
	Lstructuring		4	7	3
	Linformationrelatedtalkingtotheroom		5	6	1
	Linformationrequest		11	2	9
	Lanswering		3	6	3
	Linforming		2	3	1
	Lagreeing		0	1	1
4	Ldirecting	5.75	7	7	0
	Lsummary		1	0	1
	Lstructuring		3	3	0
	Linformationrelatedtalkingtotheroom		3	4	1
	Linformationrequest		1	4	3
	Lanswering		1	4	3
	Linforming		1	1	0
	Lagreeing		2	3	1
5	Ldirecting	6	9	6	3
	Lsummary		5	0	5
	Lstructuring		9	4	5
	Linformationrelatedtalkingtotheroom		7	9	2
	Linformationrequest		11	12	1
	Lanswering		9	5	4
	Linforming		3	3	0
	Lagreeing		6	6	0
6	Ldirecting	6.75	13	7	6
	Lsummary		6	2	4
	Lstructuring		8	8	0
	Linformationrelatedtalkingtotheroom		11	0	11
	Linformationrequest		8	18	10
	Lanswering		7	9	2
	Linforming		6	3	0
	Lagreeing		6	3	0

**Table 6**  
*Frequency of Patterns Split up in Transition and Action phase*

Parameters	V1		V2		V3		V4		V5		V6	
	T	A	T	A	T	A	T	A	T	A	T	A
Number of different patterns	9	14	5	5	19	11	6	8	74	29	13	18
Number of pattern occurrences	41	57	25	15	69	38	21	26	255	104	52	67
Mean number of pattern occurrences	4.56	4.07	5	3	3.63	3.45	3.5	3.25	3.45	3.59	4	3.72
Patterns length	7	12	2	5	10	9	4	6	18	14	14	13
Mean of pattern length	2.22	2.43	2.4	2	2.26	2.09	2.17	2.25	2.78	2.79	2.15	2.22
Mean number of pattern levels	1.22	1.36	1.4	1	1.26	1.09	1.17	1.25	1.58	1.62	1.15	1.22
Number of loops	4	5	3	1	8	3	1	4	22	12	5	4
Mean number of actors	1.67	1.71	1.8	1.4	1.79	1.55	1.83	1.63	2	1.83	1.69	1.72
Mean number of actor switches	0.67	0.79	0.8	0.4	0.84	0.64	0.83	0.63	1.14	0.93	0.69	0.72
Number of single-actor patterns	3	4	1	3	4	5	1	3	15	7	5	6
Number of multi-actor patterns	6	10	4	2	15	6	5	5	59	22	8	12



### **4.3.2 Difference in the team`s tenure, first practice versus the exam**

To analyse the assumption that there is more adaptive leadership in exam video 6 than in the first practice video one, both the behaviours and patterns are taken into account.

In video 1 there is a difference in behaviours between the action and the transition phase. This difference is also displayed in Figure 2. The difference in frequencies in the first video is in total 25 between both phases. In video 6 the difference in frequencies is 39. Comparing both differences, in video 6 the difference is higher, 39 against 25, which implies more adaptivity in video 6 when it comes to the behaviours.

In video 1, there is also a difference in interaction patterns. This difference is also displayed in Figure 3. This difference in video 1 is in total 33. In video 6 the difference is only 27,48. Comparing both differences, in video 1 the difference is higher, 33 against 27,48. This implies there is more adaptive leadership in video 1. So, this contradicts the assumption that there is more adaptivity in the sixth exam video than in the first practice video 1.

To conclude, looking at behaviours, the adaptivity is higher in video 6 and looking at the interaction patterns, the adaptivity is higher in video 1. This means the assumption cannot be confirmed since the outcome contradicts one another.

## 5. Discussion

This study aimed to explore if a leader adapts his or her behaviour during a medical simulation accordingly to what the task requires and whether this would be more effective for the performance of the team. The approach taken provides more insight into the different leadership processes in the context of medical action teams. The insights of this study not just add a contribution to the literature by examining the in-site behaviour of a medical team, but could also be used for practical development of for example training given to medical action teams.

The first hypothesis was focused on the change in communication in the transition versus the action phase. The findings showed that there was a significant difference in the summary behaviour of the leader. This means that there was a difference in the frequency of “summarizing” from the leader when the action and the transition phase are compared, it was higher in the transition phase. The significant difference between these phases implies adaptive leadership since this change can be seen as adaption to the situation. The same goes for the “agreeing” behaviour of the leader, this behaviour was also of significant difference. Meaning that there was a difference in frequency of “agreeing” from the leader in the action phase compared to the transition phase, it was higher in the transition phase. This implies again adaptive leadership since the change can be seen as adaption. Out of the eight measured behaviours, this is not enough to accept the hypothesis claiming a significant difference between the behaviours in the action phase versus the transition phase. So, there is no significant proof of adaptive leadership being present.

For the second hypothesis, when it comes to the interaction patterns of the team, no significant difference between the action and the transition phase was found. This means that a team roughly shows the same interaction patterns with regard to communication and does not adapt when the task changes. This means there is again no significant proof of adaptive leadership being present.

However, in the descriptive analysis, when the team was performing on a higher level, the results did show that the leader adapted his or her behaviour more strongly when going from the transition phase to the action phase. The behaviours of “information request” and “information related talking to the room” are increased the most. This therefore implies more adaptive leadership when the team is higher performing. In the second descriptive analysis

about the team`s tenure, the results showed that the interaction of the team is more adaptive, when going from the transition phase to the action phase in the last video compared to the first video. This implies that there is more adaptivity in the last video compared to the first video. However, the results of the interaction patterns are contradictory. These results show that when it comes to the change of interaction patterns in the action versus the transition phase, there is more adaptivity in the first practice round compared to the last round. This means that the results of the behaviours versus the results of the interaction patterns in the team`s tenure, the first compared to the last video, are contradicting in terms of adaptivity.

## **5.1 Theoretical implications**

First of all, with this study we cannot fully accept the hypothesis that there was a change in the behaviour of the leader comparing the transition phase to the action phase. This is not in line with what was expected in the first hypothesis, a change of communication of the leader from the transition to the action phase. When looking at previous research, Yukl & Mahsud (2010) mention that adaptive leadership entails the change of appropriate behaviour for the switch of situations, whereby this switch needs to be relevant to the situation. When looking at the results of this study, there is no significant difference in behaviours of the leader between the transition and action phase. However, according to Marks et al. (2001), the change between these phases is a switch in situations that require different types of behaviour. Since this study used student teams, it could be that the students are not trained as much as professionals are to recognize the different tasks and variation which is needed in the situation and therefore did not switch enough between the behaviours during the different situations. Next to that, it could also be due to the length of the videos, which gives less opportunity to change in situations because the situation is short.

Another explanation could be that the phases Marks et al. (2001) described were based on regular teams. Action teams are not regular teams. It could be hard to distinguish between both phases since action teams do have a standard way of working, but most of the time with different team members. Also, Govindarajan (2016) is claiming adaptive leaders have to react to change in the environment. They have to prepare for the change and make the change. So, as mentioned by Govindarajan (2016), when the leader is reacting on change, there is adaptive leadership. The behaviours “summary” and “agreeing” were the only behaviours found to be different in the transition versus the action phase. The behaviour “summary” could be placed

in line with the expected hypothesis since summarizing is a behaviour clearly fitting in the transition phase. The reason this fits well is that in the transition phase the evaluation is taking place, during this evaluation, summarizing is most of the time used. This entails summarizing what has happened. With more summarizing, the evaluation could be more accurate since it focused on what really happened. In the action phase there is most of the time no time to summarize because the active treatment of the patient needs more attention. The behaviour “agreeing” could be more present in the transition phase since in this phase the focus is also on consensus, which can imply more agreeing.

When comparing the results of the first hypothesis with the study of Yukl & Mahsud (2010) and the study of Govindarajan (2016), this implies that there is no adaptive leadership in this dataset when it comes to communication behaviours of the leader. When taking into account whether the team was performing effectively in a given simulation, a comparison of the leader’s behaviour between the action and the transition phase shows that the leader did adapt his or her behaviour more strongly between the phases when the team was performing better. According to Khan (2017), this can be expected, since Khan stated that adaptive leadership is causing high-performing teams. These results are therefore supporting the claim of Khan. Khan added to this that adaptive leadership is getting teams motivated more which is leading to higher performance. Motivation can be a reason why we see higher performance and teams show more adaptive leadership. So far, this is supported by the results of this studies post hoc analysis since the higher the performance, the more adaptive leadership there was. Therefore, in further research, looking into motivational aspects can be beneficial.

When comparing the result of the post hoc analysis to the study of Yukl & Mahsud (2010), who found that changed behaviour needs to be accurate for the situation to be adaptive leadership, it seems that there is less adaptive leadership, which also could mean that this higher adaptivity has not made the team’s performance higher. Another explanation for this can be that the different phases are not seen as a switch of situations, Marks et al. (2001) might have meant another kind of switch in situations than Yukl & Mahsud (2010) did. Marks et al. (2001) found the difference between the action and the transition phase, which is also meaning the switch of in situations to be from one phase to the other. The difference between Marks et al. (2001) and Yukl & Mahsud (2010) can be in interpretation of the meaning of switching in situations. This could influence the results of this study since the switch of Marks et al. (2001) could be almost unnoticeable and the switch Yukl & Mahsud (2010) talked about can be a switch way bigger.

The second assumption is about the team`s tenure. The time that the students in the teams were working together, is longer in the final practice video as compared with the first video (i.e., longer tenure). Meaning that they know each other better, even if they did not do every practice together. According to the claim of Laur et al. (2021), it can be way more difficult to work together the first time when you do not know each other than the second, third or fourth time. Hence, we expected that with higher tenure in the team, they understood better what the task required from the team, leading to a bigger change from the transition to the action phase. This study is confirming that partly, because when it comes to communication, there is more adaptive leadership in the final exam video than in the first practice video. The leader is directing more, is summarizing more and is more talking to the room on an information related basis. However, when looking at the interaction patterns of the team, it seemed that there is more adaptive leadership in the first video than in the sixth. This result is not in line with the findings of Laur et al. (2021) about adaptive leadership and is also not in line with what this study expected. The reason is that they found that there should be more adaption in the last video because the team members are then working longer together, which is also what this study expected. However, there is no clear explanation found why there is more adaptive leadership when looking at the patterns in the first video.

## **5.2 Practical implications**

The goal of this study was to explore if adaptive leadership can be beneficial for medical action teams to use. On the basis of the comparison with the tests, the findings of this study implied that there was no adaptive leadership. This therefore does not confirm the statement that adaptive leadership can be beneficial for medical action teams to use. When looking at the post hoc analysis, the result of the assumption about more adaptive leadership in higher performing teams is confirmed. This result can be used in the practice of training medical action teams. One of the practical relevance of the study can be important and useful for training purposes, for instance for the course of Advanced Life Support at the University of Twente. Therefore, this study can also be used by the Experimental Centre for Technical Medicine, which is also part of the University of Twente and master Technical Medicine. The results can be used for experiencing adaptive leadership during the training of medical action teams and in the Experimental Centre since it could be beneficial for the performance of the team. Next to this, the framework of Marks et al. (2001) can be used in training the students. When the

students reflect on themselves, the phases can be recognised and a discussion can come up to reflect on the amount of adaptation the students show. The students can ask themselves if they change their behaviours and their interactions enough when the situation and the phase are changing. Looking at this can be very beneficial in reflecting since it gives an new and different way to look at themselves. More research can be beneficial for understanding even more, but the results of this research can already be used in practice to experience.

Furthermore, this study could also be of practical relevance for action teams that want to get more insight into the connection with adaptive leadership. This study is the first step towards this insight. Most of the action teams work with an experience centre to try out new ways of working. Reflective practises are important to learn from this experience. Focussing on the level of adaptive leadership can be used for these medical teams to enhance how they reflect on their performance after they did the simulation. These teams can try to use adaptive leadership more to find out if it is also causing higher performing teams.

### **5.3 Limitations and recommendations for future research**

There are a few limitations which can influence the outcomes of this study. Firstly, in the study, only one team was followed so the study cannot compare different teams. Both of the hypotheses could not be accepted, this can possibly be explained by the small sample size of just one team. In this study, six videos were taken into account. The study would have been stronger with more videos to compare to each other. However, this type of data collection, the observation and coding, is very labour-intensive and leads to a lot of data points to work with. Hence, also with such a more longitudinal design and tracking of one team, it is possible to study adaptive leadership and team interaction. To overcome this problem, more teams should be followed so they can be compared.

Another limitation is that this team does not exist of the same students in every video, although the general composition was roughly the same for the course of six weeks. This means the data of the videos are not completely comparable, which can be beneficial for the exact comparison, since there were different students at different times. However, in actual medical teams, a comparable situation in terms of varying people is present. The assumptions about the team`s tenure, the first video compared to the last video, are also based on just one video of the first time and one video for the last time. Next to that, the time duration of every

video was not the same. On average, the meetings lasted 20 minutes. Meaning that the duration between videos differed, which might also affect the outcomes of the study. In shorter videos there can be in general less communication than in longer videos. To overcome this problem, standardization of the cases and the script could be an option to make the data more similar to compare. This has not been done in this study since the course was already set up that way.

Secondly, the sample used for the study might be a limitation. In this study, only students from the University of Twente in the Netherlands participated. This makes it a fairly homogenous group that might be trained in specific ways during their Technical Medicine studies. This fact can have consequences on the generalizability of the study. The results can be less generalizable. A suggestion for further research will therefore be to conduct the study again, with a larger sample size with more videos and student teams from other educational settings and in other countries as well included.

Another limitation of this study is the way adaptive leadership is examined. According to Govindarajan (2016), an adaptive leader is next to the change of situation at the same time focussing on the weak signals his or her team members are showing. Weak signals are defined as social barometers, focused on body language and feelings of the team members. These weak signals are sometimes hard to recognise, but that is then the task of the adaptive leader. The framework of Marks et al (2001), did not mention these weak signals. Weak signals are described as movements that can indicate that something is changing. The team member is not literally saying that he or she does not like something or feels different, but by the way the team member is acting the adaptive leader noticed it. This means that adaptive leadership can also be seen via weak signals. In this study, the behaviour is taken into account, next to the interaction patterns. This means that the described weak signals are not taken into account in this study. Doing so, it might be that there was a lot of adaptive leadership which now is not seen. A suggestion for further research is therefore to include the soft aspects of adaptive leadership to find out if those are a determining factor for spotting adaptive leadership.

Recommendations for further research would be, next to the ones mentioned above, to investigate adaptive leadership in different contexts. In addition, future studies could focus more on the soft sides of adaptive leadership, like the weak signals Govindarajan (2016) is mentioning. This might be very beneficial to the research about adaptive leadership since leadership has soft sides which cannot always be seen in spoken language. This entails for example body language and looks that are exchanged. Next to adaptive leadership alone, it

could also be very interesting to try this out with other leadership styles to see which leadership style is most beneficial for these medical action teams and action teams in general.

## **6. Conclusion**

This study aimed to explore if adaptive leadership was present in medical action teams and whether this would influence the performance of a medical action team. This was assessed by looking at the actual, in-situation, communication of the leader as well as the interaction patterns of the team in the action and the transition phase. These observed behaviours were also examined in relation to the performance of the action and in relation to the tenure of the team. The results showed that there is no proof that there was adaptive leadership present via the behaviours, as there was no difference between the transition and the action phase which implies nothing to little adaptive leadership. The same results were found for the interaction patterns of the team. Hence, the medical action teams did not change their way of communicating from the transition to the action phase, which implies adaptive leadership is not present. However, the post-hoc analysis is showing that there is more adaptivity in leadership when the team was performing on a higher level compared to when the team was not performing on a high level. When comparing the first video with the last video, the team`s tenure, the results contradict each other when it comes to more adaptive leadership since the behaviours are showing more adaptive leadership in the beginning and the patterns are showing more adaptive leadership at the ending.

With these findings, there is a starting point for improving this line of research and starting further research as the adopted methodology might lead to interesting and insightful results about how such teams can enhance their performance. With a larger sample and a broader look at adaptive leadership, including other measures of adaptive leadership in combination with the approach taken in this study, it can be used to investigate adaptive leadership in medical action teams. Next to this, it is a starting point for further investigation into which leadership style is beneficial for a medical action team, and therefore could be generalizable for action teams in general.



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# Appendix

## Appendix A

### List of performance scales

# Teameffectiviteit en prestatieschalen voor docenten

Groep:	_____
Datum:	__/__/__
Tijd blok	_____
scenario nummer	_____
Shock/non-shock:	_____
beoordelaar:	_____

INSTRUCTIEZO  
INVULLEN-NIET ZO:

#### Team effectiviteit

Erg inaccuraat

Erg accuraat

	1	2	3	4	5	6	7
1. Dit team is steeds een goed presterend team.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Dit team is effectief.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Dit team maakt weinig fouten.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Dit team verzet kwalitatief hoog werk.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## **Appendix B**

### **Complete vvt file**

#### **actors**

astudent

bstudent

cstudent

dstudent

#### **b\_e**

b

e

#### **communication type**

fcorrecting

fdirecting

finforming

fstructuring

fagreeing

fdisageering

fanswering

fsummary

finformationrequest

finformationrelatedtalkingtotheroom

lcorrecting

ldirecting

linforming

lstructuring

lagreeing

ldisageering

lanswering

lsummary

linformationrequest

linformationrelatedtalkingtotheroom

## Appendix C

### Parameters and labels THEME

#### *Overview of parameters and their labels in THEME*

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<i>Parameters</i>	<i>Label</i>
Number of different patterns	PatDiff
Number of pattern occurrences	PatOcc
Mean number of pattern occurrences	N_mean
Pattern Length	EtsinPats
Mean of pattern length	Length_mean
Mean number of pattern levels	Level_mean
Number of loops	Hasloop
Mean number of actors	Nactors_mean
Mean number of actor switches	Nswitchces_mean
Number of single-actor patterns	MonoDiff
Number of multi-actor patterns	InterDiff