

Perspective and future of ICT in healthcare service and management

Abstract—The paper aims to provide an analysis of the present condition and future perspective on the application of ICT in healthcare service and management in the context of Bangladesh. Special focus and attention was given on COVID-19 and its impact on the healthcare system. The surveys were taken recently which aims to give an overview of the scenario of the current telemedicine and healthcare perspective of our country and proposals in regard to that. The contribution of this paper lies in it's analysis of the perspective and prospects of telemedicine from patient and service providers viewpoints.

Keywords—Healthcare, Telemedicine, ICT

I. INTRODUCTION

Healthcare is one of the basic rights of a citizen. To understand health, we need to understand what it means, according to the World Health Organization (WHO), Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [16]. Keeping the aspects of health in mind, The Government of Bangladesh is constitutionally responsible to “supply the basic medical requirements to all segments of the people in the society” and the “improvement of the nutritional and the public health status of the people”¹. After the end of the independence of Bangladesh, healthcare was primarily focused on the basic services while massive changes came to the healthcare sector from the early 1990s where technological advances had a significant role. A part of the telemedicine services known as e-Health service was started by the Ministry of Health and Family Welfare to extend the healthcare facilities in 1998. Following that the Bangladesh Telemedicine association was founded in 2001. Since the introduction of the telemedicine services, it has been able to decrease overall cost, reduce transportation issues to cities and save time. By the help of tele camera in several villages the telemedicine services were very effective and willingness to partake in the system among the rural people increased gradually.

The Bangladesh Government seeks to attain and ensure conditions in which the people of the country will be able to reach and obtain the highest attainable level of healthcare. For this reason, proper Healthcare System Strengthening (HSS) is necessary alongside adequate infrastructure and technical support which will be the result of proper Healthcare education, awareness and disease control interventions. Bangladesh has made significant improvement in healthcare and management. In some cases, it has made more impressive gains compared to most of its neighbors in reducing poverty, malnutrition, illiteracy and disease and deprivation. Despite these successes, the Bangladesh health system continues to suffer from innumerable challenges [12].

A. Country Context

Bangladesh faces unique challenges when it comes to the overall healthcare system and the possible integration of ICT in the healthcare sector. Though the government has brought a significant number of changes to the system, not all the issues have been addressed. The country faces issues like high growth of population which is projected to rise to 218 million by the year 2030 [4]. The growing population of the urban areas are often underserved in major areas like housing, security and access to essential services, including health, sanitation and potable water. A substantial amount of poor and rural people faced healthcare issues due to economic disparities and the government has funded several Awareness Campaigns about nutrition and basic sanitation.

The First Five-year plan (1973-1978) highlighted the healthcare sector and the need of the health care services formation in the country. Emphasis was put on primary healthcare and several programs for malaria and pox were initiated in 1976. The first Population Project (1975-1980) provided the necessary support for the establishment of the physical infrastructure for the family planning services. Primary Health Care (PHC) as the key ingredient of overall health care was developed in the Second Five Year Plan of the country (1980-1985). Since 2009 the newly elected government undertook a massive effort to establish Community Clinics at the village level (1 Community Clinic for every 6,000 population) with a view to bring services to the doorsteps of the people at large [2]. At the same time, since the second half of the 1990s, issues such as pro-poor focus, community participation and empowerment, accountability, public private partnership for service delivery and demand-side financing gained momentum. Consequently, the structure and the service delivery model of the publicly funded health system underwent profound changes.

But due to the lack of collaboration and deficit of the long term planning the healthcare sector of Bangladesh has substantial amounts of setbacks and challenges. The challenges that the Healthcare Sector of Bangladesh faces can be brought down to two conditions that is the medical and infrastructure condition.

B. Medical Condition

The main challenge that the healthcare sector of Bangladesh faces is due to the lack of public facilities in all the levels of the country. The district health care centers and special care health care centers often lacks integration and proper tools to conduct primary tests, even if possible, the costs are substantially high and scarce. The Bangladesh Health Facility Survey² of 2009 reported that on average more than 30% of basic equipment is missing from health facilities [8]. In a study conducted by Khan and Idris in 2019, it has been mentioned that the number of ICU Beds is also

¹ Constitution of the People's Republic of Bangladesh.

² MOHFW & Tulane University Associates for Community and Population Research, 2010

less in our country if we consider the population of 170 million, where we have 1169 ICU beds, among which many are currently allocated for the treatment of COVID-19 infected patients [13]. Though Bangladesh has developed a massive development in the secondary and tertiary healthcare facilities, these facilities are often out of reach of the patients of villages and remote areas. It is also evident that Bangladesh also has 0.4 beds per 1000 beds for patients which is significantly less than the other developing nations [5].

The healthcare sector is based on a three-tier model which includes sub-district, union, and village level, which looks very effective on paper but lacks the quality of network and coordination in them. While basic health care facilities should be free for all, many cases are seen where patients must wait in long lines and pay a side-fee to get early access to this free healthcare service. All this contributes to the increasing lack of trust and out of pocket expenditure. The increasing cost restricts the access of the poor and disadvantaged people towards medical checkups, tests and medicines. In summary there is a significant gap between the principles of policy and the practicing field in the healthcare system of the three-tier PHC model.

Another crucial factor is the dominance of the pharmaceutical industries in the medical sector of Bangladesh. In the studies of Choudhury et al. (2007) it was seen that the top 10 firms are catering to the 70% medicine needs of the patients [7]. Such dominance in the market gives them the chance to control the prices of various products and use the system to their own benefit. Though there are significant Research and Development teams under the Ministry of Health and Family Welfare there exists a low-level collaboration. There is also a lack of inspection regarding the pharmacies and local drug suppliers. According to [19], Outside the public sector, there is a chaotic unregulated market of around 64000 certified pharmacies and 70000 unlicensed drug stores selling all types of medicine without prescriptions. Also, the pharmaceutical manufacturing oversight falls under MOHFW instead of the Ministry of Industry and commerce like in other countries [20].

C. Infrastructure Condition

There is a tendency of the impatient healthcare service seekers to demand quality and expert doctors, nurses and midwives and dentists which is not always available in all stages of Bangladesh. There is a high vacancy rate of doctors of nurses in the Upazila healthcare complex which results in contributing to the lack of quality services in various parts of the country, increasing the inequality of the services and rise of out-of-pocket expenditure. Also, studies Anwar et al. (2014) by found that there is a direct relation between the distance of the capital city and the place of their designated service as high vacancies are seen in Barishal (64.9%) and Khulna (58.2%) areas where people are lacking the necessary healthcare [1].

There also exists a lack of local level planning and decision making. Most of the ministries and expert of the fields are concentrated in the capital city. Thus, most of the decision comes from the capital city, even patients seeking treatment in non-communicable diseases like cancer, kidney diseases, diabetes must travel to the capital city or the district

cities to receive quality treatment. The accountability of the Upazila Health and Family Planning officials needs to be maintained and the plans should be enacted from the root level to ensure equality of the services. One of the example can be seen from the studies of World Health Organization(2008), more than 65% of the ambulances given to the Upazila level are termed “inoperable” also 80% of the health care complexes has no X-Ray machines though there has been fund allocations so that they are equipped with such machines(Bangladesh Healthcare Survey, 2007), this is just a certain part of the whole condition, there has been allegations that expensive items like X-Ray machine tends to disappear from the Health Care Complexes and later sold in the local market at a high price [18].

The lack of the management system in the local level has been a matter of serious concern in Bangladesh. The Upazila Health and Family Planning officers (UFHPO) are administered by Civil Surgeons who come from medical backgrounds and are appointed through the Civil Service but they tend to lack the paucity and the required training on public Health and management systems (Anwar et al, 2004). Proper trained individuals on the Upazila level can be employed by the government to provide a conclusive solution in this regard.

But the allocation of funding in the healthcare sector of Bangladesh remains under question. During the recent COVID-19 outbreak where a total of 10,000 crore of budget was allocated, lacking was seen in proper guidelines and roadmap to use that budget. Beside the national budget of the Fiscal year 2020-2021 falls short, it is 1.3% of the GDP and only 7.2 percent of the whole national budget. The country might be on the brink of a healthcare system collapse in the future if proper roadmap and infrastructure is not placed before the public and private hospitals. The cases of COVID and depleting faith of people on the healthcare services puts in a change where comprehensive infrastructure is needed and roadmaps are needed to be drawn.

Bangladesh being a developed nation has faced issues linked to political instability and lack of policy implementation. Repeated hartals and possessions in the past have done severe harm to public health and resources. In a data presented by Central for Policy Dialogue in the Daily Observer(2014), it was seen that 95% of the hartal were processions brought by the political party and a harm of 2000 crore is done to the economy on a single day of hartal. Due to such conditions and an increasing amount of corruption and negligence, the patients are routinely seeking treatment to countries like India, Singapore or Thailand. There is also the lack of proper data collection, access of data and proper use of raw data in the healthcare system of Bangladesh. Longlines of patients can be seen in any public medical of the country which increases the high possibility of transmission of communicable diseases. A proper and structural procedure based on the use of Information and Communication Technology is necessary to collect and evaluate health care related data on a regular basis, which will eventually help Bangladesh establish efficient allocation of resources throughout all the medical sectors.

D. Current Situation and Shortcomings

Bangladesh is a developing country which is currently going through several key changes including

urbanization, economic changes and infrastructural reforms. The Gross Domestic Product value is on the rise and there is an increased amount of foreign investment in the economy of the nation. Such shifts in the lifestyle of the citizens must be compensated with a proper and reliable healthcare system which the country lacks as shown in the primary research conducted by the authors. Some of the key reasons for which an adequate healthcare policy is not yet established in Bangladesh include issues like lack of resources, financial constraints including economic disparity, mismanagement of the quantitative & statistical tools, increasing amount of out-of-pocket expenditure. If categorized these issues can be narrowed down to

1. Limited public facilities
2. Limited access to quality healthcare facilities
3. Lack of essential commodities and medicines
4. Misuse of resources
5. Lack of proper management and expertise in the Upazila level
6. Weak Health Information Database

From the secondary data sources evaluation, we see that there are only 0.300 physicians, 0.280 nurses or midwives, and 0.020 dentists for every 1,000 people [8]. This meager number of health experts is insufficient to provide healthcare services to a growing population also giving chances to quacks to operate in remote villages where they tend to malpractice and mistreat the patient. Also, there is a lack of experts in the management sector too, purchasing public positions, mishandling of drugs and leakage of public funds are some of the key issues that need to be addressed (ESC 2020). The officers in the Secretariat (MOHFW) also lack specific knowledge or training in the health sector thus they fail to provide policy or planning.

E. Research Objectives and Gaps

The primary objective of the research was to observe the tendency of people to shift from regular healthcare practices towards telemedicine or virtual healthcare services. The study also tried to evaluate how new database systems and management systems can be used to benefit the providers and stakeholders alike. The research concludes with exemplary findings of a healthcare management system that can shift the healthcare services of Bangladesh with minimal budget used.

Though the researchers tried to bring in diverse types of people in the research findings, there is discrepancy among the sample size. Further studies are necessary on the village and Upazila level to establish relation between the healthcare providers and the stakeholders. Location, gender-based, age group specified data are necessary to provide an inclusive framework for the management system. Due to the prevailing pandemic the in-person interviews were kept short and large group-based discussions were not conducted.

II. DATA AND METHODOLOGY

The study employs a mixed method of data collection relying on both the primary and secondary data. The secondary data is based on the Upazila level of the country which includes the factor like telemedicine centers, medical colleges, doctor affiliation and involvement. The primary data were collected on two different samples, the

healthcare seekers and providers to understand the clear image on both the supply and the demand side.

In case of the first survey the data were collected focusing on 46 students from the district cities. They were asked if they had any prior experience of the telemedicine sector and how they would like to describe their experiences by the help of 5-point Likert Scale. Then they were asked if they thought that telemedicine will be cheaper than the traditional services and if integration of ICT is possible in the healthcare sector. The respondents also gave their opinion on key aspects like how much are they willing to spend for telemedicine services, possible time frame for a full-fledged telemedicine infrastructure.

In the second survey data was collected from 15 students through questionnaires and one-on-one interviews. These students are currently reading at either Medical colleges or Pharmacy in their undergraduate level. The students were asked if the integration of ICT is feasible, is the current syllabus adequate, will they open to offer telemedicine services to rural people after finishing their education, the quality of telemedicine, what amount of fees will be adequate, and how we can increase the trust of patient to healthcare services of Bangladesh.

III. RESEARCH FINDINGS

The decisive factors behind implementing the integration of ICT in Telemedicine and the underlying challenges are derived from two sets of questionnaires focusing on patients and university students. The findings are illustrated in this section, dividing it into further subcategories for a clearer understanding about the perception, approach, willingness, and expenditure.

A. Perception of Current Healthcare Condition

Table 3.1.1 Confidence on the Healthcare Sector

Sample Evaluation	Level of Trust				
	Complete Distrust	Partial Distrust	Neutral	Partial Trust	Complete Trust
In numbers	11	16	15	4	1
In Percentage	23.4%	34%	31.9%	8.5%	2.1%

Table 3.1.2 Adequate Syllabus for ICT Integration

Sample Evaluation	Level of Confidence				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In numbers	0	1	7	5	2
In Percentage	0%	6.7%	46.7%	33.3%	13.3%

The outcome of the questionnaires in both the surveys are portrayed in the Table 3.1.1(patient trust) and 3.1.2(syllabus student) respectively

It can be observed from table 3.1.1 that around 57.4 percent of the participants have little to no confidence on the healthcare sector of Bangladesh. It must be kept in mind that the survey sample are primarily from the City cooperation areas where the condition of the healthcare services is quite better than their rural counterparts. Full confidence has been shown by 1 participant which constitutes the 2.1 percent trust

in the healthcare service. This shows us the dismal condition and the clear lack of trust in the healthcare services.

From table 3.1.2 we can see that most of the students tends to hold a neutral condition if they are asked whether their syllabus is adequate to integrate ICT in the health sector. This can neither be interpreted as a positive side nor a negative sign as the students are not clear about their answers in this regard. The education system and mechanism should be given more emphasis to keep up with the changes of technology related to both medical and technological advances.

B. Perception and Potential of Telemedicine services, costs and integration

The following tables are given regarding the survey and analysis that has been taken.

Table 3.2.1 Prior Perception of Telemedicine

Factors	Possible Choices		
	Yes	No	Maybe
Prior Experience by Patients	61.7%	38.3%	0
Will Telemedicine be cheaper (Patients Perspective)	55.3%	12.8%	31.9%
Will the students offer telemedicine services in villages	86.7%	0	13.3%

Table 3.2.2 Cost of Telemedicine

Sample Distribution	Willingness to Pay		
	Up to 100 Taka	Up to 300 Taka	Up to 500 Taka
Patient's Perspective	34%	51.1%	14.9%
Provider's Perspective	46.7%	33.3%	20%

Table 3.2.3 Potential of Telemedicine and ICT

Factors	Time to Integrate ICT				
	Up to 5 years	Up to 10 years	Up to 15 years	Up to 20 years	More than 20 years
Patient's Perspective	8	15	14	3	7
Provider's Perspective	17%	31.9%	29.8%	6.4%	14.9%

The outcome of the questionnaires in both the surveys are portrayed in the Table 3.2.1 (prior experience and shift, offer telemedicine students), 3.2.2 (willingness to pay, enough payment by students), and 3.2.3 (integration time frame) respectively.

So, 61.7 percent of the participants had no prior experience in the telemedicine sectors. This can be caused as in the city areas the patients tend to visit doctors in their chambers and private clinics for their medical purposes. But among these samples from the city areas it can be observed that 55.3 percent believes that the telemedicine services will be cheaper than the traditional services, alongside 31.9

percent who are inclined to believe so. The overall number of being more than 84 percent can be a clear indication that telemedicine services will be substantial in decreasing the out of pocket expenditure in our country. In case of medical expenses, 34 percent of the respondents are willing to pay up to 100 Taka, and 51.1 percent of the respondents are willing to pay up to 300 Taka. This is also a significant decrease of expenses as such services do not have other additional costs like transportation, commissions and saves the time of the patients decreasing the chances of spreading communicable diseases. The last table shows us that 31.9 percent of the respondents believe it will take 10 years for the integration of ICT in the Telemedicine services whereas 29.8 percent believes that it will take around 15 years. These can all be contributed to the positive sides for the integration of ICT and Telemedicine, but a long-term sustainable plan is necessary to achieve such changes.

The most positive side from the students can be seen when 86.7 percent of the students showed that they are willing to offer telemedicine services to the rural people after completing their studies. This clearly shows that there is no lack of willingness when it comes to provide quality services to the backward and rural people. If we observe the case of the healthcare-based students, 80 percent of the students thinks that a fee of up to 300 takas is adequate for the healthcare services by the telemedicine sector. This, along with 100 percent positive feedback about the integration of ICT in healthcare from Table 2.2.4, re-affirms the confidence from the patient outlook that the fees can be kept at a minimal amount with increased satisfaction in the service. The table 2.2.3 shows us 86.7 percent thinks that the telemedicine services will be able to affect the condition of the rural people. If this is possible then with proper integration of ICT the inequality and the economic disparity seen among the rural and urban healthcare services can be minimized substantially.

C. Effective services related to Telemedicine

Table 3.3.1 Services to focus on

Factors	Services that should be focused			
	Infrastructure Development	Quality of Service	Cost of Service	Reimbursement and Accountability
Patient's Opinion	46.8%	83%	31.9%	23.4%
Provider's Opinion	33.3%	73.3%	26.7%	20%

Table 3.3.2 Shift in Healthcare

Sample Distribution	Shift in Healthcare		
	Yes	No	Maybe
Covid-19 digitalized the healthcare sector	70.2%	10.6%	19.1%
Telemedicine will improve the healthcare sector	93.3%	0	6.7%

The outcome of the questionnaires in the first surveys is portrayed in Table 3.3.1 (Services to focus on). Four important factors related to the telemedicine services were

given as options to the respondents, where the respondents could choose either number of them from one to all of them. It was seen the most priority was given to the Quality of Service which stands at 83 percent, followed by Infrastructure development at 46.8 percent. The significantly high amount of focus on Quality of Service can be answered as the respondents have shown little to no confidence in the present healthcare services.

The healthcare-based students showed the same signs in their approaches. From the table 3.3.2 (Shift in Healthcare), we see that 93.3 percent students believe that such telemedicine service will be able to increase the trust of the people in the healthcare sector of Bangladesh. Whereas quality of services and development of infrastructure was given higher importance among the 4 factors for effective telemedicine services with 73.3 percent focusing on the quality of the service and 33.3 percent focusing on the infrastructure development, respectively.

IV. RESEARCH ANALYSIS: CHALLENGES AND REMEDIES TO THE APPROACH

Upon close observation and further study of the data collected some key challenges of the approach suggested in the study. The challenges alongside their remedies have been illustrated in this section, dividing it into further subcategories for a clearer understanding about the lack of trust, proper enforcement of telemedicine services and challenges regarding feasible integration.

A. Remedies to the lack of trust

If we evaluate the research of this study, we find that there is substantial lack of confidence in the present healthcare services provided in our country. This indication was also seen when people openly roam around in the early stages of the COVID-19 without masks and proper healthcare measures, the government had to enforce lockdowns to stop the increase of infection and declare special “Red-zones” in the capital city to prevent people breaking the health protocols. To ensure a proper healthcare service and framework the trust and confidence of the people is necessary. The government should take proper measures which may include increasing awareness, accountability, and transparency in the healthcare sector by the help of policies to ensure increase of confidence among the people.

B. Challenges related to the proper enforcement

The effect of the telemedicine can also be depicted from the study in the view of medical students and patients. Most of the students from medical and pharmacy sector are willing to provide telemedicine services after the completion of their studies, there should be proper services established so that they can contribute to the designated sector without any intervention. The cost of services can also be kept minimal and use of mobile banking apps like Nagad, Bkash etc. will help to increase the accountability and decrease the cases of pity corruption. Collaboration with various network services like that of Grameenphone, Robi etc. including helpline services, SMS/text of reports and serials to doctors in healthcare clinics can be brought into consideration which will also help to maintain a patient health records which can be used anytime to plan and enact targeted policies based on region.

C. Challenges regarding the feasible integration

The integration of the ICT will be the most challenging aspect as it will include proper framework alongside infrastructure. The government of Bangladesh have previously developed the framework of the Digital Bangladesh and has been working relentlessly in this regard. The enactment of the 4G network all over the country alongside internet facilities have increased substantially in the recent years. Even in the pandemic situation the usage of mobile phones and mobile internet have also increased. These are creating a platform for the Government to enact policies related to telemedicine, as the results of COVID-19 were sent to many patients by the help of the SMS/text services. The foundation for an effective Telemedicine service has already been set, the only need now is an effective framework which focuses on the quality of the service as it has been demanded the attention of the policy makers from the side of both patients and service provides. Alongside the infrastructure development alongside increasing accountability will ensure the quality of service is maintained over a long period of time.

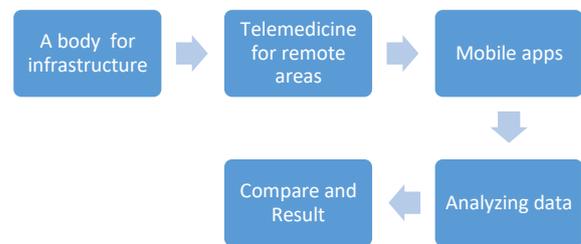


Figure 5.2.1: Method for remote area healthcare

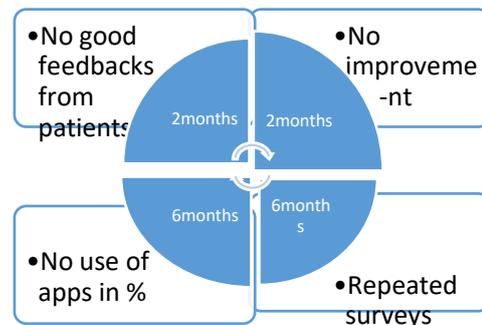


Fig 5.2.2.: New survey needed

In figure 5.2.2 a time estimated is taken to see if new survey is required or if the previous survey is to continue and also to see feedbacks from consumers.

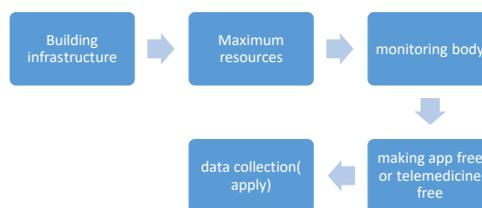


Fig 5.2.3: Proposal for ensuring better healthcare via ICT

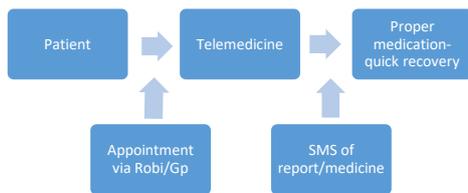


Figure: 5.1.1 Suggested Model of Healthcare



Figure: 5.1.2 Current Model of Healthcare

V. SUGGESTED APPROACHES AND REFORMS

A. Holistic Approach to healthcare with ICT Integration

The current module of healthcare has a total 5 steps or segments if someone wants to obtain the highest possible healthcare facility provided in the country. This segments are not only very difficult and unachievable for a wide range of population but also comes with a number of hurdles in each step which can be clearly seen in the Figure 5.1.2 given above. There has been a number of efforts taken both by public and private sector to mitigate these issues. Though significant changes can be seen at first but slowly the effect fades away.

The suggested reforms of the system will not only decrease the stages a patient has to go through to obtain maximum facilities it will also decrease the burden on management effectively decreasing cost and increasing database systems which can be seen from the Figure 5.1.2 above.

B. Suggested Reforms to the system

After thorough studies were made, it can be stated that an infrastructure and framework is necessary for remote area healthcare which as shown in 5.2.1 should include a infrastructural body, telemedicine and mobile apps integration, collection of data from these apps and finally comparing the results with previous results and databases. In the figure 5.2.3 we try to evaluate the survey system and how changes in the survey process can ensure better healthcare for the patients in remote areas. The figure 5.2.3 which shows the proposed module for better healthcare through ICT integration which shows the fundamental for remote areas in a wider perspective.

CONCLUSION

Healthcare system has developed rapidly in the past decade but still face a number of challenges, an ICT based approach

is less explored in this field though it has the prospects in bringing effective changes minimalizing cost and ensuring maximum services. Therefore, significant research scopes are wide open for this area and continuous studies is necessary for a fruitful and developed access to the early treatment of patients in remote areas by integrated systems like telemedicine, emergency helplines and mobile applications. We would like to urge the future researchers to study these fields in depth and bring out more frameworks for effective policy making.

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