

Multimedia Communication in Emergency Medical Dispatch Centers: Current Status and Future Research

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Emergency medical dispatch centers are important interfaces between the public and emergency medical resources. The public expects dispatchers to provide sound, safe, and immediate instructions for dealing with life-threatening situations and other emergencies.¹ Dispatchers are gatekeepers for allocation of resources such as ambulances, medical personnel, and hospital capacity, and therefore need efficient tools when prioritizing scarce resources based on the specific needs of the triaged emergency call.

Currently most dispatch centers offer only voice communication, but there is an increasing interest worldwide in how to use other media.²⁻⁵ The use of multimedia communication available through modern mobile phones may improve the information exchange between dispatch centers, patients, and bystanders, and consequently lead to improved quality, reduced unwanted incidents, improved safety, and improved access to health services.³ Potentially, improved communication may also reduce the need for ambulance transportation and the overall cost of care.

The objective of this paper is to present an overview on the state, future, and implications of research on the use of video communication in dispatching and prehospital medicine.

Usefulness of multimedia communication between callers and emergency medical dispatch centers

Video communication creates increased possibilities for a professional to guide and supervise the layperson. For example, the usefulness of video communication through mobile telephones has been demonstrated for a number of medical purposes.⁶⁻¹¹ During out-of-hospital cardiac arrest, bystanders can receive better support from video calls than from audio calls.¹²⁻¹⁵ As shown in these studies, images used by dispatchers can improve cooperation, improve confidence among callers and dispatchers, decrease communication difficulties, decrease the likelihood of undesired incidents, and provide better security for patients and users. Video communication may also enhance diagnostics, provide more and better information about the rescue scene, ease triage and coordination of rescue activities, and may save valuable time.¹²⁻¹⁵

However, video communication with dispatcher assistance has only been studied for simulated cardiac arrest. Medical emergencies are not standardized situations, but happen in a variety of environments with myriad factors which may cause communication problems and delay rescue attempts. Such situations require dispatchers to determine the number of patients involved, the number of people on scene, whether the patient is lying in a supine position, whether the patient is lying in a soft bed or on a couch during cardiopulmonary resuscitation (CPR), that rescuers are able to open the airways, that the patient is breathing, whether rescuers are doing ventilations and chest compressions during cardiac arrest, whether rescuers are struggling with a procedure, whether a bleeding is arterial or venous, whether bystanders or patients could be in a hazardous place such that actions should be taken to avoid further injury, and also to decide whether to dispatch an ambulance, etc.¹⁶ Simulated trials can demonstrate only certain aspects of emergencies, and therefore trials during real emergencies are needed in several different clinical settings.

In a study where dispatchers used early technology, video communication was preferred in spite of poor image quality.¹² Still, more information is needed

on how environmental conditions such as background noise, light, and weather, influence video communication from mobile phones. In a risk assessment of video calls from lay bystanders to dispatch centers, potential delays and poor sound quality were identified as most likely to cause loss of information.¹⁷

In stressful emergencies, bystanders may not be able to activate key functionality on their mobile phones. One possible solution is to let the dispatcher remotely activate functions on the caller's phone. This requires new functionality in technical standards and more knowledge on technological, ethical, and organizational issues.

New research projects should also identify situations — clinical or environmental — in which video communication should not be used. Also, more information on the use of still pictures for communication between patients/bystanders and dispatch centers is needed, as well as whether there are situations where still pictures provide sufficient or better information than video images. Still images from paramedics to hospitals have been successfully used for deciding the right level of care for traumatic hand injuries,¹⁸ but more evidence is needed on when and how multimedia communication between paramedics and dispatch centers is beneficial for patient care.

Multimedia communication and dispatch center workflow

The introduction of video communication between dispatchers and callers may save time, improve communication, and improve the confidence of the dispatchers, but it may also change the workflow in dispatch centers.^{12–14} Dispatchers are usually part of several processes simultaneously when they are communicating or interacting with callers, computer systems, other dispatchers, and other professionals in emergency services and health institutions.¹⁹ This working environment often challenges the mental capacity of the dispatcher. In order not to impose unacceptable loads on dispatchers' cognitive abilities and negatively influence patient care, interventions to organization, workflow, and procedures should be carefully assessed.^{20,21} The introduction of video communication in dispatch centers may cause dispatchers to have most of their attention on the image and less attention on other procedures necessary to solve the situation. The organization of emergency medical services and how multimedia communication can promote or inhibit coordination and collaboration are therefore important research topics to ensure good quality of care. This will depend on how video communication is implemented and integrated in the work flow of the dispatchers, and these topics therefore require further work.

Full scale simulators of dispatch centers, where several dispatchers can work simultaneously to handle medical emergencies have been used for training of dispatchers. In these centers all actions made by dispatchers can be studied and recorded. If extended with video communication capabilities, such simulators may be used for the study of new communication modalities during dispatch. Through observations, analysis of scenario recordings,

and dispatcher interviews, important research questions can be addressed before video calls are used between lay bystanders and dispatchers for real emergencies. These research questions include: In which situations does video communication increase risk for capacity conflicts in dispatch centers? Which factors can hinder effective communication and collaboration when using video communication in dispatch centers? How should video conferencing between callers and dispatchers be implemented in dispatch centers (user interfaces, other technical requirements, and organizational issues) in order to decrease interruptions and optimize workflow?

Multimedia communication and the organization of dispatch services

Dispatch centers receive not only requests during time critical emergencies, but also telephone calls from users needing advice or assistance for other medical problems, for example patients at home with long-term serious disabilities and complex chronic diseases. Multimedia communication may become an important tool to identify patient's needs at an earlier stage, before a more serious situation develops. How such new services should be organized and funded needs more work.

Large scale video conferencing systems are already in use for medical emergencies for collaboration between professionals at different levels of care, using several cameras and with real time transmission of clinical values such as blood pressure, heart rate, and oxygen saturation levels. Such systems have reduced the number of unnecessary transportations and led to an improved level of care.²² In some hospitals, the video conferencing system for medical emergencies has been co-located with the dispatch center, which is useful for teamwork, medical advice, and planning and coordination of transportation.^{23,24} During catastrophes, when the resources in one dispatch center are insufficient to deal with the number of casualties, video conferencing has also been tested between several dispatch centers in order to establish a large emergency dispatch and resource center for coordination of rescue efforts and optimization of treatment.²⁵

Organization of emergency medical services differs among countries. A survey of EMS systems in Europe and the USA revealed a variety of approaches, encompassing the following factors: (1) whether the medical emergency number is co-located with the police and fire departments, (2) the competencies of those who answer the call (emergency dispatchers, paramedics, nurses, physicians, police officers or others), (3) dispatcher training, (4) simultaneous dispatch, and (5) whether dispatchers provide prearrival CPR instructions.²⁶ When interpreting and designing studies dealing with dispatch, these differences must be kept in mind. The introduction of multimedia communication may fundamentally change the competency requirements and training of dispatchers and how dispatch services should be organized. Organizations unwilling to change may not experience the potential benefits of new technol-

ogy.^{20,21} Therefore, projects introducing new communication technology for dispatch centers should be closely followed to generate knowledge from both successes and failures on how to organize such new services.

Dispatch protocols and education

Dispatch center operators commonly use written procedures to triage, instruct, and guide callers during medical emergencies. These procedures are also known as dispatch protocols, such as The Medical Priority Dispatch Systems.²⁷ The Norwegian national procedures, Norwegian Index for Emergency Medical Dispatch, have been translated into several languages, and have been used as a model for such guidelines in other countries.²⁸ Dispatch protocols are designed to improve caller interrogation and pre-arrival and post-dispatch instructions, for example for quick identification of cardiac arrest and to ensure that CPR instructions are provided when appropriate. To optimize the benefits of video communication, these procedures will probably need to be rewritten.¹²

A dispatch protocol for video conferencing instructions on the use of an automated external defibrillator has been developed and tested.¹⁵ In this study, all participants placed the electrode pads correctly when guided by an emergency dispatcher through video mobile phones, and 51 of 52 participants were able to deliver a successful shock. The dispatch protocol written for this procedure illustrates how dispatchers can use images actively during emergency calls, and may serve as a guide for future development of video dispatch protocols.

A simulated trial on the detection of breathing concluded that breathing was only visible from certain orientations of the videophones, at distances less than 150 cm from the simulation manikin, and low camera positioning produced better results than having the camera at the chest level of a standing observer.²⁹ Such knowledge on how camera positions influence diagnostic possibilities is important and should be incorporated into dispatch protocols and dispatcher training.

New procedures need to be tested in both simulated and real emergency trials. Educational and accreditation programs for lay bystanders, dispatchers and other professionals should be updated as well. Important research questions include: How does multimedia change communication between dispatchers and patients/callers? How should dispatcher protocols be designed to optimize the use of images? How should dispatchers be trained to optimize the use of images and dispatcher protocols? How should bystanders be trained in first aid courses to use images in medical emergencies?

Summary

In the stressful and time critical situations following cardiac arrests, traumas, and other medical emergencies, one may ask whether support delivered through video phones increases bystander-initiated CPR, whether such a technique is safe, whether it improves survival, and what is the attitude of callers receiving such instructions? These ques-

tions were also asked three decades ago, when a program of CPR instructions provided by emergency dispatchers was first initiated.³⁰ New communication technology is now available and is changing the way people communicate and interact in their daily lives. The same technology may literally open the eyes of the dispatchers who today are blinded in their communication with callers.³¹ It is about time that emergency medical services start to use richer communication media for the benefit of our patients and the society we are here to serve. As demonstrated in this paper, this new field of research still has more unanswered than answered questions and warrants further research studies.

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