Study of the impact of a telemedicine service in improving pre-hospital care and referrals to a tertiary care university hospital in Nepal

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ABSTRACT

Background: Telemedicine is a process which involve medical experts to exchange valid information for diagnosis, clinical management, treatment and counseling for both healthcare workers and patients remotely in rural setting from urban healthcare center. Providing quality healthcare services in Nepal is challenging due to many reasons such as difficult geographic terrain, limited availability of funding and many other issues. Methods: The study design was a cross sectional and will adopt an interpretative case study approach which supports the researcher to develop a deep insight in to study phenomenon and outcomes. Study was conducted at in two rural-telemedicine programme implementation sites, namely Patle, Fikkal Bazaar and one central consultation site BPKIHS Dharan. Result: A total of 315 patients were undergone teleconsultation process during the study period. The total patients consulted after teleconsultation program in each of center were 1386 (Phikal) and 508 (Patle). Among them 205 (Phikal) and 110 (Patle) were called on the teleconsultation day. Among the patients who were seen via teleconsultation, 36 (2.6%) from Phikal and 22 (4.3%) from Patle were referred to BPKIHS. The total number of referred patient from those center to other center were 327(Phikal) and 208 (Patle) among those referred 205 (Phikal) and 110 (Patle) came during teleconsultation Process. Conclusion: Telemedicine can be used as a critical component in the solution of the healthcare crisis. Telemedicine will be the best as a substitute to improve the access to healthcare, to provide the healthcare cost-effectively. The current paradigm of care can be taken by telemedicine due to which improved health outcomes can be achieved in cost effective Ways.

Keywords: Health care, teleconsultation, telemedicine

Introduction

Telemedicine is a set of “medical activities involving distance, the virtual presence of the medical doctor to nearby patients to

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exchange valid information for diagnosis, clinical management, treatment and counseling for both healthcare workers and patients. The newest way for delivering quality healthcare services in rural healthcare settings is only possible by telemedicine as it can utilize experts from different medical fields from urban center.

Providing quality healthcare services in Nepal is challenging due to many reasons such as difficult geographic terrain, limited availability of funding, and other issues. Within this context of constrained resources and infrastructure challenges, the use of telemedicine has the potential to increase access of poor, rural people to healthcare services. Providers can receive specialized guidance, and their patients can receive specialty care, thus reducing the costs incurred for the transport. The existing literature demonstrates that telemedicine successfully decreases the number of referrals between emergency departments when specialty care is unavailable at the originating hospital.

B.P. Koirala Institute of Health Sciences (BPKIHS), Dharan, Nepal has started the rural-telemedicine and e-learning program in 2015 at three rural health facilities/district hospitals of Eastern Nepal with the aim of providing access to specialized healthcare services. The main aim of e-learning service is to update and upgrade the knowledge and skills of healthcare providers regarding clinical management of commonly reported diseases at their facility. The specialists from BPKIHS provide teleconsultation via video conferencing or telephone.

The purpose of this study was to compare the outcomes of health services utilized by the patients in terms of pre-hospital care and referral to tertiary care hospital before and after the implementation of telemedicine program. This study also explored the existing opportunities and challenges of telemedicine faced by the patients and their care takers.

Materials and Methods

Study site and population

The study was conducted at two rural-telemedicine program implementation sites, namely, Patle, Phikal Bazaar and one central consultation site BPKIHS, Dharan. Patle, is located in Dhankuta Municipality (population = 2048), about 25 km away from the district headquarter. In Patle, the program was started in Community outreach clinic operated by Dhankuta Municipality and run by a health assistant. Phikal is located in Illam (population = 11,264), about 20 km away from the district hospital. The program is operated at primary healthcare center that is run by medical officer, health assistant, and staff nurses.

BPKIHS Dharan is centrally located and supports the rural-telemedicine program in the districts. Study site and respondents were selected purposively.

Study design

The study design was cross-sectional and adopted an interpretative case study approach which supports the researcher to develop a deep insight in to study phenomenon and outcomes.

Data collection and assessment of efficacy

Data were collected in two phases

Data on the number of patients visited to the respective health facilities before the implementation of telemedicine program (January–June 2016) and after the implementation (July–December 2016) was collected.

Data were collected using semi-structured questionnaire through interview, site observation, and discussions.

Table 1: Demographic profile of subjects sought for telemedicine services (n=315)

| Variable                  | n° (%) of patients |
|---------------------------|--------------------|
| Age, median (IQR 25-75)   | 50 (25-75)         |
| Age group                 |                    |
| <5 years (1)              | 33 (10.5%)         |
| 5-14 years (2)            | 28 (8.9%)          |
| 15-30 years (3)           | 81 (25.7%)         |
| 31-50 years (4)           | 102 (32.4%)        |
| 50 years + (5)            | 71 (22.5%)         |
| Gender                    |                    |
| Male                      | 123 (39%)          |
| Female                    | 192 (61%)          |
| Occupation                |                    |
| Farming                   | 96 (30.5%)         |
| Businessman               | 63 (20.0%)         |
| Employee                  | 16 (5.1%)          |
| Unemployed                | 4 (1.3%)           |
| Dependent                 | 96 (30.5%)         |
| Student                   | 40 (12.7%)         |
| Educational level         |                    |
| Child (<5 years)          | 39 (12.4%)         |
| Illiterate                | 147 (46.7%)        |
| Literate                  | 89 (28.3%)         |
| High school               | 31 (9.8%)          |
| College                   | 9 (2.8%)           |

Table 2: Characteristics of individuals visited telemedicine centre (n=315)

| Variables                                      | n° (%) of patients |
|------------------------------------------------|--------------------|
| Types of patients visited telemedicine centre  |                    |
| New                                            | 301 (95.6%)        |
| Follow-up                                      | 14 (4.4%)          |
| Past history of diabetes mellitus              |                    |
| Yes                                            | 14 (4.4%)          |
| No                                             | 301 (95.6%)        |
| Past history hypertension                      |                    |
| Yes                                            | 36 (11.4%)         |
| No                                             | 279 (88.6%)        |
| Systolic blood pressure, median (IQR 25-75)     | 120 (100-130)      |
| Diastolic blood pressure, median (IQR 25-75)    | 70 (70-80)         |
| Temperature (°C), median (IQR 25-75)            | 96 (96-98)         |
| Pulse rate per minute, median (IQR 25-75)       | 80 (78-82)         |
| Respiration rate per minute, median (IQR 25-75)  | 18 (16-18)         |
After implementation of the telemedicine program the details of each patient enrolled for teleconsultation were recorded in the pre-designed case sheet which included demographic profile, diagnosis, referral status, outcome of the referred patients, and patient’s satisfaction regarding the teleconsultation.

**Ethical considerations**

Permission was obtained from the respective health authority to collect the data from study sites. Respondents were informed about the purposes of the study and verbal consent was taken who participated in the teleconsultation process. The study was approved by the Institutional ethical review committee of BPKIHS in June 2015.

**Statistical analysis**

The data were entered in Excel and after filtering coding and cleaning, further statistical analysis was performed by using SPSS version 11.0. Data were presented in frequency and proportion in appropriate graphs and tables. The frequency of referral before and after the teleconsultation was compared by using Chi-square test. All statistical tests were considered significant if \( P < 0.05 \).

### Results

A total of 315 patients underwent teleconsultations during the study period. The demographic profiles of the study groups are shown in Table 1.

The characteristics of the patients when they came for teleconsultation were recorded, which is shown in Table 2.

Fourteen of these 315 patients were followed up patients from BPKIHS. Additional patients are being followed up via teleconsultation, as shown in Table 3.

Of the 315 teleconsulted patients, only 18.3% were referred for various causes like further investigations or any operations, a sharp decrease from the situation before the implementation of the service, as shown in Table 4.

The total patients consulted after teleconsultation program in each of centers were 1386 (Phikal) and 508 (Patle). Among them, 205 (Phikal) and 110 (Patle) were called on the teleconsultation day. Among the patients who were seen via teleconsultation, 36 (17.6%) from Phikal and 22 (20%) from Patle were referred to BPKIHS. The referral rate of patients with teleconsultation

| Table 3: Health seeking behaviour of individuals visited telemedicine centre (n=315) |
|-------------------------------------------------|
| Variables | Time in minutes (IQR 25-75) |
|---|---|
| Median time to reach telemedicine centre from home | 25 (15-35) |
| **Reasons to visit telemedicine centre** | \( n^{o} (%) \) of patients |
| Close to home | 5 (1.6%) |
| Qualified doctors | 63 (20%) |
| Approach to BPKIHS | 247 (78.4%) |
| Individuals diagnosed at first visit | --- |
| Respiratory disease (pneumonia, COPD, ASTHMA, and LRTI) | 55 (17.5%) |
| Genitourinary (PID, UTI, renal and ureteric stone, menstrual problems) | 46 (14.6%) |
| Musculoskeletal (peripheral neuropathy, bodyache, arthritis, and trauma) | 43 (13.7%) |
| Skin (pruritus, fungal infections, and dermatitis) | 39 (12.4%) |
| ENT (CSOM, acute pharyngitis, acute tonsillitis, URTI) | 38 (12.1%) |
| Gastroenterology (GERD and diarrhoea) | 38 (12.1%) |
| Others (dental, eye, cardiovascular, and central nervous system) | 56 (17.6%) |
| **Outcomes** | --- |
| Improved/cured | 36 (11.4%) |
| Follow-up and improving | 193 (61.3%) |
| Referred | 58 (18.3%) |
| Minor operations | 11 (3.5%) |
| Admitted in ER and discharged | 17 (5.5%) |

| Table 4: Referred patients before and after implementation of telemedicine |
|-------------------------------------------------|
| | Baseline | | Interventions |
| | Phikal | Patle | Total | Phikal | Patle | Total |
|---|---|---|---|---|---|---|
| Patients enrolled | 1564 | 516 | 2080 | 1386 | 508 | 1894 |
| Patients referred to higher center | 342 | 182 | 524 | 327 | 208 | 535 |
| Overall referral rate | 21.9% | 35.3% | 25.2% | 23.6% | 40.9% | 28.2% |
| Patients receiving teleconsultation | 205 | 110 | 315 | --- | --- | --- |
| Patients referred after teleconsultation | 36 | 22 | 58 | --- | --- | --- |
| Referral rate of patients receiving teleconsultation | 17.6% | 20% | 18.4% | --- | --- | --- |
Table 5: Outcomes of referred patients via teleconsultation to BPKIHS, Dharan, a tertiary care hospital (n=58)

| Types of outcomes of referred patients | Number of patients (%) |
|---------------------------------------|------------------------|
| Operated                              | 18 (31.1%)             |
| Diagnostic purpose                    | 23 (39.6%)             |
| Other specialist consultation         | 10 (17.2%)             |
| Not tracked                           | 7 (12.1%)              |

is lower (18.4%) than the overall referral rate (28.2% for the intervention, 25.2% for the baseline). The outcome of referred patients in BPKIHS is shown in Table 5.

Discussion

This study shows a significant decrease in the number of referrals from the center where telemedicine is implemented. These findings are comparable to those of several previous studies. The reason is most likely the better identification of patients who actually require a referral, thanks to the expertise of the specialist working in tertiary care center.

Another important finding is regarding the high proportion of female patient enrolled in telemedicine. The proportion of female patients is higher than for male patients in this study, whereas most other studies show a predominance of male patients. Some of them were consulting for the first time, even when they had been sick for a while and took medicine from local shops, as they did not want to go other hospitals which were located too far. This can be due to some cultural aspects or with other reasons like time factors, travelling long distance which hampers their daily routine activity. Telemedicine thus seems to increase access to quality healthcare for female patients.

Another significant finding was the gain in time to reach medical advice. The average time taken to reach the telemedicine center were 25 min, whereas it took 75 min to reach the nearest district hospital. This not only saves time but also saves the people who earn daily wages from to take off from their work as they can visit telemedicine center without interrupting their work. This also saves money which needed for transportation, accommodation, fooding and the investigation which physician are reluctant to do on face-to-face visit. In addition to reducing the number of in-person visits, this three-way consultation will substantially reduce redundant or overlapping tests that are ordered separately by multiple providers, the most significant source of cost savings proved by the study done by Bashshur et al. in 1975.

As compared to the study done by Harno K et al. in 2000, where telemedicine decreased the need for secondary care services by transferring information and knowledge to primary care health professionals this study also shows examples where rural physicians’ connections to specialists will increase the physicians’ medical knowledge as they learn the skills needed to treat the similar conditions on their own in the future. For example, minor operative procedures were performed successfully in primary centers thanks to the remote supervision, whereas these patients would have been referred otherwise. So, in future, the healthcare providers can perform those minor operative procedures by themselves and if needed they may request remote supervision.

There were few patients with chronic disease conditions, such as diabetes and arterial hypertension, which were followed up via telemedicine much more regularly than if they had to travel further. It was already shown by Dang et al. in 2007 that for patient with diabetes, telemedicine improves glycemic control and glycosylated hemoglobin levels.

In this study, we observed that the total referral rate after telemedicine consultation was decreased to 18.4% than the overall referral rate 28.2% for the intervention, 25.2% for the baseline. The total referral rate from Patle was higher than the Phikal as Patle is operated by ANM, whereas in Phikal there are MBBS doctors.

This study also showed a high level of satisfaction of the patients in using telemedicine to access care and to connect with specialists. It was comparable to the study done by Gustke et al. which shows that the degrees of satisfaction may vary slightly with the specialty accessed through telemedicine, but overall patients have responded well to its use. One reason for satisfaction may be that the patients were able to see specialist related to their condition, and the ability to communicate with the provider in a very personal and intimate manner thanks to the telecommunications technologies. Another reason for satisfaction is that patient who had to be referred to tertiary care center were well familiarized with the nature of the disease its management plan and the cost for the treatment in advance. So, the current study shows that satisfaction did not differ significantly between video and in-person consultations.

Conclusion

Telemedicine can be used as a critical component in the solution of the healthcare crisis. Telemedicine will be the best as a substitute to improve the access to healthcare, to provide the healthcare cost-effectively. The current paradigm of care can be taken by telemedicine due to which improved health outcomes can be achieved in cost-effective ways. The implementation of telemedicine in the rural areas health center increases the quality in the healthcare and decreases the number of referred patient to the tertiary care hospitals.

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**Conflicts of interest**

There are no conflicts of interest.

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