EFFECTIVENESS OF TELEMEDICINE IN ACUTE / EMERGENCY CARE SETTINGS VERSUS FACE TO FACE PATIENT CARE: A SYSTEMATIC LITERATURE REVIEW

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Abstract

The rapid development of technologies relating to telemedicine has brought with it new opportunities and potential particularly for use in time critical settings such as emergency care. It is also thought that telemedicine may help prevent attendance for minor illness or injury to major hospital emergency departments. We reviewed the evidence for telemedicine based approaches to emergency and acute healthcare settings in comparison to face to face patient care. Searches were performed in MEDLINE, EMBASE, PubMed and the Cochrane Database. In total, seven studies involving 958 patients with an acute or emergency medical presentation were identified. The quality of included trials was assessed using the Critical Appraisal Skills Programme (CASP) tool. Outcome data were pooled under four headings: time from symptom onset to consultation, patient satisfaction, mean duration of consultation and accuracy of diagnosis. During this review no results were found for a specific comparison between patient journey time to main unit and standard treatment intervention compared to telemedicine administered at a satellite clinic or facility. Further evidence is needed regarding the efficacy of telemedicine with regard to unnecessary patient recall and the possible difficulty it presents in clinician agreement rates within diagnostic and patient management decision making. In addition greater focus could be given to the patient and practitioner satisfaction rates as well as further examination of possible time saving in response rates and implementation of appropriate treatment with the use of telemedicine.

Keywords: telecare; telemedicine; remote consultation; acute care; emergency care; review.

Introduction

Telemedicine is typically used in acute and emergency healthcare contexts to provide supervision of primary healthcare providers, radiographic interpretation and transmission of electrocardiograms prior to patient attendance in emergency departments within emergency settings.[1] It is also thought that telemedicine may help prevent attendance for minor illness or injury to major hospital emergency departments.[2] These potential benefits are demonstrated by Armstrong and Haston who indicate a perceived improvement in patient care, improved communication between clinicians and a significant cost saving with the use of a telemedicine link.[3]

Similarly Thomas et al cite the potential cost saving benefit of telemedicine for providing remote monitoring of intensive care patients where an intensivist can remotely and simultaneously care for patients in several intensive care units (ICU's).[4] Telemedical assessment in emergency settings has also been researched in the context of cardiology prior to hospital admission. Scalvini et al illustrated that telemedicine could be a useful tool in the diagnosis of chest pain in primary care, giving the potential for helping both general practitioners (GP's) and specialists while offering potential National Health Service (NHS) cost savings.[5] Similarly Roth et al, report that the use of 'an integrative telemedicine system' in assisting patient pre-hospital decision making reduced the number of visits to the hospital emergency department and consequently costs of medical care.[6]

There is current significant growth and interest, particularly in North America, in telemedicine which is thought in part to relate to the rapid development of portable and affordable desktop systems and growth in international telecommunications. However this is occurring without regulation or systematic planning

which means that further research is required to assess the efficiency, effectiveness and safety of telemedicine before it is brought into widespread use.[7] Further to this, there are concerns that existing research into the use of telemedicine has not been of sufficient quality or utilised appropriate research methodology.[8] It is increasingly important to establish whether or not telemedicine can offer clinical benefit or failing this if it can deliver the same outcomes with reduced cost to patients or the health service.

Numerous previous systematic literature reviews have been conducted to look in the effectiveness of telemedicine.[7-10] The literature to date has demonstrated that various forms of telemedicine may be feasible but to date no firm evidence of clinical benefit has been documented nor have the costs of the potentially expensive telemedicine technologies involved been discerned.[7] Nevertheless it has been demonstrated that randomised controlled trial study of telemedicine is possible and this combined with the paucity of literature in this subject area and the current rapid pace of change in telemedicine without rigorous assessment demonstrates the requirement for further research and collation of the available evidence and provides the rationale for the current study.

Methods

The review question was to determine the effectiveness of telemedicine in acute / emergency care settings versus face-to-face patient care?

The primary search was conducted of the electronic databases MEDLINE, EMBASE, PubMed and the Cochrane library Database. A secondary search was performed of unpublished literature and ongoing trials using the database: OpenGrey (System for Information on Grey Literature in Europe), WHO International Clinical Trials Registry Platform, Current Controlled Trials, UKCRN Portfolio Database, National Technical Information Service and the UK National Research Register Archive. The reference lists of all included papers were reviewed and all corresponding authors from these papers were contacted to identify any additional papers. The MeSH and search terms and Boolean operators used are presented in Table 1. The search strategy was independently performed by one reviewer (DP) and verified by a second (KP).

The review included randomised control trials (RCT), randomised controlled trial pilot studies and non-randomised controlled trials. Only full-text, English language publications published after 1966 were included. Relevant unpublished articles were also eligible for inclusion.

Table 1. MeSH, search terms and Boolean operators ultilised.

Classification	***Terms and Boolean Operators (*= truncation)***
Telemedicine type	Telemedicine OR teleradiology OR telepathology OR remote consultation OR telecommunication OR telemetry OR videoconferenc* OR teleconferenc* OR teleconsultation AND
Clinical setting	Emergency OR acute OR critical care OR intensive care AND
Study design	Random* OR Controlled trial OR Clinical trial

Patients receiving either traditional face-to-face care or telemedicine intervention from a qualified health care practitioner in emergency and or acute clinical settings were included. Both male and female patients, adult and paediatric patients were included. Patients receiving care in clinical areas other than emergency and or acute clinical settings were excluded. Patients receiving care from a non-professionally qualified healthcare worker were excluded. Studies evaluating medical care given using telemedicine in the form of a recognised telecommunication technology, which include at least one communication media, used interactively to manage acute/emergency conditions were included. Studies that sought to compare more than one telemedicine approach, without inclusion of a control group, were excluded.

Titles and abstracts from the search strategy were independently assessed by the authors. Full-text version of each potentially eligible paper was obtained. Eligibility was then re-assessed by the two reviewers based on this full-text, until consensus was agreed on the finally included studies.

Data were independently extracted by one reviewer (DP), with verification by a second reviewer (KP). Data extracted included: participants' age, gender, interventions including telemedicine type,

geographical site of intervention, e.g. acute or community based healthcare setting, administering practitioner, chief clinical complaint and medical specialty; missing data, outcome measurements; follow-up period; and results.

The primary outcomes were: (1) time from symptoms onset to consultation via telemedicine, arrival at the hub, and to initiation of the drug therapy; (2) patient satisfaction outcomes and (3) duration of consultation. The secondary outcomes were: (4) unnecessary return of patient to healthcare provider; (5) agreement on diagnosis and management between involved healthcare practitioners; (6) accuracy of diagnosis and (7) time from alarm to a therapy decision.

All included studies were assessed for methodological quality using the Critical Appraisal Skills Programme (CASP) appraisal tool for randomised control trials[11] and were appraised by one reviewer (DP) and verified by a second (KP).

An assessment of the methodological heterogeneity was made by examining the inter-study variation in population characteristics, interventions, concurrent interventions as part of the standard rehabilitation programme, and outcome measurements as substantial heterogeneity was demonstrated, a meta-analysis was not conducted. Therefore a narrative review of the data is presented for the specific outcome measurements.

Results

A summary of the search results is presented in Figure 1. Fifty papers were identified from the search strategy. After reviewing the titles, abstracts and eventually full texts, seven studies were eligible and included in the review.

Using the modified Critical Appraisal Skills Programme (CASP) critical appraisal form all studies scored a minimum of six or more out of an eleven point scale of methodological quality, with almost 60% of studies scoring seven or more. The main strengths of the selected studies were that study participants in all trials had similar base line characteristics and that the patient groups were treated equally in each study aside from the experimental intervention. The only part exception to this was Brennan et al who demonstrated some difference in gender distribution between their two experimental groups with more females being randomised to the control group than the telemedicine group.[12]

One of the main weaknesses was that none of the included studies could demonstrate blinding of patients, health workers *and* study personnel. The other significant weakness lack of precision in estimation of treatment effect with only two studies giving confidence limits within their study results.[13,14]

The studies universally demonstrated that, aside

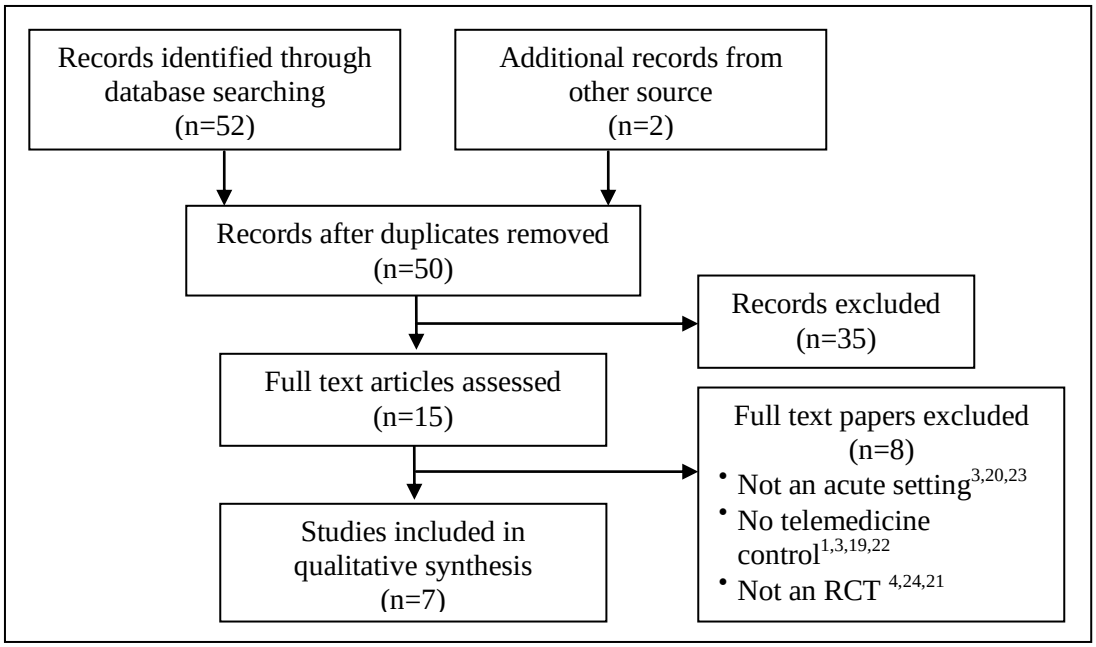

Figure 1. The literature review process.

from the trial intervention for each patient group that patients in both groups of each study had been treated equally; or at least that some reasonable effort had been made to achieve this. However the main similarity in treatment of patients was in the 'process' they entered as part of their clinical journey (aside from experimental intervention). This was clearly evidenced by Benger et al, in particular.[13]

Assessing the size of the treatment effect of each study revealed that the studies were not necessarily easily comparable in this way. Nonetheless, studies focussed on outcome measures that demonstrated effect on one or more of three possible treatment effects: duration of time taken until intervention (or variation), clinical effectiveness and rate of complication. All studies appeared to demonstrate that all clinically important outcomes had been considered.

A summary of the interventions, outcomes measures and results in Appendix A. The results of each study's cohort characteristics are summarised in Table 2. In total, 958 participants were included: 559 males and 350 females, with a mean age of 45 years.

All studies had patient populations who had a history of presentation to an acute or emergency setting but there was significant variability in the nature of the presenting complaints ranging from eye problems,[15] to stroke patients,[14] to patients failing to maintain their airway or achieve sufficient oxygenation levels.[16] Only two studies investigated patients with a similar type of presentation classification – 'minor emergency presentations'.[12,13] However even within this definition of presentation significant variability of presentation existed with patients presenting with complaints varying from psychiatric difficulty, abrasions, animal bites, asthma, toothaches and minor allergic reactions.

The included studies all utilised one, or in the case of Benger et al, two types of 'standard' face to face consultations with their control groups.[13]

All studies utilised an experimental group with a telemedicine input. This provided a vehicle for at least a component of assessment, monitoring and / or diagnostic decision making.[12-16,18] In the case of Walter et al, the telemedicine group also received investigation via an ambulance equipped with a computerised tomography (CT) scanner and 'point of care laboratory'.[14] Table 2 summarises the telemedicine interventions used in each study.

Table 2. Population characteristics of included studies.

Study	Sample n=	Male / female	Mean age (y)	History of present condition
Benger et al (2004)[13]	600	370/230	34	Minor injuries sustained within the previous 10 days
Bowman et al (2003)[15]	80	45/35	41.5	Eye problems presenting to emergency setting
Brennan et al (1999)[12]	104	66/38	No data	Minor presentations at emergency department
Cho et al (2011)[16]	25	15/10	50	Patients who could not maintain their airway or were not able to efficiently ventilate / oxygenate
Robie et al 1998[17]	19	Not specified	Neonates	Neonate requiring surgical assess-ment for a variety of presentations
Walter et al (2012)[14]	100	63/37	71.5	Stroke
Wojcicki et al (2001)[18]	30	0/30	26	Diabetes type 1 in pregnant women
Total	958	559/350	223	n/a
Mean	137	112/70	44.6	n/a

Primary outcome measures

Time from symptom onset to consultation via telemedicine, arrival at the hub, and to initiation of drug therapy.

Cho et al found that time taken 'for intubation' was 56 ± 2 seconds in the control group and 62 ± 12 seconds in the experimental group with SD 12 (p=0.30).[16]

Patient satisfaction outcomes.

Brennan et al, found no difference in patients' satisfaction between the control group 95% and in the experimental group 98 (p=0.54).[12]

Duration of consultation

Benger et al, looked at mean duration of consultation. In the control groups seen by an emergency physician consultation time was 3.1 min (95% CI 2.9-3.3 min), seen by a GP 3.4 min (95% CI 3.2-3.6 min) and for the experimental group managed by telemedicine 6 min (95% CI 5.7-6.2 min).[13]

Secondary outcome measures

Unnecessary return of patient to healthcare provider.

Bowman et al looked at number of 'unnecessary recalls' following eye injury found that two out of 40 participants from the control group returned (5%). In the experimental group when a 'slit lamp' was used 5 out of 40 (12.5%) returned and when no slit lamp was used 9 out of 40 returned (22%).[15] Brennan looked at frequency of return visits within a 72 hour period and reported 0% in both patient groups returned within this time frame.[12]

Agreement on diagnosis and management between involved healthcare practitioners.

Benger et al looked at expert panel discrepancy assessment scale and reported the following discrepancy rate. For the control groups seen by and emergency physician 0.5% (95% CI 0.1% - 1.5%), by a GP 0% (95% CI 0% - 1.7%) and in the experimental group 1.4 (95% CI0.6% - 0.7%.[13]

Bowman et al also looked at agreement levels between two observers for each phase and reported the agreement levels below.[15] (Table 3)

Accuracy of diagnosis

Brennan et al looked at whether or not there had been a need to change the diagnosis and found in the control group no data were available and in the experimental group no change of diagnosis had been necessary.[12] Benger et al looked at 'clinical effectiveness' and detected 'no significant differences' between groups.[13] Cho et al, looked at success rate and reported it to be 100% in both control and experimental groups.[16]

Time from alarm to therapy decision

Walter et al looked at primary time from alarm to therapy decision for stroke patients and reported a significant reduction in the experimental group 35 min vs 76 min (p=0.0001).[14]

Discussion

The studies included in this review did not yield any data for one of the three identified primary outcome measures - time from symptom onset to consultation via telemedicine, arrival at the hub, and to initiation of drug therapy. With regard to patient satisfaction, one study found that patients in the control group were less than satisfied than patients in the telemedicine experimental group.[12] However this finding was not statistically significant. In one study, telemedicine consultations took significantly longer than 'standard' consultations with both Emergency and General Practitioner physicians.[13] Whether a difference of two to three minutes is of clinical significance is debatable. Brennan reported an increased average duration in

Table 3. Diagnostic concordance.[15]

Control: group 1	Experimental: group 2
1. Complete agreement 30 (75%) 2. Trivial disagreement 8 (20%) 3. Clinically important disagreement 2 (5%)	Without slit-lamp camera, p=0.007 1. Complete agreement 16(40%) 2. Trivial disagreement 20 (50%) 3. Clinical important disagreement 4(10%) With slit-lamp camera, p=0.007 1. Complete agreement 23(58%) 2. Trivial disagreement 15(37%) 3. Clinical important disagreement 2(5%)

control group compared to the experimental group,[12] but Bowman found there to be no difference in the duration of the consultations between standard and telemedicine groups.[15]

The secondary outcome measure of unnecessary return of patient to healthcare provider was looked at by two studies included in the review. Bowman found that in both telemedicine groups (one with, and one without the use of slit lamp), unnecessary recalls were statistically significantly greater in these groups compared to the control group.[15] However Brennan reported no returns in the control and experimental groups.[12] Two studies looked at agreement on diagnosis and management and concluded that there was a higher rate of clinical agreement in term of diagnosis and management in non-telemedicine groups. Benger found that there was statistically more agreement on assessment findings in the control groups compared to the telemedicine group.[13]

Bowman et al also reported that 'complete agreement' between two observers was significantly higher in the control group than in the telemedicine group.[15] This finding would appear to support the findings of Benger et al.[13] Similarly the rate of 'trivial disagreement' was significantly higher in the telemedicine experimental group and the rate of clinically important disagreement was twice that of the control group.

Three studies included in the review looked at accuracy of diagnosis. Two studies were in agreement that there were no significant differences in accuracy of diagnosis in control and telemedicine groups.[13,16] One further study did not make firm conclusions. Brennan et al looked at whether or not there had been a need to change the diagnosis and unfortunately found in the control group no data were available however in the experimental group no change of diagnosis had been necessary.[12] Walter et al, looked at primary time from alarm to therapy decision and reported a statistically significant difference with longer time period recorded in the control group compared to the experimental group.[14]

With regard to methodological quality issues of evidence base, in six of the seven studies there was no blinding of patients, healthcare workers or study personnel. This potentially limits confidence in their findings but blinding of study personnel and participants is often not feasible in telemedicine interventions telemedicine, which cannot be easily disguised. This is particularly true for telemedicine offered in acute or emergency care settings where the treatment is offered at the point of patient presentation. A strength of the studies is that in six of the seven, patients were appropriately randomised.

There was variability in reporting of outcomes for all participants. In five out of seven studies reporting of withdrawn participants was evident and in two it was difficult to tell whether all the patients who entered the trial were properly accounted for at its conclusion.[15,16] There were differences in reported study population characteristics as below, but importantly study origin was also diverse with studies derived from the USA, Korea and Poland as well as the UK. This limits overall generalizability to one particular population.

There are some potential clinical implications of the findings with regard to the effectiveness of telemedicine in acute and emergency settings. The results provide some justification for clinicians choosing to safely investigate the efficacy of telemedicine for patients in acute and emergency settings and for further formal study of telemedicine in this clinical environment. Telemedicine intervention in acute and emergency care settings could primarily be justified based on the possible improvement on time from alarm to therapy decision for patients following acute stroke.

Nevertheless some disadvantages in the use of telemedicine were found to exist. For example the duration of a telemedicine consultation (compared to standard consultation),[12] rate of unnecessary return of patient to healthcare provider[15] and reduced agreement in diagnosis and management between healthcare practitioners when telemedicine was in use.[13] The clinical significance of these findings are not clear.

Although telemedicine has not been assessed in acute and emergency care settings specifically, systematic literature reviews regarding the use of telemedicine have reported the feasibility of the use of telemedicine systems but very little evidence of telemedicine benefits.[7] This finding corresponds with the results of this review which have not demonstrated clinical benefit but have shown the telemedicine interventions can be workable, safe and of satisfactory performance.

The existing literature on telemedicine in acute and emergency care is of suboptimal quality. This is a finding of other literature reviews on telemedicine.[8]

The review had several limitations. The quality and consistency of the statistical data provided in the

studies was limited. Only two studies stated confidence intervals limiting interpretation of study precision.[13,14] Five studies stated p values however a variety of mean, range and standard deviation values were reported alongside p values limiting direct comparison and meta interpretation.[12,14,15,16,18] The heterogeneity of methodologies and statistics limited the analysis to a narrative review. For example there was variance with regard to gender ratios with one study which included an exclusively female study cohort[18] to studies which had near to a 2:1 male to female gender ratio for included study participants.[12,14] Similarly there was significant disparity within participant age groups. One study looked exclusively at neonates,[17] another on elderly patient cohorts[14] with two studies focusing on more middle aged patients.[15,16] One study did not state patients' ages.[12]

One of the most methodologically heterogeneric features was the presenting conditions of the patient cohorts. Although two studies examined patient populations with minor injuries presenting to an emergency setting,[12,13] there were no other studies with patient presenting conditions in common. Out of the other five studies one each looked at patients with eye problems,[15] airway difficulties,[16] neonates requiring surgical assessment,[17] stroke patients[14] pregnant women with diabetes.[18]

Another weakness of the review is the number of eligible studies retrieved for analysis. With only seven studies there are potential risks around accurate interpretation as it is possible that the results from a modest sample of studies can be interpreted as having more significance than is correct and it should be noted that one was a pilot trial with a small patient cohort,[16] and another, a non-randomised trial[15] This meant only five randomised controlled trials were eligible for inclusion in the study. However this highlights the need for further high methodological quality, multi-centre, randomised control trials into telemedicine in acute and emergency care settings.

Conclusions

Ongoing research is needed in this area to further investigate the capacity for beneficial effect that telemedicine may have in acute and emergency care settings. Specifically investigation into the type and application of telemedicine in acute and emergency care settings is warranted as very little evidence current exists to inform this.

No results were found for a specific comparison between patient journey time to main unit and standard treatment intervention compared to telemedicine administered at a satellite clinic or facility. The existing literature base also demonstrates paucity of evidence in assessing the benefits of telemedicine in relation to standard intervention for long term clinical outcomes such as mobility and function post acute stroke. Therefore further assessment of this type of outcome measure, in relation to the speed at which intervention is delivered, is indicated to address the unanswered questions surrounding the precise potential benefits of telemedicine specifically in acute and emergency settings.

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Appendix A

Reference	**Conditions**	**Country**	**Interventions**	**Outcome measures**	**Summary of results**	**Authors' conclusions**
Benger et al 2003[13]	Minor injuries sustained within the previous 10 days	United Kingdom	Onsite specialist treatment (group 1) vs General practitioner treatment (group 2) vs Telemedicine treatment (group 3)	Mean duration of consultation, expert panel discrepancy assessment scale, clinical effectiveness	Study sample: 600 (group 1 n=262, group 2 n=64, group 3 n=274) Mean duration: group 1=3.1 min, group 2=3.4 min, group 3 = 6min Expert panel discrepancy: group 1=0.5%, group 2=0%, group 3=1.4% Clinical effectiveness: no significant differences detected	Telemedicine is capable of providing a satisfactory standard of care. There is no evidence that telemedicine provides superior care and there are a number of process issues that may impede successful implementation of this technique.
Bowman et al 2003[15]	Eye problems	United Kingdom	Consultation in person (group 1) vs telemedicine (group 2)	Agreement levels between two observers for each phase, length of consultation, number of unnecessary recalls.	Study sample: 80 (group 1 n=40, group 2 n=40) Agreement levels Group 1: complete agreement n=30(75%), trivial disagreement n=8(20%), clinically important disagreement n=2(5%); Group 2 (without slit lamp camera): complete agreement n=16(40%), trivial disagreement n=20(50%), clinically important disagreement n=4(10%)	Telemedicine was found to be an accurate, safe and efficient method of diagnosing and managing patients, especially if slit lamp images were used.

					Length of consultation: Study states no difference, numerical data not available	
Brennan et al 1999[12]	Abrasions, minor allergic reactions, animal bites without skin laceration, bronchitis, asthma, first degree burns, eye conditions, leg injury at or below the knee, otitis media, psychiatric clearances, sore throats, simple cystitis, toothaches, uncomplicated insect and tick bites, arm injuries, check on	USA	Standard face to face assessment by the emergency physician(group 1) vs telemedicine (group 2)	72h return visit, average time of the assessment, need for additional care, satisfaction of patients and physicians, change of diagnosis	Study sample: n=100, group 1 n=50, group 2 n=50. Average time of the assessment: group 1=117 min, group 2=106 min. 72h return visit: 0% vs 0% Need for additional care 2.4% vs 2.3% Positive overall patient satisfaction: 95% vs 98% Change of diagnosis: n/a vs 0%.	The present study shows that telemedicine can be used successfully in an emergency department for patients with predefined presenting complaints in emergency medicine.

	wounds					
Cho et al 2011[16]	Patients who could not maintain their airway or were not able to efficiently ventilate / oxygenate	Korea	On-scene directed (OSD) airway management(group 1) vs Tele-Airway management System (TAMS) group 2.	1.Time taken for intubation. 2. Success rate. 3.Complications.	Study sample n=25, group 1 n=13, group 2 n=12 Mean intubation time (sec): group 1=56 sec, group 2=62 sec. Success rate: group 1=100%, group 2=100% Complications (oesophageal intubation: group 1 n=4, group 2 n=2.	The pilot study demonstrated the feasibility of the TAMS as an alternative to OSD. However a larger study will be required to determine non-superiority or equivalence.
Robie DK et al 1998 [17]	Bilateral inguinal hernias, low imperforate anus, necrotizing enterocolitis, feeding tube replacement, possible intestinal obstruction, poor feeding, abdominal wall defect, meconium per vagina, large dorsal mass, cystic abdominal	USA	Bedside consultation(group 1) vs videoteleconferencing (group 2) vs Computer-based "store and forward" (S&F) programme(group 3)	Average time of the assessment, physician satisfaction	Sample size: 19 (group 1 n=7, group 2 n=6, group 3 n=6) Average time of the assessment Group 1 – not specified Group 2 – 101 min Group 3 – 24 min, plus 10 min for completing records Physician satisfaction: Group 1-data not available Group 2,3: confidence in interacting by telemedicine (8 out 10), awareness of distraction (5.5 out 10), absorption in the consultation (7.6 out 10)	Telemedicine was used successfully in each case and proved accurate in diagnosing and guiding further evaluation.

	mass					
Walter et al 2012[14]	Stroke	Germany	Hospital intervention(group 1) vs Telemedicine mobile stroke unit-MSU(group 2)	1.Primary time from alarm to therapy decision. 2.Time form alarm to CT and laboratory analysis 3.Number of patients receiving thrombolysis	Study sample n=100, group 1 n=47, group 2 n=53. Primary time from alarm to therapy decision: group 1=76 min, group 2=35 min. Time from alarm to CT and laboratory analysis: Group 1=71 min, group 2-74 min. Number of patients receiving thrombolysis: Group 1 n=8, group 2 n=12	For patients with suspected stroke, treatment by the MSU substantially reduced median time from alarm to therapy decision. The MSU strategy offers a potential solution to the medical problem of the arrival of most stroke patients at the hospital too late for treatment.
Wojcicki et al 2001[18]	Diabetes type 1	Poland	Standard face to face assessment by the emergency physician (group 1) vs telemedicine (group 2)	1.Mean values of MBG mean value of J indices calculated for the first week, first month and whole duration of the project. Number of hypo and episodes of hyperglycemia (%). 2. Mean variations of the MBG and J indices calculated for the first week and whole duration, represented by standard deviation	Study sample: n=32, group 1 n=15, group 2 n=17. Mean values of MBGs: group 1=137+/-18, group 2=132+/-13 J (-): group 1=35.5+/-10.9, group 2=33.3+/-6.5 Hypoglycemia episodes (%): group 1=3.31+/-2.66, group 2=3.19+/-1.95 Hyperglycemia episodes (%): group 1=12.7+/-10.4, group 2=10.8+/-5.2	Telematic intensive care system improved the effectiveness of the treatment of diabetes during pregnancy. It provided better glycemic control during 24 weeks of monitoring and and ensured higher accuracy in comparison to standard therapy.

				(SD) and coefficient of variance (CV). 3. Glycemic control indices calculated every week. 4.Comparison of glycemic control for patients with IQ>100 and IQ<100.		