TELEMEDICINE IN FRENCH GUIANA: IMPLEMENTATION AND EMERGENCY CARE PERSPECTIVES

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Abstract

Background: Telemedicine is practiced in Emergency Departments (ED) and Intensive Care Units (ICU) worldwide. It remains either underutilised or experimental, particularly in areas of advanced practice. French Guiana is a French territory in South America. The population is a mix of several nationalities, with 44% living in a high state of precariousness due to poverty, unemployment and crime. The density of medical professionals is the lowest in France, and is essentially concentrated on the coastal part of the territory with 20% of the population living in remote areas over 100 km from the nearest ED. **Aim:** This paper reports the development and effect of equipping remotes health facilities with videoconferencing on emergency care delivery **Methods**: Recent technical improvements in the country provided the means to set up an efficient IT system and strengthen the emergency care offered. The approach consists of several axes of development to secure first-aid in remote sites and improve our territorial and international medevac organisation. Due to the lack of skills, a specific programme for non-emergency health professionals has been designed to allow this advanced practice. Tele-expertise is used to connect the only ICU team in the country to all ED by video, and maintain a permanent link with long-haul medical evacuation flights. It is an opportunity to build medical and scientific cooperation within the Caribbean area by using block chain technology. **Results:** For one year, equipment has been deployed into the main remote sites and secondary hospitals facilities. It allowed a better management of medevacs since the beginning of the recent epidemic of COVID-19 it reinforced the links into the hospital network. **Conclusion:** Even though telemedicine is included in emergency care organisations worldwide, its use depends on the available technical setting, and is still subject to experience that requires scientific validation.

Keywords: French Guiana; telemedicine; emergency medicine; intensive care; medical evacuation; videoconferencing
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Introduction

Telemedicine is being developed and practiced in Emergency Departments (ED) and Intensive Care Units (ICU) worldwide. It has paved the way for new practices and can strengthen the operational capacity of the emergency network.[1] Telemedicine represents a great opportunity to manage care over a wide territory with improvement of decision-making in remote sites, easy access to tele-expertise, and an efficient management of medevacs. In France, telemedicine was written into the Hôpital Patient Santé Territoire (HPST) law in 2009 and benefits from a regulatory framework for its practice.[2] Despite this, telemedicine struggles to find a clear role in medical practices related to emergency care even though its utility is no longer debated.[3]

French Guiana (FG) was a pioneer in the integration of telemedicine in France, thanks to its collaboration with the National Centre for Space Experimentation (CNES) based in Kourou, FG, known for the Ariane and Soyouz rocket launches. Nevertheless, the situation has changed very little since its implementation. Last year, the project benefited from technology evolution with easier to use and miniaturised devices, and improved Internet connectivity.

FG, an overseas department and region of France, is located in the North Atlantic Coast of South America. It is a large area of 83,534 km^2 and an estimated population of 283,540 people, in 2019.[4] FG shelters a unique Amazonian ecosystem and is almost entirely covered with equatorial rainforest. Immigration is the highest of any French territory

due to its gold wealth that attracts thousands of illegal miners, the ease of crossing borders from neighbouring countries, and the quality of its medical care.

The Guianese public healthcare network includes three hospitals located along the coast and sixteen remote healthcare centres spread along the borders with Suriname and Brazil. A regional referral hospital is based in Cayenne, the biggest town of the territory, with 150,000 inhabitants including the surroundings. The regional referral hospital houses the only Intensive Care Unit (ICU) in FG, as well as the Regional Call Centre for Emergencies (Service d'Aide Medicale Urgente or SAMU 973) in charge of managing the urgent medical response and coordination of all rescue at the territory level. In contrast, Private medicine is available in the three principal agglomerations (Cayenne, Kourou, and Saint Laurent du Maroni), spread over a distance of 350 km. It plays a minimal role in the emergency care network.

The density of healthcare personnel is among the lowest in France. Indeed, the density of family practitioners is 44 per 100,000 people against 66 per 100,000 in West Indies and 85 per 100,000 people in mainland France.[5] About 44% of the population live below the poverty line and EDs are perceived by the population as the primary access point to the healthcare system.[5] Often they are undocumented foreigners, without any personal health insurance, using emergencies departments to get medical consultations and drugs for free.[5] On average, 80% of the population live in the coastal zone, and can access the closest hospital in less than 16 minutes by car. The remaining 20% live in remote areas where there are major disparities in available healthcare and access might be counted in hours or (sometimes) in days. The largest ten villages, where the main part of this population live, are more than 100 km from Cayenne, with the two most distant being more than 400 km from Cayenne. Some can be reached by road but most are only accessible by airplane (or helicopter) or by river boat.[6] (Figure 1)

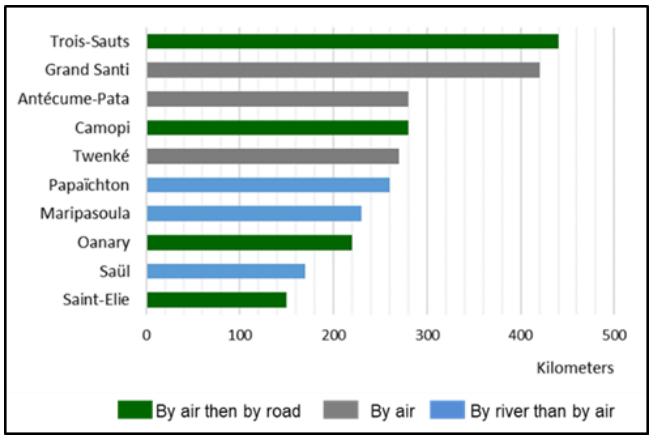


Figure 1. Distance to Cayenne E.D from main remote sites.[6]

In this context, we aimed to implement an interactive telemedicine network to connect the different hospitals in FG to the expert consultants (in Martinique, Guadeloupe, and in mainland France) as well as out-of-hospital teams during ground interventions and medevacs.

Table 1. Time to land to remote sites and return by helicopter. Preparation per outgoing flight is 20 min. (Personal data)

From Cayenne to remote sites	One way flight time with preparation	Total flight time with return
Kourou	30 min	40 min
Cacao	40 min	60 min
Regina	60 min	70 min
Saint-Elie	50 min	80 min
Saint-Georges	55 min	90 min
Saül	60 min	100 min
St Laurent du Maroni	65 min	110 min
Camopi	75 min	130 min
Grand Santi	75 min	130 min
Maripasoula	75 min	130 min
Papaïchton	75 min	130 min
Antecume-Pata	85 min	150 min
Twenké	80 min	140 min
Trois-Sauts	95 min	170 min

Establishment of the technical environment

In the absence of an efficient and secure infrastructure for communication, the use of public social networks became current practice both for remote healthcare centres and local hospitals to keep in touch with experts in FG and abroad. Whilst effective this was done without authorisation and contravenes rules for the confidentiality of medical data. The success of any telemedicine implementation is strongly dependent on the available technical setting. From this point of view, FG has numerous weaknesses in its network with blind parts in the territory. Available ICT infrastructure encompasses the hospital Internet cable, cellular operators and satellite connectivity for some remote areas. The telemedicine technical setting must also be developed at the same time as the communication network is strengthened. The main challenge was to find a "4 wheel drive" IT solution able to work within a multiple technology setting, consuming little Internet or satellite bandwidth whilst using various kinds of devices. To aid the project, a professional consultancy was engaged to design the planned network.[7] (Figure 2) Moreover, their partnership with Inmarsat represented for us a guarantee of sufficient Internet speed whatever the location in the Territory. Access to the call platform is through a simple https connection. All data passing through the system are encrypted and servers host audio or video data only within the time of communication. Users can launch either audio or video conferences (SRTP UDP protocol). The network is also used daily for conference calls with patients or colleagues, to support advanced practitioners, to provide expert second opinion, and for elearning. (Figure 2)

Telehealth and emergency calls management

FG is a multi-lingual territory where French is the official language but where several native dialects and at least five foreign languages are used daily (Portuguese, Spanish, English, Chinese and Arabic). Since some of the population do not speak French, fully comprehending phone conversations during emergency situations is often difficult and requires more effort. As a consequence of this challenge of obtaining reliable information in emergency case, rescue teams are currently sent by default to circumvent possible adverse consequences. The access time to reach remote sites, even by helicopter, is quite long, with an additional 20 min needed to pick up the medical team at the hospital before flying to the patient's location. (Figure 3) A further complication is the experience of local medical teams who might not represent reliable contacts. Their lack of experience and local social pressure to evacuate patients may result in overestimating the seriousness of some medical situation. Internal data screened for the last five years shows that on average, 12% of medevacs by helicopter were not required and could have been managed with a reliable telemedicine system. This represents 108 flights and a yearly cost of €378,000 (~$450,000 USD) that could be saved and used for the telemedicine network. The literature shows that telemedicine allows for better patient assessment at distance and avoids unnecessary transfers.[8]

SAMU 973 partners and advanced practices

In FG, there is a lack of qualified doctors and weaknesses in the emergency care network.[5] The integration of advanced

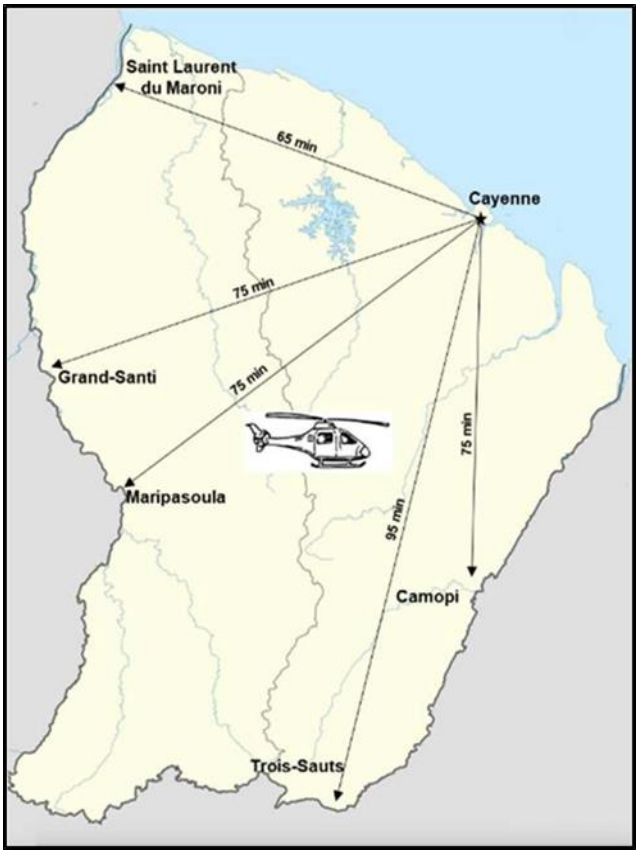


Figure 3. One trip access time to the main remote sites by

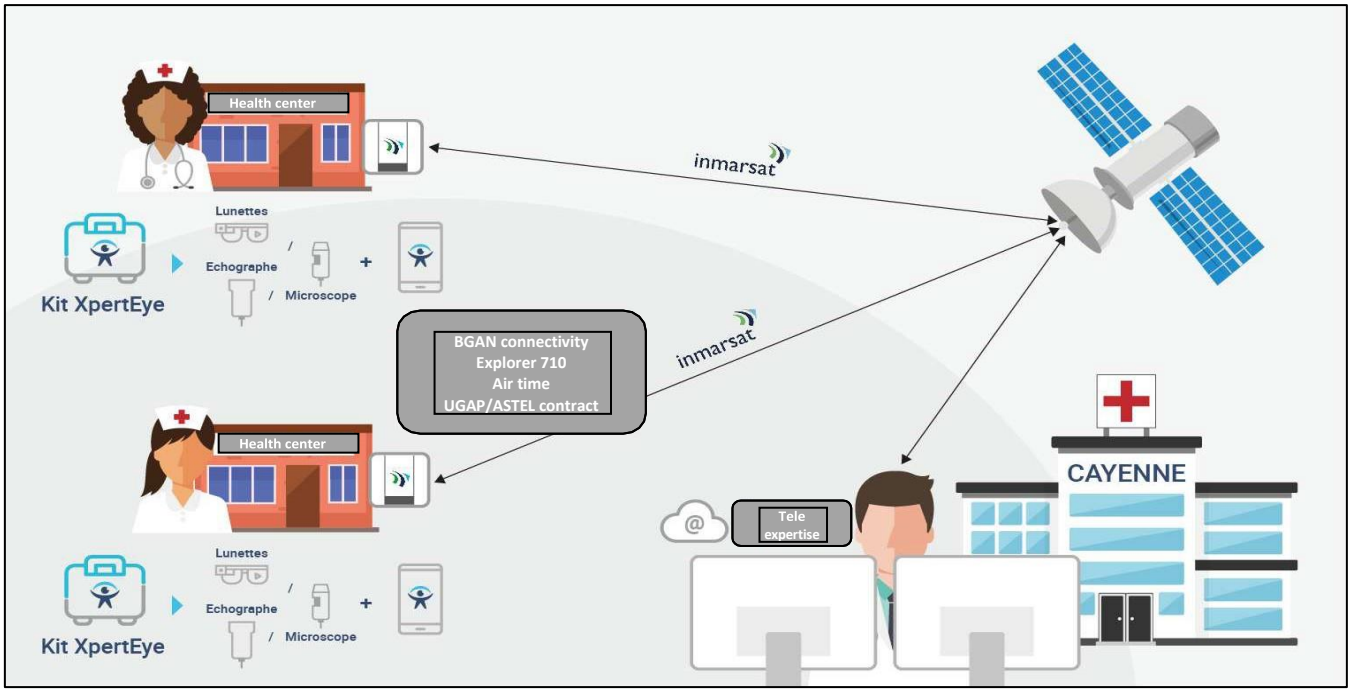


Figure 2. Communication system for connecting remote sites.[7]

practice providers (family doctors or nurses) into emergency management might be deemed an added value, but can raise concerns regarding the potential independence of practitioners and the security of patients.[9] The implementation of advanced practices in emergency medicine, has been adopted as part of a strategy for changing regulations on health.[10] The challenge consists of finding a balance between an appropriate level of training and live permanent support which must be helpful but not intrusive, thereby preserving the self-trust of practitioners working on site and avoiding stress. The success of the telemedicine implementation is also correlated with the launching of post-university training that aims to provide appropriate emergency knowledge for early handling of any critical situation. The latter takes into account capacities of non-emergency practitioners to follow specific procedures with alternative practices for which they are tele-assisted.

According to an internal investigation in 2019, 40% of doctors working in remote areas had already faced critical situations needing mechanical ventilation, which was judged as not feasible before the arrival of the emergency doctor coming from Cayenne (Personal data). This is obviously stressful and can impair or delay the correct performance of procedures by healthcare providers. The literature shows that management of emergency situations requires good conditions at work to prevent stress and burn out.[11] The telemedicine system set up includes a camera worn by the practitioner on site which allows the emergency doctor to guide them remotely and in real time, facilitating life-savings actions. (Figure 4) In our investigation, interviewed professionals declared that this kind of support makes the emergency management less anxiety-provoking for those who have to manage urgent situations without expertise, avoiding any delay in diagnosis or in carrying out the appropriate treatment.

Figure 4. COVID-19 medevac by airplane with connected glasses.

Tele-expertise programme set-up and expert support

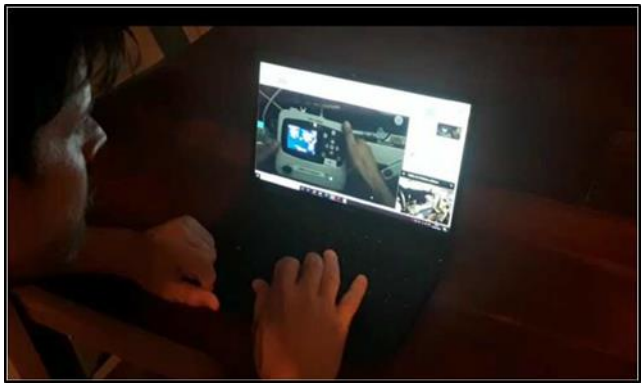
The telemedicine system represents a major technical advance and has opened the door of hospitals to patients living in remote areas. It is possible to organise multidisciplinary consultations remotely, and local caregivers can now benefit from expert guided mentoring in real-time.[12] Chronic disease patients usually have to travel by canoe or plane to reach the referral centre, perhaps located hundreds of kilometres from home, to monitor their condition. It is a challenging journey that often leads to a renunciation of care. The difficulties were compounded during the COVID-19 outbreak when all domestic flights were cancelled. These particular circumstances have sped up the use by specialists of telemedicine to monitor chronic patients.

Thus, despite the period of travel restrictions and curfews, patients were still able to benefit from medical follow up. Furthermore, in FG, some specialists are only based in the referral hospital such as in the only ICU of the territory. Thus others hospitals based in Kourou and Saint Laurent du Maroni, are regularly seeking assistance from the ICU team of Cayenne. ICU doctors regularly reported that it was challenging to get an accurate idea of patients' medical status by phone. Telemedicine allows for better assessment of patients at a distance and avoids unnecessary transfers.[8] SAMU 973 performs on average of 242 overseas medevacs a year to the West Indies or the French mainland. These are always serious cases needing specific medical support missing in French Guiana such as neurosurgery, interventional cardiology or neonatology. Any medevac takes several hours (up to 12 hours) by chartered or regular flights, with limited technical support. Expert support during long-haul flights enhances the quality of care.[13,14] Connected devices have been used during transatlantic commercial as well as military strategic flights to transport patients with COVID to West Indies hospitals. (Figure 5) Moreover, its development is the opportunity to strengthen a medical and scientific cooperation in the Caribbean area by using blockchain technology.[13]

Tele-education or elearning

eLearning is now a common practice worldwide, particularly since onset of the COVID-19 pandemic, but also in isolated locations such as French Guiana where there are few alternatives.[15] Except for some diplomas, most of the post-university education is dispensed in mainland France or abroad. Thus, continuing professional development, which is legally mandatory for French practitioners, is a real obstacle. Surprisingly, elearning is not yet well developed in French Guiana, even though individuals pay attention to actively participating in national or international scientific events as well as attending to regular training at the cost of much effort. Design and implementation of an elearning project for medical education in FG is still a challenge that requires a clear institutional strategy, an adequate framework, suitable Internet connectivity, and , above all, an experienced project

A



B

Figure 5. (A) Care of a new born during a transatlantic medevac flight. (B) Tele-expert support during a transatlantic flight.

leader.[16] Similar to other low and middle-income countries, elearning may mitigate the burden of health worker shortages as well as ensuring high-quality delivery of medical education.[17] Indeed, the plan is to implement an internal programme that develops individual skills, takes into account the needs of practitioners in remote areas, service goals, qualifying courses for younger doctors, and the annual continuing education programme. During the COVID-19 period, regular virtual training benefited teams working in remote areas, especially for implementation of protective measures and providing periodic updates about specific treatments as knowledge evolved. (Figure 6)

Conclusion

The establishment of telemedicine in remote areas such as French Guiana has long been hampered by technical contingencies which have prevented its deployment. The recent development of the Internet network, combined with the availability of user-friendly IT systems allows expansion of its role as part of emergency management. Further deployment of telemedicine makes sense, particularly in regions where the healthcare network is weak and competencies are rare. Furthermore, since the ED of Cayenne

A

B

Figure 6. (A) Medical training by elearning.
(B) eLearning instructor advising the student

Hospital is frequently solicited to support foreign medical teams across neighbouring borders, telemedicine represents an obvious advantage in growing management capacity. Beyond the technical aspects, the most challenging part is still to guarantee the commitment of caregivers in its use as part of their practices. It requires a clear strategy and a solid accountable team for its setting up in the best conditions.

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