

# Predictive Analytics based Financial Assistance Model for Chronic Care Patients in India



Ramakumar Kommajosyula, Nirupama Bhat, P L S Rao

**ABSTRACT**---Indian pharmaceutical industry (IPI) has traversed through many phases and it is in emerging phase now (2019). IPI is looking for innovation, creativity, newness in patient connect to perform different activities to achieve their stated goals. According to a recent World Health Organization report, approximately 50% of the people with chronic illness do not take their medication as prescribed [1]. Medication Non-Adherence is a huge problem across the world. Pharmaceutical companies across the world manufacture medicines with set of standard operating procedures, guidelines, quality execution systems, inspection and verification from quality control and quality assurance activities. The very intention of producing medicines is to sell them to the patients who are in need. The last thing Pharmaceutical companies expects from Health Care Professional (HCP) is to write the prescription and patient carrying it to Pharmacy to buy the medicine. The medicines for chronic illness are expensive in general. Despite having the prescriptions for medicines, there are plethora of reasons for Patient not to buy them. One of the most remarkable reason is – ‘the medicine costs are exorbitant’. If the medicines are not taken in case of the chronic illness, the patient’s quality of life degrades over a period of time, eventually resulting to fatality. This is a known concern to Pharmaceutical companies and new methods are invented to address the need for supporting the Patient at difficult times. This paper made an attempt to introduce predictive analytics based financial assistance model for chronic care patients in India.

**Keywords:** Chronic Illness, Financial Assistance, Patient Affordability, Predictive Model.

## I. INTRODUCTION

Over the decades, Indian pharmaceutical industry has evolved from doctor centric patient care to personalized medicines and gene based therapies. There are a few pharmaceutical companies in India who provide different patient centric services and facilities to avail the medicines as per the need. Pharmaceutical companies located in India manufacture different medicines and supply them to third world countries, predominantly. Though majority of research and development activities are carried out outside, significant work is being done in India also.

Third world countries lack the medicine manufacturing facilities and India provides the support to those countries. These medicines are provided to those countries at a lower cost – But, these do not contain the lifesaving medicines or chronic illness medicines. Indian pharmaceutical industry is in an emerging phase now and more investments in lifesaving medicines research and gene based personalized medicines research are the core needs. Chronic illnesses are on the rise across the world and gene-based therapies will save lives in the future.

The medicines invented for chronic illnesses are majorly patented and manufactured outside India and they are expensive. Indian pharmaceutical companies are yet to devote in research and development activities, which will help reduce the cost of chronic illness medicines. World Health Organization and various Governments across the world watches the health parameters of different geographies and puts adequate controls in place to reduce the mortalities. The leading cause for mortality in India and across the world is chronic illnesses like Cancer and Cardiovascular related problems [5].

Making medicines available at the pharmacy is not merely sufficient to enable the patient to buy them. There are various reasons why patients do not buy medicines i.e., do not adhere to medication as prescribed – these reasons include: (a) cannot get prescription filled or delivered, (b) do not think they need the medicine, (c) the medicine costs are prohibitively exorbitant, (d) afraid of the side effects, (e) forget the medicines etc. These reasons are significantly similar to chronic patients in India and across the world.

Pharmaceutical companies lose \$637 billion in revenue annually due to medication non adherence [2]. Traditionally, making the medicines available at the pharmacy is sufficient – but, given the revenue losses, pharmaceutical companies are looking at ways beyond the medicine being available in the pharmacy shelf. Pharmaceutical companies continue to devise new ways in helping the medicine reach the patient. These new ways are also known as beyond-the-pill initiatives by pharmaceutical companies. Pharmaceutical companies understood that the root cause for the problem is ‘Medication non-adherence’ and need to deploy innovative ways to reach the patient in ensuring medication adherence.

As per the laws across the world, pharmaceutical companies cannot advertise the medicines for chronic illness in any way, nor contact the patient by any means for the purpose of promoting or selling

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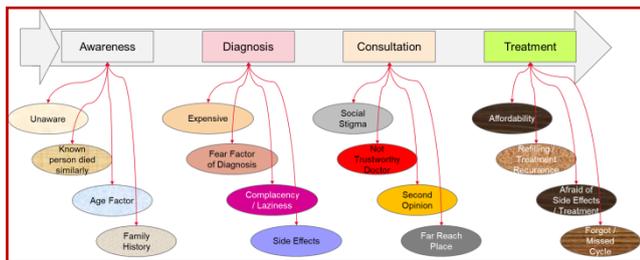
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**Fig 1. Patient Journey versus points of drop out from care regimen**

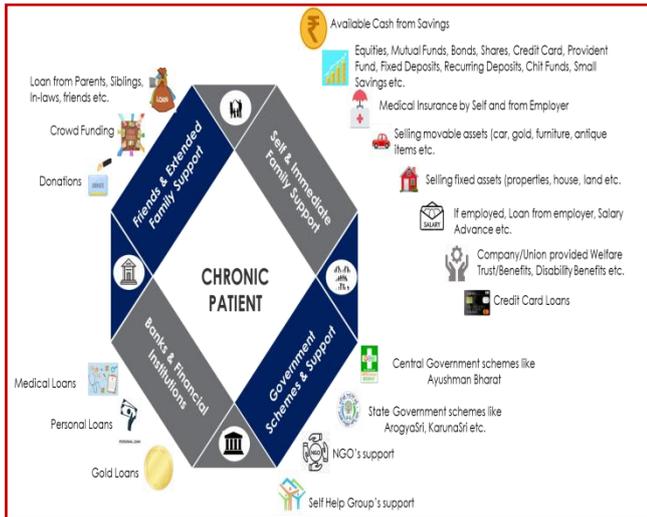
the medicines to the patient. The prevalent reason for not buying the medicine in case of chronic illness patients is the expensive cost of medicine [3]. Pharmaceutical companies design and develop new methods to ensure the delivery of medicines to reach the patients in need. Pharmaceutical companies map different services to patients as per their journey. Patient’s journey can be mapped in different stages such as: awareness, doctor consultation, confirmation through diagnostic tests, prescribing treatment, adhering to prescription regimen, buying medicines, improved quality of care. The below Figure 1 depicts the patient’s journey at various stages and shows the steps where the patient drops from the care regimen.

**II TRADITIONAL MODELS OF FINANCIAL ASSISTANCE**

Indian computing industry has evolved over a period of time and now is the time to provide innovative computer aided methods and solutions to various different industry problems. Technologies have become advanced and insights from huge data warehouses have become handy in the current day computing world. These technologies help Healthcare and Life Sciences industry in solving its time defying business problems. Pharmaceutical companies need to take the advantage of these technologies in reaching the patients at large and increase their revenue potential.

Generally, pharmaceutical companies design patient centric services in collaboration with various third party vendors such as: (a) awareness programs through conducting periodic campaigns, (b) medicine delivery services directly to the door-step of the patient or the hospital attached to patient, (c) educational literature to patient to better manage the disease, (d) refill reminders and notifications via traditional and digital modes, (e) diagnostic support in collecting tissue samples at the convenience of the patient, (f) capturing adverse events and reporting to drug safety teams, (g) clinical support in helping the infusion as per the comfort of the patient, (h) financial assistance based on eligibility to buy the medicine, (i) providing free-of-cost medicines by verifying the medication adherence, (j) develop patient specific digital applications through mobile and web portal, so that the patient can avail different services, (k) patient counselling services, (l) providing dietician/nutrition support, (m) giving physiotherapy support at home, (n) care taker counselling services, (o) hotline services to deal with emergencies, (p) mobile app to doctor to track the health of their patients, (q) conducting outreach programs in rural areas etc. [13] The primary intention of each of these services is to ensure that the medicines are bought on time and adhered to as per the

prescription regimen. The prevalent reason for chronic patients in India for medication nonadherence is affordability of the medicine. People from different sections of the society have varied reasons for not buying the prescribed medicine and resulting in medication nonadherence. Pharmaceutical companies in collaboration with financial institutions develop methods to provide financial assistance for chronic patients in India. Government of India provides many health facilities to its citizens through its eco system, yet the cost of medical treatment in case of chronic illness is expensive and out of reach for many citizens. Due to this fact, patients with chronic illness look for various other means in buying the expensive medicines. Buying medical insurance is another common trait for many to avail the money to buy medicines [4]. Insurance is a subject matter of solicitation and Indian citizens are aware of the fact that the insurance can be bought for medical irregularities. Many insurance companies in India do not provide insurance schemes for identified persons with known chronic illnesses. This situation makes the chronic patient much more difficult to afford the medicine cost. This is a challenging situation for not only the patient, but also for the pharmaceutical company – and it provides an opportunity for the pharmaceutical company to innovate through its collaboration vendors to provide the financial assistance to those chronic patients. Traditional known models in financial assistance for chronic patients is through Government schemes, company medical facilities for those who are employed, self-procured medical insurance schemes, obtaining loan from friends and relatives at the time of need etc. [12] When chronic patients do not find any way out to buy the needy medicine, few pharmaceutical companies in India are helping the patients to obtain financial assistance through their collaborating third party vendor, as part of their beyond-the-pill initiative to improve the medication adherence. Financial institutions provide monetary assistance to chronic illness patients with a set of standard parameters that are defined as per the wealth of the borrower. Many a times, these parameters look at only the financial aspects of the borrower (in this case, the chronic patient), leaving the health parameters aside. The intention of the financial institution in providing the financial assistance is not only to provide the monetary assistance, but also to recover the money over a period of time. If the health parameters are not taken into consideration and if patient does not survive after taking the monetary assistance, the recovery is subject to the legal proceedings in recovering the money based on the wealth of the borrower. Traditional method of providing the monetary assistance is based on the analysis of the borrower, but the new method introduced in this paper is a predictive analytical method, which helps in assuring the recovery of the money for the financial institution, while helping the chronic patient during the important time. The problem is manifold, if the patient has multiple illness conditions, i.e., concomitant conditions. The affordability becomes a challenge not only for



**Fig 2. Traditional financial assistance options for chronic patients in India**

the patient, but also for the care taker to support financially. Only 10 chronic patients out of every 1000 diagnosed chronic patients in India are receiving the optimal care i.e., 1% of the chronic patient population. With the help of a new analytical method driven financial assistance model for chronic patients in India, pharmaceutical companies expect to provide better quality of care and improve the medication adherence. The below Figure 2 depicts the traditional financial assistance avenues for chronic patients in India.

**III PREDICTIVE ANALYTICS BASED FINANCIAL ASSISTANCE MODEL & RESULTS**

While more than 50% of population of the world lives with various chronic diseases, 20% of Indian population are living with diseases of chronic in nature and this number will increase in the coming years [9]. This number is expected to increase in the coming days and years and the challenge of affordability is all the more important to solve by pharmaceutical companies, healthcare payers and financial institutions. While devising a new financial assistance model for chronic illness patients, it should be viable and sustainable for all the stakeholders (lender, borrower, guarantor etc.) in the eco system [6].

Human emotions run higher due to disorders in health and wealth. Chronic illness is a difficult situation to understand and manage the well-being of an individual [7] i.e., all round parameters of the individual. This chronic condition affects individuals from different sections of the society – like basic amenities (food, shelter and clothes etc.), safety and social comforts (income, friends, relations etc.), esteem needs (desire to have special amenities) and sometimes self-actualization benefits (charity, philanthropy etc.).

Pharmaceutical companies in collaboration with third party vendors provide financial assistance to chronic patients for the purpose of diagnosis and treatment [8]. The diagnoses of chronic diseases are also expensive and many a times, the patient goes through multiple tests to confirm the prevalence of disease. Based on the stage of the chronic disease, i.e., from an early stage to an advanced stage, the treatment options vary and so as the costs incurred. The reason for expensive diagnosis is that these diagnostic tests

are based on comprehensive genomic profiling approach. The treatment approach for each patient is personalized based on the stage of the chronic condition. Doctors help optimize the treatment strategies based on the diverse clinical situation of the patient.

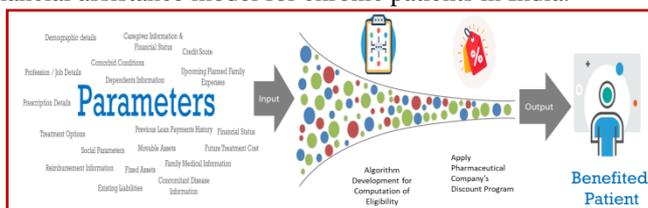
In India, traditionally medical insurance is not provided to those people who are diagnosed with chronic illnesses. In seldom cases, even if some Insurance Company is ready to provide the insurance, the premium is astronomical. This scenario is changing in the recent times and insurance companies and financial institutions are providing monetary loans for the chronic patients with the existing evaluation methodology. The current methods for issuing monetary loans is purely based on various financial parameters of the borrower. These parameters include (a) estimated annual income of family including other earning members of the family, (b) analysis of bank statements for spending patterns, (c) existing financial obligations for ongoing loans i.e., percentage of income for loan payments, (d) credit score of the borrower, (e) age of the borrower, (f) guarantor for the loan, (g) fixed assets on the name of the borrower etc. All these parameters revolve around the financial aspects of the borrower and do not consider any other aspect into consideration at the time of approval of the loan.

Not all chronic illnesses result in fatal conditions immediately, but many can be treated with medical care giving the patient positive outcomes. Chronic illness patients in India live longer than expected when treated under proper medical care regimen, compared to non-adherence of medication. Because of the current financial conditions, which are not favoring to buy the expensive medicines, chronic patients in India are deprived of necessary medical care during their difficult times [10]. With numerous advances in the computing industry and relooking at the longevity of the chronic patients, financial institutions in collaboration with pharmaceutical companies design newer methods to enable the patients to buy the necessary medicines. Predictive analytics of the chronic patient data helps in evaluating whether the borrower would be in a position to repay the monetary loan disbursed, while chronic patient gets the required financial assistance during the tough time of the life [11].

The disadvantages of considering only the financial parameters of the borrower is that most of the chronic patients are not eligible to obtain the approval of the loan. A chronic patient with lot of fixed assets but less or no regular income will be deprived of the loan approval. Whereas a chronic patient with good credit history and lot of financial commitments to fulfill, but the medical condition do not favor longevity of life will be easily getting the loan approval from financial institutions. After due evaluation of these reasons, there is a need to look at the chronic patients, considering all possible parameters before approval or rejection for monetary assistance.

The multi-dimensional approach to the approval of a loan is not only based on the financial parameters of the borrower, but also takes the parameters on patient’s health,

patient’s disease history, lifestyle of the patient, social parameters, insurance and reimbursement options, family history etc. The below Figure 3 depicts the proposed financial assistance model for chronic patients in India.



**Fig 3. Proposed financial assistance model for chronic patients in India**

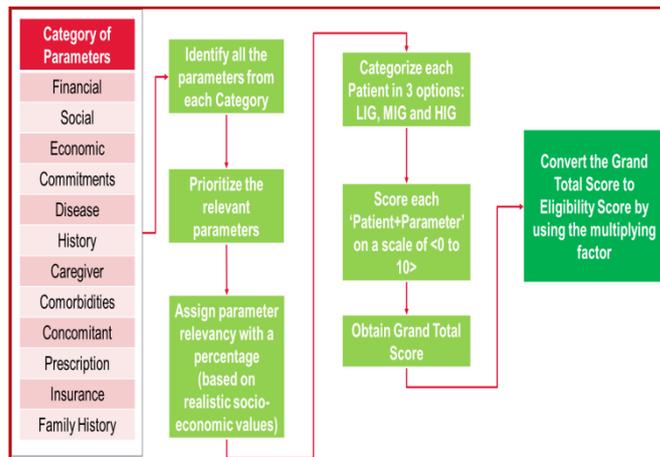
The multi-dimensional approach for evaluating the eligibility of chronic patient for financial assistance follows a segmented approach. The first segment is to identify all the different categories in relation to the chronic patient. These categories include: (a) Financial, (b) Social, (c) Economic, (d) Commitments, (e) Disease details, (f) Disease History, (g) Caregiver details, (h) Comorbidities, (i) Concomitant conditions, (j) Prescription, (k) Insurance, (l) Family History etc.

The second segment is to identify various parameters under each category. For example, the parameters under ‘Financial’ category include: (a) Fixed Assets, (b) Regular Income, (c) Movable Assets, (d) Outstanding Loans, (e) Credit score, (f) Previous Loans history, (g) Current expenses, (h) Income Returns details etc. For example, the parameters under ‘Social’ category include: (a) Social status, (b) Position or Designation in society, (c) Life Style, (d) Known Social risks, (e) Criminal history, (f) Behavior with colleagues, (g) Life expectancy, (h) Employability Rate, (i) Educational Attainment etc.

The third segment is to prioritize the relevant parameters and assign each parameter with weightage/relevancy percentage. There are numerous parameters in each category and the weightage percentage should be appropriately assigned based on realistic socio-economic values, the relevancy to the disease area and the necessitated loan amount. For example, Haemophilia is a chronic disease (but treatable condition) and each cycle of the treatment in a year costs around couple of lakhs – hence, the financial parameters need not be given a higher percentage in this case. Whereas, Oncology is a chronic disease (few cancer conditions are treatable) and each cycle of treatment in a year costs few tens of lakhs – hence, the financial parameters need to be given higher percentage in this case.

The fourth segment is to divide each patient portfolio into three options on the basis of income group – LIG (Lower Income Group), MIG (Middle Income Group) and HIG (High Income Group). The options can be more than three based on the requirement of financial assistance model.

The fifth segment is to place each category and each parameter in a tabular format while patient portfolio on the column side. The intention of this segment step is to provide a score on multi-dimensional approach to determine the patient’s eligibility for monetary assistance. The below Figure 4 depicts the proposed financial assistance model for chronic patients in India on a segment-wise approach.



**Fig 4. Segment-wise approach of proposed financial assistance model for chronic patients in India**

The sixth segment is to score each ‘patient profile plus parameter’ on a scale of zero to ten (i.e., 0 to 10), considering both the parameters in combination. Also each parameter has a relevancy/weightage in percentage terms, making the combination for the financial assistance model stronger than traditional one-dimensional model. The individual score needs to be multiplied by the weightage/relevancy to obtain the weighted subtotal for that parameter. Similarly, compute the weighted subtotals for all the parameters for the patient profile.

The seventh segment is to obtain the grand total of the weighted subtotal and multiply with a multiplying factor. The multiplying factor is only for the purpose of arriving at Eligibility score based on the patient profile, leading to the decision of approval or rejection of the monetary assistance. The intention of the multiplying factor is based on the financial institution’s policy – i.e., a financial institution may provide 80% of the requested loan amount to the borrower and expects the borrower to pay the remaining 20% from their pocket. The multiplying factor can also be used to arrive at how much percentage of money can be approved as against the requested monetary assistance. The below Figure 5 depicts the design of the proposed financial assistance model for chronic patients in India.

Category	Parameter	Relevancy / Weightage	Patient Profile			Subtotals	Weighted Subtotals	Weighted Score for Eligibility Score
			LIG (Low Income Group)	MIG (Medium Income Group)	HIG (High Income Group)			
Category-1	Parameter-1	40%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	Eligibility Score = Grand Total Score x Multiplying Factor  (Multiplying Factor is only to arrive at the Loan Amount Percentage)
	Parameter-2	90%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
	Parameter-3	30%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
	Parameter-4	80%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
Category-2	Parameter-5	50%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
	Parameter-6	100%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
Category-3	Parameter-7	20%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
	Parameter-8	10%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
	Parameter-9	70%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
	Parameter-10	60%	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	<0 to 10>	
Grand Total Score →						<0 to 100>		

**Figure 5. Design of the proposed financial assistance model for chronic patients in India**

Category	Parameter	Relevancy / Weightage	Patient's Profile			Weighted Subtotal	Eligibility Score for Loan Amount Percentage
			LIG	MIG	HIG		
Financial	Fixed Assets Value	50%	0	7	0	6.30	69.40%
	Movable Assets Value	50%	0	9	0	8.10	
	Outstanding Loans	50%	0	8	0	7.20	
Social	Educational Attainment	40%	0	9	0	3.60	69.40%
	Life Expectancy	40%	0	7	0	2.80	
	Employment Rate	40%	0	9	0	3.60	
Disease	Obesity Rate	75%	0	9	0	6.75	69.40%
	Comorbid Conditions	75%	0	9	0	6.75	
	Healthy Vitals	75%	0	6	0	4.50	
	Duration of Disease	75%	0	8	0	6.00	
Grand Total Score ->						55.60	

Fig 6. Illustration of the proposed financial assistance model for chronic patients in India

A comprehensive illustration for the multi-dimensional approach to the financial assistance model for chronic patients in India is depicted in Figure 6.

IV FUTURE WORK & CONCLUSIONS

An innovative approach has been devised to unravel an adaptive learning model based on analytics in this paper. Substantial reasons are explained for utilizing the multi-dimensional approach of fulfilling the financial needs of a chronic patient, while financial institutions do not lose on their intent in providing the financial assistance. The authors hope that this approach helps the pharmaceutical industry, micro financial institutions and help the needy chronic patients at large leading a better quality of life. While the financial assistance is only one aspect in ensuring the medication adherence, the health of a chronic patient lies in the hands of the patient, caretaker and Doctor.

Enviably predictive analytics based financial assistance model should evade as many monetary hurdles as possible for the chronic patient helping the patient in leading a normal life. The future work on this subject matter should help in devising more models and help Government in making policies for better quality of care of chronic patients living in India.

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