https://doi.org/10.55453/rjmm.2023.126.4.10
The article was received on March 09, 2023, and accepted for publishing on June 3, 2023.

ORIGINAL ARTICLE

First Romanian Tele-Echography Network – Preliminary Results

Carmen D. Nicolau[1], Bogdan Cormos[1], Luiza Enache[1], Adrian Tarta[2], Remus Sipos[3], Adrian Saftoiu[4]

[1] Lotus Image Medical Center, Actamedica SRL, Bucharest, Romania
[2] Numeris Com SRL, Bucharest, Romania
[3] University of Medicine, Pharmacy, Sciences and Technology, George Emil Palade, Targu Mures, Romania
[4] Elias University Emergency Hospital, Carol Davila University Of Medicine and Pharmacy, Bucharest, Romania

Correspondence: Carmen Daniela Nicolau, carmen.nicolau@gmail.com

Abstract: *The evolution of society, the development of the Internet, and the increased need for medical services generated the emergence of telemedicine. The visual and auditory connection between the doctor and the patient allowed good communication, but the limitation of the clinical examination remained a problem. Tele-echography complements tele-consults and brings valuable information in many specialties. Our study is conducted on data obtained by organizing the first network of telemedicine with tele-echography in the country. The ultrasound examinations targeted only the abdomen, but the structure also allows tele-echocardiography as well as the extension to other services at distance. The purpose of the study is to objectively assess the ability of tele-echography to complete the teleconsultation with information on which we can rely. The national tele-echography network was created by distributing 40 tele-echographs in the country, one in each county, in the family doctors' offices. The obtained data were analyzed statistically. The study shows that tele-echography can be performed with very good accuracy in synchronous mode but low in asynchronous mode, which required re-examination or resumption of examination in the reference medical center. The widespread use of tele-echography associated with teleconsultations can have favorable consequences on the medical act, the quality of life of the patients and the doctors, and society by reducing pollution and urban agglomerations.*

Keywords: *tele-echography; teleconsultation; abdominal echography*

INTRODUCTION

Telemedicine is defined as a technique that comprises the usage of information and communication technologies (ICT) to enhance the access of patients to distant healthcare providers and technologies [1].

Tele-echography or tele-ultrasonography (Tele US) uses remote transmission to provide enhanced US diagnosis, based on the opinion of remote experts. TELUS is frequently performed at the point-of-care (PoC) by primary care doctors, with a profound impact on patients located at remote destinations [2].

The aim of the organization of the national network telemedicine with tele-echography is to provide patient-centered care, with enhancement in the clinical decision-making for individual cases. The procedures' results are amplified by the involvement of specialists as remote experts [3].

The results of previous studies have motivated the organization of the first tele-echography network in Romania [4,5,6].

In the studies carried out in the field of telemedicine with tele-echography, the following disadvantages are identified: the deficit of specialized medical staff, the difficulties of time management, and the costs of equipment and the internet [7,8,9].

The national telemedicine network with tele-echography is made up of 40 tele-echography centers organized as follows: In each county, the Lotus Image medical center from Targu Mures provided a tele-echography through which tele-consultations, including tele-echography, were performed with the specialists.

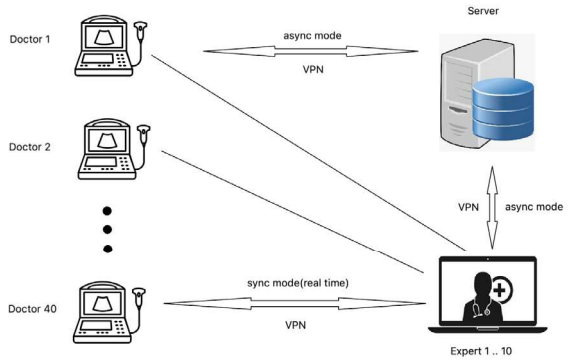
In this preliminary retrospective study, we present the details of this structure and the statistical analysis of the accumulated data from abdominal examinations. The presented data

demonstrate the increase in the quality of the medical service when tele-echography is associated with teleconsultation and motivates the extension to the other specialties: cardiology, obstetrics and gynecology, pediatrics, endocrinology, and senology.

MATERIALS AND METHODS

The components of the tele-echography network are a doctor, portable POCUS device -Telemed LS64 FLT-1T with EchoWave II (EWII) software, a virtual private network (VPN)-secure, private, and encrypted online connection, remote expert. The two main parts of the process are the transmission and reception of ultrasound images. The transmission is done by the ultrasound device and the internet connection. The reception is made up of personal computers or smartphones with dedicated soft. In asynchronous mode, the third component intervenes, the server where echography films are stored and downloaded later by experts. In synchronous mode, the examinations are made at the same time and the result of the examination is issued immediately after its completion.

Figure 1: Tele-echography network



Synchronous examination or real-time is the most appreciated method of examination by patients, examining physicians, and experts because it alleviates the possibility of timely interaction between the three of them, the adjustment by verbal guidance of the examination to obtain the correct images and their interpretation in the clinical context and release the results immediately after the end of the examination.

Asynchronous examination or store-and-forward has the advantage that the videos and results are saved digitally and can constitute both an image database and forensic documentation in case of malpractice process. The second advantage is that it allows greater flexibility in the working time for the patient-examining physician and expert but is subject to the risk of incomplete or incorrect results with the possible consequence of requesting the resumption of the examination from the expert.

The national tele-echography network that was created within this project had both options. As a result, through the activity in the network, a database was established consisting of both the storage of echography videos and of the standardized results.

By entering the standardized elements in an excel database, a complex statistical analysis was possible, which included the following elements: the reasons for the patients' presentation for tele-echography, the number of organs completely or incorrectly reviewed, the ability to visualize the spleen and kidney, the collaboration with the patient to obtain and maintaining apnea necessary for a correct examination of the upper abdomen.

RESULTS

The study group resulted from the selection of approximately 3000 tele-echography abdominal examinations performed in synchronous and asynchronous modes within the created network. The results of the examinations were drafted and standardized, and the parameters were entered into the excel database. Incomplete results and re-examinations were excluded. The created database contains both medical documents and video recordings. The distributions of the ”reasons for presentation” for the tele-echography examination are shown in Table 1, Figure 2. A large proportion of persons presented themselves to the specialist for screening (30.3%). This parameter illustrates the awareness of the population for prevention and confirms the role of this method to meet the needs of the patients. Chronic abdominal pain syndrome and nonspecific syndromes were the reasons for teleconsultation with tele-echography in another third of the patients.

Figure 2: Reasons for the presentation at the tele-echography

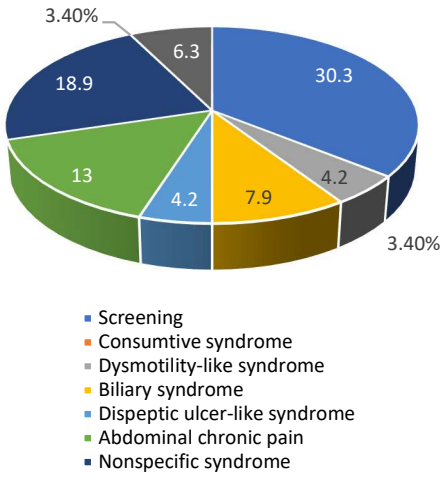


Table 1: The reasons for the presentation at the ultrasound

Reasons for the presentation	Number	Percentage
Screening	144	30.3
Consumptive Syndrome[1]	16	3.4
Dysmolity-Like Syndrome[2]	20	4.2
Biliary Syndrome[3]	38	7.9
Dyspeptic Ulcer-Like Syndrome[4]	60	12.6
Abdominal Pain Syndrome[5]	62	13
Nonspecific Syndrome[6]	90	18.9
High Urinary Syndrome[7]	16	3.4
Lower Urinary Syndrome[8]	30	6.3
Total	477	100

[1] Consumptive syndrome – clinical syndrome characterized by consuming the body's reserves, secondary to the evolution of serious chronic diseases.
[2] Dysmotility-like dyspepsia – bloating, abdominal distention, flatulence, and prominent nausea.
[3] Biliary Syndrome – abdominal pain, especially in the upper right side of the abdomen under the rib cage, nausea or vomiting
[4] Dyspeptic Ulcer-Like Syndrome – discomfort or pain that occurs in the upper abdomen, often after eating or drinking.
[5] Abdominal Pain Syndrome – continuous or almost continuous abdominal pain, slightly related to intestinal function, associated with decreased daily tone, and which has been present for at least the last six months.
[6] Nonspecific Syndrome – Indigestion, abdominal pain with bowel movements, feeling full after eating a small amount of food, nausea, vomiting.
[7] High Urinary Syndrome – Painful urination (dysuria), frequent urination, especially during the day, pain in upper abdomen and back
[8] Lower Urinary Syndrome – blood in your urine (hematuria), difficulty urinating (urinary retention), feeling an immediate urge to urinate, frequent urination, especially during the day, painful intercourse (dyspareunia), painful urination (dysuria), pain in your genitals, lower abdomen and lower back.

Correlation between the parameters in pathology where the ultrasound examination has a major role in the diagnosis such as lithiasis and proliferative disease

Correlations between biliary syndrome and cholelithiasis

Out of 38 patients who complained of biliary syndrome, only 4 were found biliary lithiasis ultrasound aspects, while out of 439 without the biliary syndrome, 25 (5.7%) had cholelithiasis Table 2. The differences are statistically insignificant (p -0.27). The absence of a syndrome in the anamnesis does not exclude a certain type of pathology. The usefulness of the ultrasound examination is obvious in this case.

Table 2: The relationship between biliary syndrome and cholelithiasis

P -0.27			Cholelithiasis		Total
			not	yes	
Biliary Syndrome[1]	not	number	414	25	439
		%	94.3%	5.7%	100.0%
	yes	number	34	4	38
		%	89.5%	10.5%	100.0%
Total		number	448	29	477
		%	93.9%	6.1%	100.0%

[1] Biliary syndrome: Abdominal pain, especially in the upper right side of the abdomen under the rib cage. Nausea or vomiting with or without icter

Correlations between high urinary syndrome and renal lithiasis

Of the 16 people who complained of a high urinary syndrome, only 2 were labeled with renal lithiasis. Of the 461 people who did not report a high urinary syndrome, only 18 were labeled with renal lithiasis. The differences are statistically insignificant (p -0.14), Table 3.

Table 3: The relationship between high urinary syndrome and renal lithiasis

P -0.14			Renal lithiasis		Total
			not	yes	
High urinary syndrome[1]	not	number	443	18	461
		%	96.1%	3.9%	100.0%
	yes	number	14	2	16
		%	87.5%	12.5%	100.0%
Total		number	448	457	20
		%	93.9%	95.8%	4.2%

[1] High urinary syndrome: upper back pain, dysuria, polakiuria, with or without macroscopic hematuria, fever, chills

Correlations between lower urinary syndrome – hypertrophy of the prostate

Of the 31 people who reported down urinary syndrome, 7 (22.6%) were labeled benign hypertrophy of the prostate (BPH). Of the 446 people who did not report a urinary syndrome down, only 43 (9.6%) were labeled with BPH. The differences are statistically significant (p -0.03), Table 4.

Table 4: The relationship between lower urinary syndrome and benign hypertrophy of the prostate (BPH)

P -0.03			BPH not	BPH yes	Total
Lower urinary syndrome[1]	not	number	403	43	446
		%	90.4%	9.6%	100.0%
	yes	number	24	7	31
		%	77.4%	22.6%	100.0%
Total		number	448	427	50
		%	93.9%	89.5%	10.5%

[1] Lower urinary syndrome: difficulty urinating (urinary retention), feeling an immediate urge to urinate, frequent urination, especially during the day, painful intercourse (dyspareunia), painful urination (dysuria), pain in your genitals, lower abdomen and lower back pain with or without hematuria, fever, chills

Tele-ultrasound examination skills

We analyzed the examiner's ability to highlight the abdominal organs that present difficulties of ultrasound examination at the classical, direct examination. One of the factors that makes ultrasound examination difficult is obesity. That's why we analyzed the number of unchecked organs and the body mass index (BMI).

Number of unvisualized organs and body mass index (BMI)

In 41 cases an organ was not revealed, in 5 situations two organs were not visualized, in 4 cases – 3 organs, in one case – 5, respectively 9 organs. In cases where an organ has not been visualized, 4 (13.3%) people with obesity grade II are noted, or 17 (10.4%) overweight people. Situations with two unvisualized organs were identified in normal or overweight people Table 5.

Table 5: Relationship between BMI and number of organs not viewed

P -0.98			No invisible org 0	1	2	3	5	9	Total
BMI[1]	under ponderal	number	18	0	0	0	0	0	18
		%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	normo ponderal	number	123	11	2	1	0	1	138
		%	89.1%	8.0%	1.4%	0.7%	0.0%	0.7%	100.0%
	Supra ponderal	number	144	17	2	1	0	0	164
		%	87.8%	10.4%	1.2%	0.6%	0.0%	0.0%	100.0%
	obesity grade I	number	103	8	1	2	1	0	115
		%	89.6%	7.0%	0.9%	1.7%	0.9%	0.0%	100.0%
	obesity grade II	number	26	4	0	0	0	0	30
		%	86.7%	13.3%	0.0%	0.0%	0.0%	0.0%	100.0%
	obesity degrees III	number	11	1	0	0	0	0	12
		%	91.7%	8.3%	0.0%	0.0%	0.0%	0.0%	100.0%
Total		number	425	41	5	4	1	1	477
		%	89.1%	8.6%	1.0%	0.8%	0.2%	0.2%	100.0%

[1]BMI = weight (kg)/height (cm^2)

Relationship between tele-ecographist and spleen visualization

The spleen has the same characteristics in ultrasound examinations as kidneys: intestinal gaseous overlaps and the chest cage make it difficult to examine these organs. Therefore, we evaluated the feasibility of the method by establishing the vision rate of the spleen at each of the examiners included in the study. The results, contained in the table below, demonstrate the uniformity of this parameter and support the promotion of the patient's examination method (Table 6).

Number of unidentified organs during an examination

The first condition for correct examination is the honesty of the examiner; declaring the parameters unidentified during the examination makes sure that they will be evaluated in other conditions (e.g. after the treatment of reducing bloating, examination of the bladder in the replete or gallbladder of fasting) or with other imaging means: retroperitoneum by CT or MRI, prostate by an endorectal probe, genital organs by an endovaginal probe (Table 7).

Table 6: Relationship between tele-ecographist and spleen visualization

P -0.96			View the spleen		Total
			not	yes	
Teleecographer	Other	number	0	19	19
		%	0.0%	100.0%	100.0%
	CJ	number	2	59	61
		%	3.3%	96.7%	100.0%
	PV	number	11	358	369
		%	3.0%	97.0%	100.0%
	RS	number	1	27	28
		%	3.6%	96.4%	100.0%
Total		number	14	463	477
		%	2.9%	97.1%	100.0%

Table 7: Relationship between the tele-ecographer and the number of unvisualized organs

P -0.38			No invisible organs						Total
			0	1	2	3	5	9	
Tele ecographer	Other	number	18	1	0	0	0	0	19
		%	94.7%	5.3%	0.0%	0.0%	0.0%	0.0%	100.0%
	CJ	number	57	4	0	0	0	0	61
		%	93.4%	6.6%	0.0%	0.0%	0.0%	0.0%	100.0%
	PV	number	325	35	3	4	1	1	369
		%	88.1%	9.5%	0.8%	1.1%	0.3%	0.3%	100.0%
	RS	number	25	1	2	0	0	0	28
		%	89.3%	3.6%	7.1%	0.0%	0.0%	0.0%	100.0%
Total		number	425	41	5	4	1	1	477
		%	89.1%	8.6%	1.0%	0.8%	0.2%	0.2%	100.0%

The two cases in which no organ could be visualized were correlated with very low acoustic impedance, increased BMI, and difficulties in maintaining clinostatism and apnea, due to the accusation of comorbidities, in conditions of postprandial examination and with the bladder in vacuity. In these cases, the limits of the method are declared and the patient was guided to imaging methods compatible with their particularities.

DISCUSSION

The terms used in this study are based on the recommendations of EFSUMB 2018 in which it is specified that the ultrasound examination suggests diagnostic hypotheses, but does not make a diagnosis [10]. To extend the accumulated experience to other specialties, we analyzed the studies published in the following areas: emergency medicine, obstetrics, gynecology, cardiology, pediatrics, musculo-skeletal, and pneumology.

Portable ultrasound units were used in the initial phase of trauma resuscitation for Focused Assessment with Sonography for Trauma, based on triage protocols for trauma patients by paramedics emergency physicians: infield FAST or e-FAST examinations. The study demonstrated similar quality with original movies; after 20 min lecture on FAST and US system presentation TeleUS (FAST) for US naive paramedics by emergency physicians was performed FAST on a patient with real-time EP connection. The result of the study was 100% complete views, with a mean time of 262 seconds (< 5 minutes) [11].

Obstetrics and gynecology: lack of fetal radiation exposure make teleUS the perfect tool for geographically isolated pregnant patients. Confirmation of intrauterine pregnancy, monitoring of fetal growth, and evaluation of pregnancy-related complications, with markedly reduced costs, were demonstrated in the studies [12,13,14].

Echocardiography is indispensable in clinical decision-making remote fetal echocardiography congenital prenatal heart disease left ventricular systolic function, LV ejection fraction [15].

Remote spatial applications International Space Station applications, 2h pre-flight training modules, 60 min in-flight session, e-learning system for US operators, no consistent significant effects of long-duration space flight on

echocardiographic variables [16,17,18].

The use of ultrasound in the examination of musculoskeletal structures exceeded the limit of the penetrability of ultrasound through the bone and allowed the opening of new horizons both in direct examination and by tele-echography including self-examination [19].

In pediatrics, the use of point-of-care ultrasonography (POC US) is very useful [20].

During the COVID-19 pandemic, it was necessary to use all diagnostic means including ultrasound, which proved to be a low-cost tool very useful in remotely guided pulmonary resuscitation [21].

Tele-echography in addition to teleconsultations is a unanimously accepted aid.

The main problem is the number of specialists needed to solve the increasing demand for tele-echography services. The solution can be to accredit the overspecialization of the nurses in synchronous tele-echography, and the use of artificial intelligence in the field of tele-ultrasound.

On the existing structure, other types of ultrasound examinations are carried out: echo cardio, thyroid echo, and peripheral eco doppler, which is the subject of ongoing studies.

In the future, networks, such as those described, can be organized in human communities such as militia units, refugee camps, children's camps, and theaters of battle.

CONCLUSION

Portable hand-held ultrasound devices will move this valuable medical investigation near the patient and the medical society must prepare for this stage.

Future research directions may be a combination of tele-consultation with other investigations that can participate in the diagnosis of the remote patient: tele-EKG, tele EEG, tele-dermatoscopy, tele-otoscopy, telemedicine stethoscope.

Conflicts of interest and sources of funding

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Acknowledgments

This work was supported by a grant from the Ministry of Research and Innovation project number ID P_34_498, within MFE 2014-2020-POC.

Authors' contribution

Conceptualization, Nicolau Carmen Daniela and Luiza Enache methodology, Cormos Bogdan; software, Adrian Tarta validation, and formal analysis, Adrian Saftoiu, investigation, Remus Sipos resources, Nicolau Carmen Daniela; writing—Nicolau Carmen Daniela; writing—review and editing, Adrian Saftoiu.; project administration, Bogdan Cormos. All authors have read and agreed to the published version of the manuscript.

Ethics approval and consent to participate

The study was conducted following the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of Lotus Image Medical Center (protocol code 10 / 22.10.2022)." for studies involving humans.

Patient consent for publication

Informed consent was obtained from all subjects involved in the study.

References:

1. Bokolo, A.J. Application of telemedicine and eHealth technology for clinical services in response to COVID-19 pandemic. Technol Health. 11, 359–366 (2021). https://doi.org/10.1007/s12553-020-00516-4

2. Nicolau CD. Telesonography - the 5th dimension of ultrasound examination. Ultraschall Med. 2014 Dec;35(6):576-8. doi: 10.1055/s-0034-1369404. PMID: 25621366.

3. Constantinescu EC, Nicolau C, Săftoiu A. Recent Developments in Tele-Ultrasonography. Curr Health Sci J. 2018 Apr-Jun;44(2):101-106. Doi: 10.12865/CHSJ.44.02.01. Epub 2018 Mar 27. PMID: 30687527; PMCID: PMC6320468.

4. Britton N, Miller MA, Safadi S, Siegel A, Levine AR, McCurdy MT. Tele-Ultrasound in Resource-Limited Settings: A Systematic Review. Front Public Health. 2019 Sep 4;7:244. doi: 10.3389/fpubh.2019.00244. PMID: 31552212; PMCID: PMC6738135.

5. Duarte M.L., Ribeiro dos Santos L., Wagner I., Peccin M.S. Telementored ultrasonography: a narrative review, Sao Paulo Med. J. 140(2), 2022; https://doi.org/10.1590/1516-3180.2020.0607.R2.15092021

6. Adilson Cunha Ferreira, Edward O'Mahony, Antonio Hélio Oliani, Edward Araujo Júnior, Fabricio da Silva Costa, "Teleultrasound: Historical Perspec-tive and Clinical Application", International Journal of Telemedicine and Applications, vol. 2015, Article ID 306259, 11 pages, 2015. https://doi.org/10.1155/2015/306259

7. Norum J, Bergmo TS, Holdø B, Johansen MV, Vold IN, Sjaaeng EE, Jacobsen H. A tele-obstetric broadband service including ultrasound, videoconferencing and cardiotocogram. A high cost and a low volume of patients. J Telemed Telecare. 2007;13(4):180-4. two: 10.1258/135763307780908085. PMID: 17565773.

8. Loria, K. "Remote access: How ultrasound in telemedicine is changing education, training, and patient care." Radiology Today magazine (2021). Vol 19 No. 8 P. 24

9. Drake, A.E., Hy, J., MacDougall, G.A., et al. Innovations with tele-ultrasound in education sonography: the use of tele-ultrasound to train novice scanners. Ultrasound J 13, 6 (2021). https://doi.org/10.1186/s13089-021-00210-0

10. https://www.thiemeconnect.com/products/ejournals/pdf/10.1055/a-0770-3965.pdf.

11. Boniface KS, Shokoohi H, Smith ER, Scantlebury K. Tele-ultrasound and paramedics: real-time remote physician guidance of the Focused

Assessment With Sonography for Trauma examination. Am J Emerg Med. 2011 Jun;29(5):477-81. doi: 10.1016/j.ajem.2009.12.001. Epub 2010 Apr 13. PMID: 20825815.

12. Smith, V.J., Marshall, A., Lie, M., et al. Implementation of a fetal ultrasound telemedicine service: women's views and family costs. BMC Pregnancy Childbirth 21, 38 (2021). https://doi.org/10.1186/s12884-020-03532-4

13. Rabie NZ, Sandlin AT, Ounpraseuth S, Nembhard WN, Lowery C, Miguel KS, Magann EP. Teleultrasound for prenatal diagnosis: A validation study. Australas J Ultrasound Med. 2019 Aug 30;22(4):248-252. doi: 10.1002/ajum.12175. PMID: 34760566; PMCID: PMC8411791.

14. Gyselaers W, Lanssens D, Perry H, Khalil A. Mobile Health Applications for Prenatal Assessment and Mon-itoring. Curr Pharm Des. 2019;25(5):615-623. doi: 10.2174/1381612825666190320140659. PMID: 30894100.

15. Gyselaers W, Lanssens D, Perry H, Khalil A. Mobile Health Applications for Prenatal Assessment and Mon-itoring. Curr Pharm Des. 2019;25(5):615-623. doi: 10.2174/1381612825666190320140659. PMID: 30894100.

16. Gyselaers W, Lanssens D, Perry H, Khalil A. Mobile Health Applications for Prenatal Assessment and Mon-itoring. Curr Pharm Des. 2019;25(5):615-623. doi: 10.2174/1381612825666190320140659. PMID: 30894100.

17. Hamilton DR, Sargsyan AE, Martin DS, Garcia KM, Melton SL, Feiveson A, Dulchavsky SA. On-orbit prospective echocardiography on International Space Station crew. Echocardiography. 2011 May;28(5):491-501. Doi: 10.1111/j.1540-8175.2011.01385.x. Epub 2011 Apr 29. PMID: 21535119.

18. Balasingam M, Ebrahim J, Ariffin IA. Tele-echocardiography - Made for astronauts, now in hospitals. Indian Heart J. 2017 Mar-Apr;69(2):252-254. doi: 10.1016/j.ihj.2017.01.010. Epub 2017 Jan 26. PMID: 28460775; PMCID: PMC5414961.

19. Kirkpatrick AW, Blaivas M, Sargsyan AE, McBeth PB, Patel C, Xiao Z, Pian L, Panebianco N, Hamilton DR, Ball CG, Dulchavsky SA. Enabling the mission through trans-Atlantic remote mentored musculoskeletal ultrasound: a case report of a portable hand-carried tele-ultrasound system for medical relief missions. Telemed J E Health. 2013 Jul;19(7):530-4. doi: 10.1089/tmj.2012.0243. Epub 2013 May 19. PMID: 23682590.

20. Zennaro F, Neri E, Nappi F, Grosso D, Triunfo R, Cabras F, Frexia F, Norbedo S, Guastalla P, Gregori M, Cattaruzzi E, Sanabor D, Barbi E, Lazzerini M. Real-Time Tele-Mentored Low Cost "Point-of-Care US" in the Hands of Paediatricians in the Emergency Department: Diagnostic Accuracy Compared to Expert Radiologists. PLoS One. 2016 Oct 17;11(10):e0164539. doi: 10.1371/journal.pone.0164539. PMID: 27749905; PMCID: PMC5066956.

21. McBeth PB, Crawford I, Blaivas M, Hamilton T, Musselwhite K, Panebianco N, Melniker L, Ball CG, Gargani L, Gherdovich C, Kirkpatrick AW. Simple, almost anywhere, with almost anyone: remote low-cost telementored resuscitative lung ultrasound. J Trauma. 2011 Dec;71(6):1528-35. doi: 10.1097/TA.0b013e318232cca7. PMID: 22182864.