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QUALITY IMPROVEMENT IN PARAMEDIC CARE

Abstract: *The aim of this paper was a systematic review of quality improvement in paramedic care. Only very few reviews on some aspects of this have appeared so far. Hence a more comprehensive review including many aspects of paramedic care quality and its improvement was considered necessary. A Google Scholar search using the topic itself as the search term yielded 41 usable papers for this review. Both qualitative and quantitative papers were included to cover all possible aspects. The selected papers have been described under different sections. The papers on paramedic impact, roles, QI programmes and strategies, training and education and communication and collaboration were dominant. Much less research was observed on mobile enhanced healthcare, feedback to paramedics on their performance and research in developing countries. So, the recommendation is to increase research on these topics in future.*

Keywords: *Paramedic; Roles; Impact; Quality; Feedback; Training.*

1. Introduction

The National Registry of Emergency Medical Technicians, USA describes the job of paramedics as follows: “The Paramedic is an allied health professional whose primary focus is to provide advanced emergency medical care for critical and emergent patients who access the emergency medical system. This individual possesses the complex knowledge and skills necessary to provide patient care and transportation. Paramedics function as part of a comprehensive EMS response, under medical oversight. Paramedics perform interventions with the basic and advanced equipment typically found on an ambulance. The Paramedic is a link from the scene into the health care system.” (NREMT, 2020).

A related term is Emergency Medical Technician (EMT), but there are some differences between the two regarding the

level of skills, competencies and duties between them. The hierarchical order is EMT-basic, who provide emergency medical services (EMS) providing entry-level patient care; then EMT- intermediates known as EMT-1s, 2s etc. and then paramedic. Thus, paramedic is the highest level of emergency medical technicians.

It takes 1-3 years (1200-1800 hours of courses) to become an emergency medical technician (EMT) or a paramedic. The paramedic training needs to be in approved institutes preferably and certified by an accredited institution. NREMT provides all these as a comprehensive package. State licensing is required for practice. In many ways, the range of functions of a paramedic mimics that of a doctor.

Many governments have paramedic education standards like that of National Highway Traffic Safety Administration (NHTSA) (NHTSA, 2009). A more detailed

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document provides procedural details of various functions performed by EMTs and paramedics.

The human tendency is to think and say that quality of the job performed by him/her is always good. On the other hand, proper evaluation might reveal a lot of deficits in the performance and there is room for improvement. Even the best performance can be improved. The experience described by Kilpatrick (2019) shows exactly how an assessment of current quality of EMT and paramedic services can be evaluated and improved. Some points of note in this respect listed by the author were: resistance to change due to strong conviction that everything is good, need for presenting hard evidence to show that they are wrong and change their mindset, technologies cannot substitute human jobs, but can increase efficiency of doing things; and showing their own data to employees is the only way to increase accountability and responsibility and make them to do better next time onwards.

In Emergency Medical Services, quality improvement (QI) essentially means the delivery of faultless, high-quality prehospital care. Robust education programme supported by no fault-finding intention ensures success of QI programmes. A project approach with specific aims to improve specific areas of EMS consists of plan-do-study-act (PDSA) steps. Areas of concerns include equating quality improvement with quality assurance, narrow focus within EMS and generation of large volumes of data, which are collected with immense difficulty. Compliance with state requirements will be easier when there is a QI programme for EMS in the healthcare organisation (Lincoln et al., 2019).

The above details sufficiently highlight the importance of quality and its improvement in the paramedic services. Therefore, a detailed review of this topic was undertaken to evaluate the current status of QI in paramedic care. The next sections describe

the method adopted for this review and results obtained which are discussed and concluded in later sections. Some limitations of this review will also be listed at the end.

2. Methodology

A search of Google scholar was done using the keywords ‘Quality improvement + paramedic care’ to yield 45 papers for inclusion in this review. Out of this, four were used in the above sections. Balance 41 papers are described below under various sections. The results are discussed and the review concluded in the final sections. Some limitations of this review are also listed at the end.

3. Result

3.1 Paramedic impacts

Paramedics perform endotracheal intubation on nearly all victims of out-of-hospital cardiopulmonary arrest (CPR). From the data analysed, Wang et al. (2009) observed multiple and prolonged CPR interruptions in the case of paramedic out-of-hospital endotracheal intubation efforts. Endotracheal intubation-associated CPR pauses were approximately 22.8% of all CPR interruptions.

Physiologic alterations during prehospital rapid sequence intubation (RSI) performed by ground-based paramedics were studied by Walker et al. (2018) using 134 such cases from electronic patient monitor data files. Peri-intubation changes in oxygen saturation, heart rate, and blood pressure were analysed. Neurologic (42%), respiratory (26%), toxicologic (22%), trauma (9%), and cardiac (1%) diagnostic impressions were assigned to paramedics. Out of overall intubation success rate of 95%, first-attempt success rate was 82%. There were no differences with respect to these success rates among diagnostic impression categories. However, the majority of peri-intubation physiologic

alterations occurred on first-attempt success. These results showed that the first attempt success does not completely account for intubation quality. The authors suggested that standard care documentation needs to be supplemented with electronic monitoring data for a comprehensive evaluation of intubation quality.

The success rate in the first attempt at humeral placement of the EZ-IO by paramedics among prehospital adult cardiac arrest patients was evaluated by Wampler et al. (2012) in a retrospective study. Out of 247 humeral placement attempts by paramedics, 91% of first attempts were successful. Another 3% was gained by second attempt. In the case of unsuccessful attempts, obesity was the cause for 2%, stable placement without flow for 1% and undocumented causes for 2% of the failures. Successful placement with subsequent dislodgement was noticed in the case of another 2% cases. Thus, proximal humeral IO access seems to be a reliable method for vascular access of out of hospital patients with cardiac arrest if paramedics are highly proficient.

In a study using 22 narrative interviews of women who birthed under paramedic care in Queensland, Australia, the women described feeling of being empowered, confident and exhilarated. Some concerns about paramedic practice, lack of privacy, poor interpersonal skills and lack of consent for certain procedures were also expressed by some of them. The perception of poor quality service by paramedics points towards the need for specific QI and training programmes related to their skill deficits (Flanagan et al., 2019).

In a review on contribution of paramedics in primary and urgent care requirements, Eaton et al. (2020) identified the topics dealt related to their contribution as the clinical role, the clinical work environment, the contribution to the primary care workforce, the clinical activities, patient satisfaction and education and training for paramedics moving from the ambulance service into

primary care.

The importance of health and well-being of paramedics was recognised in an article by Meadley, et al. (2020). It is essential for successful ambulance service and provision of the highest level of clinical care. An example of the attempt in this direction is that of the Paramedic Health and Wellbeing Research Unit (PHAWRU) at Monash University (Victoria, Australia). This is a newly formed unit consisting of collaborative team of researchers, emergency service end-users and paramedic representatives. Its aim to understand better and minimize the negative health impacts of a career in paramedicine. The research team also works on evidence-based strategies to improve musculoskeletal, physiological, metabolic, nutritional, mental and sleep health in paramedics.

3.2 Role of paramedics and its expansion

One traditional role of paramedics is to provide emergency care and transport within a community or industrial settings. Currently, there is increasing integration of emergency services with the overall health system. This expanded the role of paramedics. Now, paramedics are collaborating with other professions to assume new and extended roles. The expanded roles consist of non-emergency community-based care, preventative medicine and social care. As the number of paramedics is less compared to the demand covering all these roles, there is workforce shortages. In addition, reduced funding of health services and increase in population with changing demographic profile of many rural and remote communities, demand the need for effective collaboration among health professionals to respond to the health needs of these communities. Mulholland et al. (2014) undertook a study on the renewed role of paramedics in the rural settings through a review. Interprofessional education (IPE), multidisciplinary teamwork and interprofessional learning (IPL) were

identified as the major themes in the reviewed articles. The new roles were related with IPL in the case of rural paramedics. Here, the association of collaborative practice was greater for community-based care rather than for emergency treatment and transport to hospital. Programmes and interventions were covered more extensively.

Another traditional role of paramedics had been providing transport to hospital. Shift from this role to comfort care support at home involves a major deviation from their traditional role. Such a care programme includes a new clinical practice guideline, medications, a database to share goals of care and palliative care training. Carter et al. (2020) undertook studies to understand the scope by examining the essential elements of scale and spread of this care model. An implementation science model, the Consolidated Framework for Implementation Research (CFIR) was applied for the purpose. Deliberative dialogue sessions were held between groups consisting of paramedic, palliative care, primary care, and administrative experts in a province that had the Program (Nova Scotia, March 2018) and another one that did not have (British Columbia, July 2018). Framework analysis was done using CFIR. Themes were derived from consensus in a larger research team. Inter-sectoral communication between paramedics and other health care providers evolved as the major theme, but with privacy problems. Relationships with care providers and training of paramedics (cost may be a problem) were also important for expected positive outcomes for patients. Challenges of culture and mindset of paramedics preventing change from traditional roles could be expected. Paramedic champions may be the solution with respect to change management.

A review by Leduc et al. (2020) identified five categories of interventions aimed at avoiding visit of patients from long term care facilities to ED services. The five categories

of interventions were: use of advanced practice nursing; a program called Interventions to Reduce Acute Care Transfers (INTERACT); palliative care; conditions in which specific interventions are required and use of extended care paramedics. Decrease in ED visits was the most commonly measured outcome in the reviewed studies. Decrease in hospitalisation, patient adverse events (functional status and relapses) and emergency system functions of crowding/inability of paramedics to transfer care to the ED were less common outcomes measured decreasing in that order. Only about 18% studies measured mortality as an outcome.

A detailed discussion of requirement, extent of practice, ingredients and evaluation of professionalism among UK paramedics was done by Woollard (2009). The points discussed are equally valid in the case of other countries also in defining what is professionalism, how paramedics can be judged as exhibiting professionalism or not and what remedies exist in ensuring adequate professionalism among paramedics so that they perform their roles more effectively and with high quality of execution.

In a case study involving interviews, post-placement survey and assessment in a South East England setting, Ruston and Tavabie (2011) observed that placement of paramedic practitioner students (PPSSs) in accredited general practice (GP) training expanded their skills on patient-centred, community based health care. Also, the acquired skills enabled them to treat patients at home rather than automatically transporting them to hospital every time.

The aim of the study by Garza et al. (2003) was to evaluate the effect of paramedic experience on orotracheal intubation success in prehospital adult nontraumatic cardiac arrest patients. Secondary data of four months showed that 98 paramedics performed 909 intubations on 1066 cardiac

arrest patients, yielding an intubation (success rate- 85.3%). However, no correlation between months of experience of paramedics and intubation success rate.

3.3. QI programmes and strategies

The perspectives of paramedics on quality of care in out of hospital EMS was assessed by focus group discussions with them during a training session. Paramedics identified 18 quality indicators with 17 methods of measurement. Some of the quality indicators proposed were different from what was being used currently (Greenberg et al., 1997).

A typical QI programme consists of setting the measurement variables, standards, regular monitoring, feedback and training if improvements in skills are required. Results of such a comprehensive QI programme in Salt Lake City Fire Department was reported by Joyce et al. (1997). To check the quality of reporting, monthly random audits were performed on about 6% of EMS patient care reports (PCRs), both basic and advanced life support (ALS and BLS). Patient Care Reports (PCRs) were assessed at monthly intervals for adequate documentation of six patient assessment parameters, appropriate treatment and short-term outcome. Time intervals and adherence to protocol were also included in the assessment. Overall documentation and performance were rated based on all these variables. Monthly and cumulative QI reports were circulated to all providers. Both positive and negative feedback were provided to specific teams. Continuing medical education sessions were arranged to address deficits in adherence to quality identified by the QI audits and scene observations.

Significant positive impact on paramedic OSTs among patients with penetrating trauma is possible with an intensive QI program. This was demonstrated by the reduction in fallout rates of penetrating trauma rates and mortality rates among the

fallouts. This study on penetrating trauma patients transported by paramedics to Los Angeles County/USC Medical Center, a Level-1 trauma centre, was undertaken by Eckstein and Alo (1999).

In an early review on the QI in pre-hospital paramedic care in Australia, Linwood et al. (2007) noted a slower pace in the implementation of QI in pre-hospital care compared to in-hospital care in Australia. In-hospital QI practices may not be transferable to pre-hospital contexts. The positioning of ambulance in EMS in the total scheme of health control and funding models determined the current status of QI in the case of paramedic care.

The need for QI programmes to reduce medication errors by paramedics was demonstrated in the findings of Vilke et al. (2006). As high as 9% of paramedics reported medication errors like wrong doses, protocols and routes during the previous one year. Issues related to these errors were failure to do the triple check, infrequent use of the medication and errors in calculation of dosage leading to incorrect dosage. These errors were detected at various levels of their work.

Multidisciplinary teams including paramedics were involved in an in-situ simulated QI programme of ED services of a Canadian hospital. The QI programme items consisted of a wide range of topics for improvement. The programme was successful and effective in identifying latent threats to patient safety, testing of new patient care protocols, identifying and rectifying equipment issues, and promote teamwork in a sustainable manner to improve the overall care quality in the ED (Baylis et al., 2018).

A British Columbian hospital's EMS QI strategy was aimed at improvement of outcomes for out-of-hospital cardiac arrest (OHCA) through paramedic-led on-scene resuscitation of high quality. In a post-hoc study involving prospectively identified consecutive non-traumatic ambulance-

treated adult cases of out of hospital cardiac arrest, Grunau et al. (2018) measured the changes in care variables and survival data covering the period of 2006 to 2016. Analysis of data showed significant improvement in care variables and survival due to implementation of the programme.

Three targeted interventions were implemented with the aim of reducing infection rates in patients due to prolonged in situ intravascular catheters (IVCs) during their admission to the hospital. Paramedics of Queensland Ambulance Service (QAS) insert these IVCs are inserted in prehospital settings. The 3 interventions tested were the use of “QAS-IVC” stickers by QAS paramedics to indicate QAS-inserted IVCs, making IVC documentation mandatory during patient handover, and clinician engagement to provide patient education on IVC infection signs. Audits were undertaken in wards to evaluate outcomes. The interventions were found to be apparent and beneficial as the limited number of patients having in-dwelling QAS-IVC showed. Awareness among medical staff and patients also increased (Ding et al., 2019).

A novel model of care for the evidence-based hospital-to-home Care Transitions Intervention (CTI) was applied to a new context of ED-to-home transition in three EDs of two cities. This modified version of care was delivered by paramedics. An evaluation of this programme using surveys, review of medical records and review of documentation by CTI coaches, was done by Shah et al. (2018). High levels of acceptability was noted among participants and most participants and their caregivers preferring to choose an ED featuring the CTI program in the future. Expected services during contact were delivered most part of the time.

A suite of Point of Care Tools (POCT) devices to perform an expanded range of pathological tests was provided to paramedics on trial basis, along with technology for electronic data capture

temperature control and monitoring, in a specially designed kit bag—the Labkit. The availability of POCT results at the time of paramedic assessment itself reduced to and from trips to the emergency department. A rise in admission of patients was also noticed in the case of patients, whose pathological results indicated the need for urgent treatment which may not have been noticed without the tool. Overall, significant proportion of conveyance decisions were changed due to the direct effect of the Labkit results. High levels of satisfaction among patients and added value in most of the cases where it was used to support decision-making perceived by paramedics were also observed. These results prove the high potential of reliable, quality-assured POCT by paramedics to improve efficiency in the healthcare system and benefit patients (Heaney et al., 2020).

3.4 Training and education

According to Mabry et al. (2012) critical care training of flight paramedics in an air ambulance system based on modern civilian helicopter EMS practice reduced the estimated risk of 48-hour mortality among severely injured patients in a combat setting. The retrospective natural experiment compared mortality of patients with injury from trauma in the case of the US Army’s standard helicopter evacuation system staffed with medics at the Emergency Medical Technician – Basic level (standard MEDEVAC) with a case of one staffed with experienced CCFP using adopted civilian helicopter emergency medical services practices.

A Plan, Do, Study, Act (PDSA) procedure was adopted by Helmer et al. (2020) for QI aimed at safety and effectiveness of advanced care paramedic administered intramuscular (IM) ketamine for patients with extreme agitation in the out-of-hospital setting. Advanced care paramedics with specific training were performed all the procedures. They administered IM ketamine

to substitute midazolam. A clinical audit form was used to record the ketamine dose, patient response on the Richmond Agitation Sedation Scale (RASS) at prescribed time intervals, any adverse effects and any airway management interventions performed. Effective control of acutely agitated patients with adequate sedation at 5 minutes post-delivery was achieved with 5 mg/kg Ketamine IM administration without dose-dependent adverse effects. Adverse effects, if any, were managed very quickly using airway management interventions.

The objective of a study by Eckstein and Suyehara (2002) was to determine the precision with which paramedics are able to select the appropriate Standing Field Treatment Protocol (SFTP) instead of On-line Medical Direction (OLMD) for patients with Congestive Heart Failure (CHF). The results showed that paramedics correctly identified only about half of the dyspnoeic patients who had CHF. On the other hand, their assessment of CHF positively predicted when this diagnosis was made. These results indicated the need for further training and quality improvement for improving paramedic performance in this difficult area.

The aim of the study by Katz and Falk (2001) was to determine the frequencies of unrecognized, misplaced endotracheal tubes inserted by paramedics in a large urban, decentralized emergency medical services (EMS) system. The study revealed about 25% of the patient arrivals in the hospital had improperly placed endotracheal tubes. Wrong intubation in the oesophageal region was often associated with death of patients in the ED. Need for training the paramedics to place the tubes correctly is obvious from the results.

Clinical simulations can be used for evaluating the skill level, especially in cases of low-frequency, high-risk problems like seriously ill or injured paediatric patients arriving ED. Three clinical assessment modules (CAMs) were designed and validated using paediatric simulators with

varying technologic complexity. Scenarios included an infant cardiopulmonary arrest, sepsis/seizure, and child asthma/respiratory arrest. Each scenario required paramedics to perform an assessment and provide appropriate paediatric patient care within a 12-minute time limit. Trained instructors conducted the simulations by following strict guidelines for sequences of events and responses. Videos of CAMs were reviewed by an independent evaluator to verify scoring accuracy. Percentage of steps completed for each of the three scenarios and specific performance deficiencies were recorded. Only about half of the steps were completed by the participants. Performance deficiencies included lack of airway support or protection; lack of support of ventilations or cardiac function; inappropriate use of length-based treatment tapes; and inaccurate calculation and administration of medications and fluids. Continuous education programmes to improve the required skills were evidently required. (Lammers et al., 2009).

If paramedics do not comply with the recommended hand hygiene and gloving practices, it may lead to transmission of care-associated infections with serious negative consequences on patient outcomes. Barr et al. (2017) evaluated the behaviours and perceptions of Australian paramedics in relation to their hand hygiene and gloving practices using both online survey and semi-structured focus groups. The participants' adequate knowledge about the importance of hand hygiene and gloving. They reported poor compliance with both practices particularly during emergency cases. They wear gloves throughout a clinical case and change them either at the completion of patient care or when the gloves are visibly soiled or broken. The results proved that hand hygiene was missed at defined moments during patient care mostly due to misuse of gloves. Need for training them for QI practices on proper use of gloves became evident from this study.

A doctoral study by Hill (2020) showed beneficial effects for increasing knowledge and confidence of nurses and paramedics in identifying paediatric non-accidental trauma (NAT), but the effect in improving the discharge or follow-up instructions were not significant. However, both have high clinical significance.

The distinction between acute ischemic stroke including large intracranial vessel occlusion, haemorrhagic stroke and stroke mimics by pre-hospital stroke scales is highly imperfect with attendant serious problems. The diagnosis methods used at the point-of-care are serum biomarkers, telemedicine, mobile computed tomography units and ultrasound equipment. Kilic et al. (2020) evaluated the possibility of using a web-based stroke education program for paramedics in which, training in use of Transcranial Color-Coded Duplex Sonography (TCCS) is also included. A pre and post-test study showed high scope and potential advantage for proposed web based course in enabling paramedics to perform short neurological examination along with good quality TCCS. Their combined use can help in patient selection for endovascular embolectomy.

3.5 Communication and collaboration

Perinatal complications requiring emergent transfer to a higher level of care may occur rarely in community birth settings. Good perinatal outcomes during such emergent transfers depend on high quality and effective interprofessional communication and collaboration. In a quality improvement project on the interprofessional emergent birth centre transfer, mock drills were performed on improvement of communication and collaboration among birth centre midwives, local paramedics, and receiving hospital staff. Adequate education was given to local paramedics by the birth centre midwives and hospital staff. Pre and post tests were done to assess the knowledge gained by paramedics due to education. Then

the mock drill followed by a questionnaire survey for all participants was done. The results showed effectiveness of interprofessional education and collaborative mock drills in increasing the knowledge of perinatal emergencies, which facilitates interprofessional communication and collaboration during emergent birth centre transfers (Olvera et al., 2020).

In a consensus opinion on QI programmes using Delphi study for Korean pre-hospital care, paramedics were chosen as the dispatchers and providers of pre-hospital advance life support (ALS) with physicians for medical direction and support (Ahn et al., 2007).

An important component of the prehospital care framework is how delegated control of medical interventions from physicians to paramedics are handled. An online control patch exists to help the communication between paramedic and the physician at the base hospital. This communication is mainly in the form of requesting an order to proceed with that intervention. Many factors contribute to the nature of outcome and effectiveness of this communication. In a study, Kelton et al. (2020) examined the areas of potential improvement in this type of communication. Various types of patch calls and records of four years were examined. About 56% of patch requests for order on interventions were granted by the physician. Clarification or reframing the request when not granted also occurred. Time gap between request and granting or not granting permission were similar. However, the authors did not report about the differences between outcomes of granted and not granted requests.

The paper by Noack et al. (2020) reported on the development of a digital communication tool to help paramedics communicate with patients who can only speak a foreign language, to monitor its implementation, and evaluate its effect on communication between foreign-language patients and staff. The tool was found beneficial in improving

communication between paramedics and foreign language patients. There was an increase in the quality and quantity of information collected from the patient, which helped to record the clinical parameters and identify severe cases. Other benefits like observe on-scene times, demands for emergency physicians and the usage of the intervention were also visible.

The aim of a pilot study by Presswood et al. (2020) was to evaluate the feasibility, benefits to patients and cost-effectiveness of a palliative medicine doctor and paramedic working together within the community to respond to urgent '999' calls. Although there was no real need identified for this type of service, there were occasions when it impacted on decision making including patient admissions. Its benefit was only noted for learning, co-ordination of care and facilitating shared decision making.

3.6 Palliative care

Palliative care by paramedics in the 911 system USA was reviewed by Wallner et al. (2020). There were 318 calls of 2018 for analysis. About 83% of calls were received during 7-8 am and the peak was 10 am to 6 pm. Transportation to hospital accounted by about three-fourth of the total calls. Palliative care physicians initiated about 16% of calls to transport to hospitals. About 20% patients refused transport and about 6% were dead before transportation. New or suddenly worsening conditions were the most common reasons for calls. Need for care beyond the provider capacity and lift assistance without any visible injury were other causes for calls.

Paramedics providing palliative care at home programs are aimed at addressing the mismatch between traditional paramedic practice and patient's goals of care. Goldstein et al. (2020) found that less than 5% of 500 cases analysed could be categorised as appropriate for paramedic palliative support by the Gold Standard,

created by expert consensus. Some cases of disagreement were reviewed and then included in the most appropriate category. A previously derived Palliative Support Composite Measure (PSCM) and its two modifications did not perform well.

3.7 Mobile health integration

Mobile Integrated Health (MIH) can be helpful in effectively using paramedics with special training paramedics to narrow the gaps in local health care delivery by shifting them beyond EMS duties. A study was done by Siddle et al. (2018) to evaluate the efficacy of using paramedic/social worker dyad for home assessments, medication review, care coordination, and improve access to care in an urban setting. Before and after intervention acute care outcomes were compared. The study proved the effectiveness of the intervention in reducing acute care hospitalisations.

3.8 Feedback mechanism

Paramedics do not receive adequate feedback on their clinical performance. To assess and develop their diagnostic and decision making skills, there is a minimum requirement of health-related 'outcome feedback' of patients attended by them. To determine the design of a feedback, the perceptions and attitudes of paramedics on the current feedback provision and need for a formal provision of patient outcome feedback were measured through semi-structured interviews which were analysed using interpretive phenomenological analysis. The general perception among paramedics was that they received feedbacks only on exceptional incidents, but lacking in depth. Some participants described it as an isolation of their practice. Formal provision of outcome feedback by electronic methods (to reduce resource demands) from the clinician can help in integrating and progressing in their paramedic profession as a whole. A level of support or supervision

was also suggested to minimise the potential for harmful consequences (Eaton-Williams et al., 2020).

A mechanism was initiated for providing feedback on QI results to paramedics with the aim of improving chart documentation areas which were difficult to correct. A before-after comparison of paramedic trip sheets was done to assess the impact of feedback in the New Castle County Delaware with all paramedics in the area participating. The results did not show any impact of feedback on endotracheal intubation (ETI) success rate or resuscitation rate. But the feedback improved chart documentation (ETID) and behaviour by reducing trauma scene times (O'Connor & Megargel, 1994). Use of a similar feedback mechanism in the case of paramedic-initiated non-transport of elderly (>65 years) reduced the incidents of non-transportation and delayed hospitalisation, as was reported by Persse et al. (2002).

4. Discussion

A statistics of papers reviewed under different sections is given in the Table 1 below.

Table 1. Number of papers in each topic.

Topic	No of papers
Paramedic impact	6
Role of paramedics and its expansion	6
QI programmes and strategies	10
Training and education	8
Communication and collaboration	5
Palliative care	2
Mobile health integration	1
Feedback mechanism	3
Total	41

Understandably, the maximum number of papers were on QI programmes and strategies. This is because the topic of this

review and the search term stressed this aspect. The categorisation of impact of paramedics and their role is somewhat artificial. The two are complementary to each other. Without their role, impact will not happen. Therefore, although there were only six papers in each of these categories, together they account for 12 papers. To this, the three feedback papers need to be added considering their importance for paramedics to assess their own performance and try to improve. Then the total will be 15, which is about 37%. Training and education were implicit in some papers on QI programmes and strategies. It was more convenient to categorise them differently. Here again, the two together account for 18 papers. Proper communication and collaboration is very important for the success of paramedic functions. This point was very evident in the paper on foreign patients who cannot speak or understand the local language authored by Noack et al. (2020).

Most papers were very specific on specific context. Hence, their generalisability is very limited. Authors have recognised this in their conclusions. So, most of them have restricted to recommend use in similar contexts only.

Both quantitative and qualitative methods either alone or in combination (mostly so) were used. Mainly surveys, interviews and focus groups were supported with analysis of documents to facilitate reporting results more precisely. Phenomenological analysis (Eaton-Williams et al., 2020) , Delphi study (Ahn et al., 2007), simulation (Baylis et al., 2018; Lammers et al., 2009) were some specific research methods used.

Inadequate research in topics of mobile use (only one paper) and feedback to paramedics (only three papers), considering their importance in the current world, are particularly notable. Also, there were only two papers on palliative care. Works available from developing countries were almost absent. More research on these areas are required.

5. Conclusion

The above systematic review showed that research on paramedics covered a variety of topics in a variety of specific contexts to achieve specific targets. Many different quantitative and qualitative approaches were

used. Much less research has been done in certain areas. It is recommended that future research should pay attention to those topics also. Multi-country studies including both developed and developing countries may be extremely useful in this respect.

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