

**How to Cite:**

Bhattacharjee, A., Chaudhary, M., & Ranganathan, S. (2022). Adoption of value-based pricing for prescription drugs: An extension of Roger's innovation diffusion theory. *International Journal of Health Sciences*, 6(S4), 5347–5364.  
<https://doi.org/10.53730/ijhs.v6nS4.10084>

# **Adoption of value-based pricing for prescription drugs: An extension of Roger's innovation diffusion theory**

**Arjun Bhattacharjee**

S P Jain School of Global Management

Corresponding author email: [arjun.ds20dba016@spjain.org](mailto:arjun.ds20dba016@spjain.org)

**Monica Chaudhary**

S P Jain School of Global Management,

Email: [monica.chaudhary@spjain.edu.au](mailto:monica.chaudhary@spjain.edu.au)

**Smitha Ranganathan**

S P Jain School of Global Management

Email: [smitha.ranganathan@spjain.org](mailto:smitha.ranganathan@spjain.org)

**Abstract**---Value-based pricing (VBP) is increasingly recognized by academics and practitioners as the most effective approach to price prescription drugs and improve patient access to medicines. However, despite the apparent support, there has been high rate of failure and continued low adoption of value-based agreements between payers and drug manufacturers. This paper aims to explore the potential factors influencing various stakeholders' intentions to use VBP. For this purpose, the original version of the Roger's Innovation Diffusion Theory, which included relative advantage, compatibility, complexity, trialability and observability is studied and extended with Health Information Technology (HIT) and value measurement factors. The study presents a detailed review of existing literature in the area of healthcare pricing and introduces a conceptual framework that can be used for understanding organizational readiness for rapid adoption of VBP for prescription drugs. Finally, based on the constructs presented in the literature, we propose future research questions that need to be addressed to inform how the healthcare sector should approach the VBP adoption.

**Keywords**---innovation, HIT, value-based pricing, prescription drugs.

## Introduction

Prescription drugs are medications that are used to treat various medical conditions like diabetes, arthritis and cancer. The benefits for why a person takes prescription medication is generally to alleviate mild to severe pain and to live a more comfortable life. However, the prices of prescription drugs, especially of newer agents, have escalated in recent years. In 2020, spending on prescription drugs worldwide is approximately \$1.3 trillion and almost a quarter of it was from the United States [1]. Annually, these spends are projected to increase between 3% and 6% worldwide. A large proportion of these costs are for cancer treatments with a global spending of approximately 160 billion dollars in 2018 and with a 10% year-on-year increase for the last 5 years [2].

This increasing price of prescription drugs impacts global healthcare spends and also reduces the funding for other public investments. In addition, health insurance companies or payers often limit coverage for outpatient drugs. In out-of-pocket markets, the high price is a bigger threat to patient access and treatment adherence [3]. Prescription drugs are usually expensive due to various factors like seriousness and complexity of disease, high research cost and unavoidable substitution of less expensive drugs with expensive ones for better efficacy.

Traditionally, drug pricing contracts have been majorly volume-based that establishes a fixed price for the medication and is unchanged during the treatment cycle causing increased financial pressure on the insurers. Alternatively, value-based pricing (VBP) allows dynamic prices for the same medication depending on how well it actually performs (efficacy) for patients in real life [4]. Under value-based agreements, payers and drug manufacturers associate the payment for a drug to the actual outcome achieved with the treatment. Some examples of these measures are hospitalization visits, side-effects, numbers of life years extended, or other vital signs [5]. Though interest in VBP has been growing in the healthcare industry, the adoption has remained low due to various reasons. Some of the identified challenges are accurate outcomes measurement, data management, and lack of transparency but with a research gap to further identify and study these factors impacting adoption [6].

Innovation adoption has been a well-researched area with multiple studies and frameworks. Among the most widely accepted approaches is Innovation Diffusion Theory (IDT) [7]. The theory proposes that five attributes of an innovation influence its adoption: relative advantage, compatibility, complexity, observability and trialability. The theoretical framework is applicable for all sectors with new innovations and can also support the study of adoption of VBP for prescription drugs. However, it is required to consider all relevant factors explaining VBP acceptance for prescription drugs which are not implicitly available in the framework to develop a more complete and powerful conceptual model [8]. As a result, an extension of Health Information Technology (HIT) and value measurement is considered in a more comprehensive manner to examine this adoption study. Health Information Technology (HIT) refers to the electronic systems used for storing, receiving, collaborating, and using patient health information for analysis and decision making [9]. Value measurement factors

include challenges faced while measuring the right outcome of a prescription drugs. By incorporating and testing these additional factors, payers and drug manufacturers could gain a better understanding and solve this problem of low usage rate of the new pricing approach.

This study introduces a conceptual model that explains the main innovation factors of IDT in relation to VBP and subsequent extension with HIT and value measurement factors. The paper is structured as per these sections: research methods, literature review with proposed conceptual framework, and contributions and limitations arising from the research.

## **Methods**

The research is conducted by examining existing publications describing the adoption of VBP for healthcare industry, specifically prescription drugs. The following databases were searched: PubMed, EBSCO and Google Scholar. Search terms included: 'value-based pricing', 'outcomes-based pricing', 'value-based agreements', 'prescription drugs price', along with 'adoption' or 'challenge' or 'implementation'. Given that this is a fast-evolving area, the search results were constrained to five years with only English publications. Only articles from peer-reviewed journals were considered and thus blogs, news and other grey literature were excluded. An initial search gave 158 results out of which 46 were selected based on the review of abstract and methodology. Finally, 25 studies were selected based on their relevancy and consistency with this research area. The results were categorized based on geography, methodology, and participant profile.

The analysis of the literature review is structured in 3 phases, as described in Fig. 1: Defining the innovation attributes or "What's" of the traditional IDT, identifying major VBP constructs or "Why's" from 25 selected research articles focusing on challenges of VBP adoption, and finally, mapping the VBP factors to IDT framework for final conceptual model.

## **Literature Review**

Although VBP has started to gain attraction in the healthcare industry, there are limited publications that examine its worldwide adoption for prescription drugs. There are few research articles examining VBP implementation in different countries. For example, Rees et al. [10] reviewed value-based healthcare in UK but specific challenges and barriers for VBP were not studied. Thus, it cannot be used for making an adoption decision. Alternatively, Zolkiewski et al. [11] studied the implementation barriers of VBP. However, their research was focused more on services and did not include a formal theoretical framework. Therefore, there is a research gap to conduct a holistic review of published papers toward VBP adoption and implementation in healthcare and especially for prescription drugs. When considering the final selection of the primary studies, couple of issues were encountered. Firstly, the participants who are considered for the empirical research. Over 84% of them considered payers and drug manufacturers as primary stakeholders while patients were considered in only 40% and healthcare professional and policy experts in less than 20% of the studies. Secondly, the

prevalence of studies across different countries is limited. A majority of research comes from Europe (48%) and United States (40%) with minimal studies from other countries.

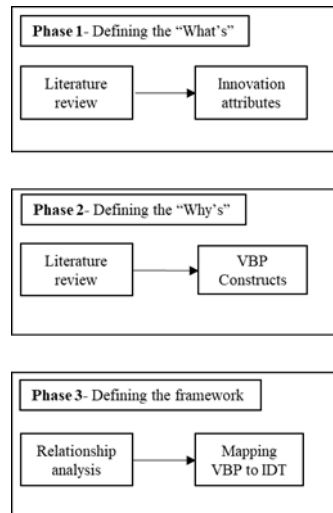


Fig 1: Literature review Framework

### Phase I: Defining the What's

Roger defined innovation as any product, process or service which is perceived as novel or new by the end user or an organization [12]. Innovation may not be entirely new in origin, but any item or a process that the end user perceives to have a novel use. With this definition, VBP for prescription drugs can be called an innovation in itself. Pricing based on perceived value of a product or service has been there for a long time in specific industries like fashion and B2B services. However, interest for such pricing agreements for healthcare has increased substantially over the last decade. Furthermore, adoption of innovations can be defined as the willingness to accept this new idea and incorporating for regular use [12].

Various academic studies have been conducted by prominent scholars to introduce theories and identify the factors impacting the adoption of innovation [13]. Few of the most popular and widely used innovation adoption theory models are discussed here. Theory of reasoned action (TRA) was introduced in 1967 and is a prominent model to predict and explain human behavior to adopt innovation. The framework consists of two basic factors: personal interest and social influence[14]. Davis et al. [15] and Baraghani [16] mentions that TRA is very generic and does not include an individual's perception towards the innovation. An additional factor of perceived behavioral control was thus included in TPB to mitigate the limitation of TRA [17]. However, both TRA and TPB have limitations since individuals do not always behave as per the defined attitudes and subjective norms and may not act even after an intent is formed [18]. In addition, the adoption of VBP is organization focused and might still be adopted regardless of an individual's nature or behavior. This makes both these models not suitable for our study [12].

According to Oliveira and Martins [19], IDT) framework provides an option to focus on firm level adoption and not only at an individual level. IDT helps us understand why an innovation is adopted and at what rate will it spread in a society [7]. Rogers [12] highlights that adoption is possible when uncertainty is reduced and five specific innovation attributes helps to decrease this uncertainty. These innovation-adoption influencing attributes are: relative advantage, compatibility, complexity, observability, and trialability.

*Relative Advantage* is the primary and one of the most powerful factors of innovation adoption. An organization will decide to adopt a new product or process only if it is perceived to be a better option than current one [21]. The advantages provided by VBP for prescription drugs has to be compelling enough for the decision makers to adopt it for their organization. *Compatibility* allows organizations to understand how the innovation will fit in their current structure [22]. It is the degree of consistency perception with existing technology, patient needs, company values and beliefs [12]. Higher the compatibility, better will be the adoption. However, if compatibility is too high, organizations might not perceive it as an innovation and that can impede change management and adoption.

*Complexity* is the degree of perception about the innovation in terms of difficulty to comprehend or use [21]. Unlike others, this factor has an inverse impact on the adoption VBP and policy makers will need to manage it during the initial implementation. However, if the innovation includes new technologies, it might be perceived to be more advanced and advantageous if they are complex rather than simple [7].

*Observability* is the degree of how easy it is to share and make the results visible to stakeholders about the innovation [23]. Communication is of prime importance and the adoption of VBP will be faster if the results are shared neatly and transparently among payers and healthcare providers. Moore and Benbasat [24] divided observability into two aspects: result demonstrability and visibility. Result demonstrability focusses on measuring tangible performance indicators and visibility allows decision makers to view the outcome of implementing the innovation.

*Trialability* allows organizations to examine the innovation partially before its full adoption [23]. This factor is quite aligned with modern approach of agile implementation and gives the end users a perception of surety and help in deciding if the innovation should be adopted or rejected. A test drive offer by the automobile company or a proof-of-concept conducted by organization before a full roll-out of a new innovation are examples of trialability. Rogers [12] focused on the innovation adoption process in two phases: initiation and implementation. Healthcare industry has already been in the initiation process for some time but there have been significant challenges in the implementation process [25], [26]. The literature review on VBP (Phase II) is mainly focused on implementation sub-process which includes three stages: adjustment or redefining, clarification, and making it a routine.

Roger's IDT theory has gained popularity in diverse sectors like marketing, social

justice, agriculture, education and communication [21]. In healthcare, IDT has been used to increase the adoption of crucial public health initiatives and innovative technologies for patient care. Helitzer et al. [27] applied IDT to understand the acceptance of tele-health programs in Mexico. Lee [28] studied the adoption of online patient care by nurses using a qualitative study in Taiwan. Liz Burley et al. [29] studied adoption of mobile technology among healthcare professionals using this theory and identified patterns of their decision-making. The robustness and existing evidence provide confidence to use Roger's IDT as a suitable framework for understanding the adoption factors of VBP for prescription drugs.

## **Phase II: Defining the Why's**

A medical drug can be defined as a chemical substance which is used for cure or prevention of a disease. Prescription drugs are specifically which are advised for intake by healthcare professionals, can be purchased only from licensed pharmacies and are regulated by local drug authorities [30]. Traditionally, prescription drugs have been priced based on cost or competitor prices [2]. Though volume-based pricing is easy to implement, they do not consider the actual value provided to the patients after using the drug. Many prescription drugs, especially specialty drugs, are of high cost due to multiple reasons like out-of-pocket payments, budget allocations and limited disclosure of real-world evidence and value of medication in terms of cost-effectiveness [31]. Given the rise in new treatment options, insurers have become sensitive to drug cost, impacting patient access and adherence [32]. There is a pressing need for transformation in traditional pricing models that can mitigate the financial toxicity and allow better reach of these drugs.

Alternatively, value-based agreement considers the end value of the product or the service as the primary factor for determining the right price of the good or service. VBP has been accepted as a robust pricing method for certain goods and services. In life science, VBP has started with few implementations and mainly with the use of QALYs (Quality-adjusted life-year). QALYs can be defined as an aggregate value of different parameters like length of life and different variables of patient life's quality [33]. Apart from QALY, VBP can take advantage of other drug outcomes like reduction in hospital visits, blood glucose level, heart rate and side effects like nausea. Under value-based agreements, the drug manufacturer provides a discount to the payer or patient if the drug did not achieve target thresholds of the outcomes in real-life setting [34]. Thus, the risk component of perceived high price is distributed between both parties of the contract.

VBP helps to reduce the impact of initial high drug price, however, their adoption has remained low due to several challenges during the contracting and executing stage [35]. Some of these roadblocks are measurement of right outcomes [5], difficulty to exchange treatment data [6], and lack of transparency among stakeholders [26]. A comprehensive list of the studies on VBP adoption can be found in Table I. It provides a summary of constructs influencing VBP adoption and are identified from ten case studies, six qualitative studies (interviews), six quantitative studies including meta-analysis, and three studies using literature reviews.

### Phase III: Defining the framework

This phase is aimed at mapping the frequently included constructs from Phase II to the IDT framework, in order to propose the final conceptual model. After analyzing the constructs included by each one of the selected 25 studies, we calculated their frequency of appearance and included only those which appeared at least twice. Based on the preceding discussion under Phase 1, we adopted Roger's IDT framework to incorporate these VBP

Table 1: Summary of research articles (most recent first)

Study	Year	Country	Sample/ Study Description	VBP evaluated/ drug	Constructs studied	Future Research Constructs
[52]	2022	Global	Case Study	Prescription Drugs	<ul style="list-style-type: none"> <li>• Outcomes Definition</li> <li>• Data collection</li> <li>• QALYs</li> <li>• Cost-effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>• Outcomes definition</li> <li>• Data Analysis</li> </ul>
[46]	2022	Europe	Literature Review (24)	Prescription Drugs	<ul style="list-style-type: none"> <li>• Data Collection</li> <li>• Rebate Period</li> <li>• RWE</li> <li>• Data management</li> <li>• Reimbursement mechanism</li> <li>• Outcomes definition</li> <li>• Interoperability</li> <li>• Adherence</li> </ul>	<ul style="list-style-type: none"> <li>• Transparency</li> <li>• Empirical study</li> </ul>
[36]	2021	Germany	20 expert interviews	General	<ul style="list-style-type: none"> <li>• Outcome Measurement</li> <li>• Brand Advantage</li> </ul>	<ul style="list-style-type: none"> <li>• Artificial Intelligence</li> </ul>
[48]	2021	Global	Quantitative study (792 survey participants) + 20 expert interviews	General	<ul style="list-style-type: none"> <li>• Outcomes Definition</li> <li>• Stakeholder Attitudes</li> <li>• Negotiation Power</li> <li>• Data Collection</li> <li>• Data Management</li> <li>• Transparency</li> <li>• Data Analysis</li> <li>• Risk sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Firms' business Models</li> <li>• Firms' level of maturity</li> </ul>
[53]	2021	Malaysia	Survey (230 managers)	General	<ul style="list-style-type: none"> <li>• Firms level of maturity</li> <li>• Outcomes definition</li> <li>• Data Analysis</li> <li>• Stakeholder attitude</li> <li>• Transparency</li> </ul>	<ul style="list-style-type: none"> <li>• Transparency</li> <li>• Dialogue</li> </ul>
[49]	2020	OECD countries	Comparative Study	Personalized medicines	<ul style="list-style-type: none"> <li>• Alternate pricing policies</li> <li>• Transparency</li> </ul>	<ul style="list-style-type: none"> <li>• Dynamicity</li> </ul>
[56]	2020	US	Population-based cohort	Diabetes	<ul style="list-style-type: none"> <li>• Cost-effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>• RWE Availability</li> </ul>

[39]	2020	US, Europe	study Comparative Study	Oncology, Diabetes	<ul style="list-style-type: none"> <li>• Rebate Period</li> <li>• Clinical studies</li> <li>• Government Policies</li> <li>• Reimbursement</li> <li>• Dynamicity</li> </ul>	<ul style="list-style-type: none"> <li>• Transparency</li> <li>• Outcomes definition</li> <li>• Data Collection</li> <li>• Data Analysis</li> </ul>
[25]	2020	US, Europe	Case Study	Prescription Drugs	<ul style="list-style-type: none"> <li>• RWE Availability</li> <li>• Outcomes Definition</li> </ul>	<ul style="list-style-type: none"> <li>• Patient Adherence</li> <li>• Rebate period</li> </ul>
[40]	2020	Europe	Literature Review (174)	Prescription Drugs	<ul style="list-style-type: none"> <li>• Dynamicity</li> <li>• Rebate period</li> <li>• Outcome definition</li> <li>• Data collection</li> <li>• Government Policy</li> </ul>	<ul style="list-style-type: none"> <li>• Financial Agreement terms</li> <li>• Data Collection</li> <li>• Governance</li> <li>• Implementation Cost</li> <li>• Cost-Effectiveness</li> <li>• Rebate period</li> <li>• Personalization</li> </ul>
[54]	2020	US, Europe	Meta-analysis (6 countries contracts)	Prescription Drugs	<ul style="list-style-type: none"> <li>• QALY</li> <li>• Cost-effectiveness</li> <li>• RWE</li> </ul>	<ul style="list-style-type: none"> <li>• Health Technology assessments</li> <li>• Indication pricing</li> </ul>
[41]	2020	Canada	Meta-analysis (34 drug indications)	Prescription Drugs	<ul style="list-style-type: none"> <li>• Patient Perceived Value</li> <li>• Cost-effectiveness</li> <li>• QALYs</li> <li>• Budget Allocation</li> <li>• Government Policy</li> </ul>	<ul style="list-style-type: none"> <li>• Non-holistic pricing</li> <li>• Fear to lose</li> <li>• Outcomes Definition</li> </ul>
[50]	2019	Germany	20 expert interviews	General	<ul style="list-style-type: none"> <li>• Non-holistic pricing approach</li> <li>• Fear to lose</li> <li>• Outcomes Definition</li> <li>• Value Framework</li> </ul>	<ul style="list-style-type: none"> <li>• Pricing awareness</li> <li>• AI</li> <li>• Behavioral Pricing</li> <li>• Product as a service</li> </ul>
[51]	2019	Germany	20 expert interviews	General	<ul style="list-style-type: none"> <li>• Data Management</li> <li>• Artificial Intelligence</li> </ul>	

Study	Year	Country	Sample/ Study Description	VBP evaluated/ drug	Constructs studied	Future Research Constructs
[4]	2019	Global	Literature Review (88)	Prescription Drugs	<ul style="list-style-type: none"> <li>• Risk sharing</li> <li>• Budget allocation</li> <li>• QALYs</li> </ul>	<ul style="list-style-type: none"> <li>• Outcomes definition</li> <li>• Data Analysis</li> </ul>
[57]	2019	US	Literature Review (24)	Oncology	<ul style="list-style-type: none"> <li>• RWE</li> <li>• Clinical studies</li> <li>• Data Management</li> <li>• Interoperability</li> <li>• Value Framework</li> </ul>	<ul style="list-style-type: none"> <li>• Artificial intelligence</li> <li>• Data Management</li> <li>• Cost-effectiveness</li> <li>• Advanced payment</li> </ul>



						models
[47]	2019	Amsterdam	Semi-structured interviews (17)	General	<ul style="list-style-type: none"> <li>• Firms level of maturity</li> <li>• Internal champion</li> <li>• Stakeholder attitude</li> <li>• Competitor pricing</li> </ul>	<ul style="list-style-type: none"> <li>• Firm's size</li> <li>• Stakeholder relationship</li> </ul>
[45]	2018	Dutch	Case Study: Data from four different hospitals were used to perform "what-if" analyses	Non-Small Cell Lung Cancer	<ul style="list-style-type: none"> <li>• Outcomes Definition</li> <li>• Outcome Definition</li> <li>• Clinical studies</li> <li>• Multiple therapy at once</li> <li>• Implementation Cost</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation Cost</li> <li>• Administrative Burden</li> <li>• Data Collection</li> <li>• Stakeholder Attitude</li> </ul>
[35]	2018	UK	24 interviews with 11 companies	Mix Industries	<ul style="list-style-type: none"> <li>• Multiple stakeholders</li> <li>• Dynamicity</li> <li>• Firms level of maturity</li> <li>• Stakeholders attitude</li> <li>• Outcomes Definition</li> <li>• Negotiation Power</li> <li>• Implementation Cost</li> </ul>	<ul style="list-style-type: none"> <li>• Firm's level of maturity</li> <li>• Risk Sharing</li> </ul>
[42]	2018	US	interviewed 9 manufacturers, 6 policy experts, and 8 payers	Prescription Drugs	<ul style="list-style-type: none"> <li>• Contract Challenges</li> <li>• Data Management</li> <li>• Government Policy</li> <li>• Budget allocation</li> <li>• Patient Perceived Value</li> </ul>	<ul style="list-style-type: none"> <li>• Role of providers</li> <li>• Internal champion</li> <li>• Data Analysis</li> <li>• Negotiation Power</li> </ul>
[37]	2018	US	Quantitative study using regression discontinuity analysis	Chronic Diseases	<ul style="list-style-type: none"> <li>• Stronger incentives</li> <li>• Risk sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported Outcomes</li> <li>• Firms Maturity</li> </ul>
[44]	2017	Global	Case Study	General	<ul style="list-style-type: none"> <li>• Stakeholder Attitude</li> <li>• Product-oriented sales</li> <li>• Firms level of maturity</li> <li>• Government Policy</li> <li>• Outcomes definition</li> <li>• Implementation cost</li> <li>• Supplier's brand</li> <li>• Rebate period</li> <li>• Interoperability</li> <li>• Internal</li> </ul>	<ul style="list-style-type: none"> <li>• Firms' Maturity</li> <li>• Patient's Perceived value</li> </ul>

[38]	2017	US	Survey (144 pricing professionals)	General	champion • Outcomes Definition • Market segmentation • Pricing levels definition • Risk Sharing • Stakeholder Attitudes	• Strategic commitment from the top • Positive Internal Perception
[43]	2017	US	Case Study	PCSK9 inhibitors	• Risk sharing • Budget allocation • RWE	• Heterogeneity of treatment response • Clinical efficacy • Clinical studies
[5]	2017	US	Case Study (26 agreements)	Prescription Drugs	• RWE • Clinical Studies • Budget allocation • Data Management • Outcomes definition • Implementation Cost	• Data Availability

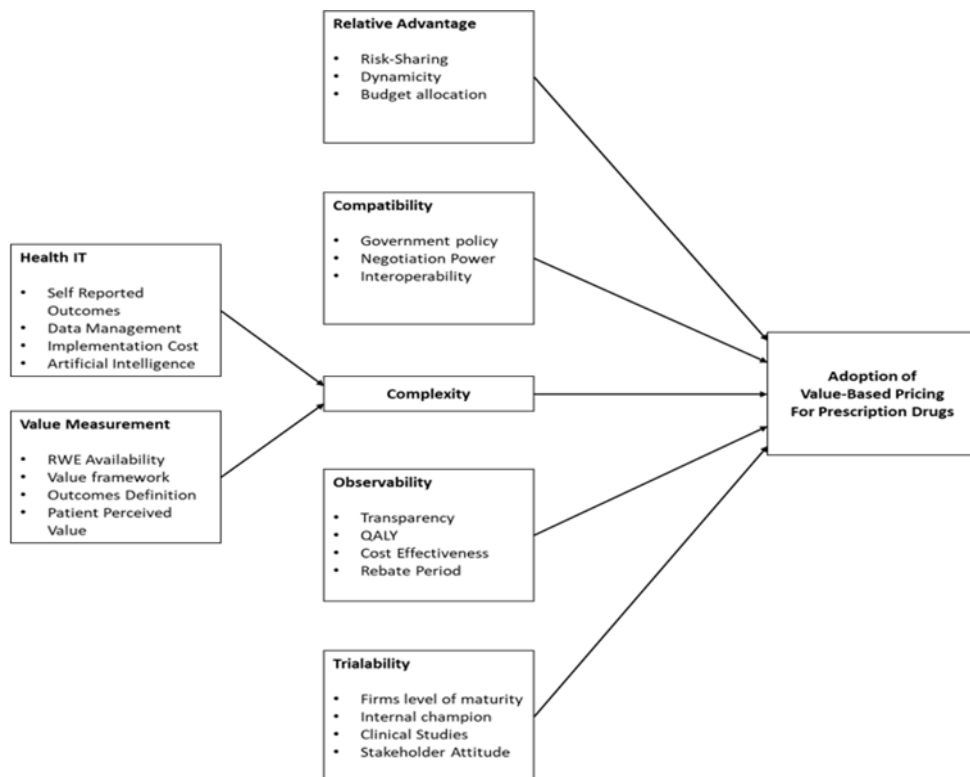


Fig 2: Conceptual Framework

variables to study organizations' adoption of value-based agreements for prescriptions drugs. The conceptual model of this paper is shown in Fig. 2.

Relative advantage includes factors which demonstrate a higher degree of perceived benefits of VBP compared to traditional pricing. Under VBP, the pricing agreements allows improved risk sharing between drug manufacturers and payers for treatment failures [4], [36]–[38]. Also, the contracts can be dynamic and personalized for patients as compared to traditional volume-based pricing [35], [39], [40]. One of the major advantages of value-based approach is that it reduces payers and government's budgetary risk for overspending, thereby allowing access to promising treatments [41]–[43].

Compatibility factors for VBP allow easy fit of the implementation into existing culture, technology and values of payers and drug manufacturers. For VBP to be successfully adopted, the agreements have to be compatible with existing government and regulatory policies [39]–[41], [44]. They include security standards like General Data Protection Regulation Act 2018 (GDPR) and Health Insurance Portability and Accountability Act (HIPAA). VBP adoption requires existing negotiation power to be continued and remain balanced with both payers and drug manufacturers [35], [48]. Finally, Gonçalves et al. [45], Bohm et al. [46], and Woznicki [47] suggested a direct correlation of data interoperability and the success of VBP.

Complexity is the key challenge for VBP adoption and it is crucial to support the implementation process and make it easy to understand and use. The literature review helped to divide complexity into two focused constructs: Health Information Technology (HIT) and value measurement. HIT includes systems to collect outcomes results, manage patient data and analyze using artificial intelligence [9]. Self-reported outcomes or patient-reported outcome measures allows direct patient input for improving quality of care by leveraging new technologies like wearables [40], [46], [52]. Implementation cost for deploying new systems for VBP has been a major hindrance for many organizations [5], [35], [44], [45]. Data management mainly involves better handling of personal and sensitive patient information by providing an extension to electronic health record systems [42], [46], [48], [57]. Artificial Intelligence is an important factor for HIT to analyze large volumes of records and provide novel suggestions on value measures [41][42].

Value measurement is the other extension of complexity construct and it requires Real-World Evidence (RWE) availability which is a major source of outcomes data [5][43][45][54]. Outcomes definition is the process to analyze intermediate or final results of a drug or treatment in terms of efficacy, safety and clinical validity [50], [51]. The success of a value-based agreement is significantly dependent on defining the appropriate and specific values of the prescription drug [25], [36], [46], [52], [53]. On the other hand, the biggest challenge faced today is the disagreement between payers and drug manufacturers about which outcomes should be included in the agreement for a fair assessment. Value framework helps to convert the identified value to price. As per Levaggi and Pertile [49], the complexity of prescription medicines makes value framework very relevant and may have a substantial impact on the conclusions. In addition, the pricing is

expected to consider complex issues of social justice, disease criticality and equity which impacts patient's perception of drug value [41], [42].

Observability helps to make the results of VBP visible to key decision makers for improving adoption. However, the entire process of value measurement and sharing using patient data makes it difficult to have full transparency, thus making observability difficult to achieve [36], [49], [53]. QALY has been used to some extent to demonstrate the results of VBP contracts [4], [54]. However, Parmar et al. [41] clarifies that further research is required on QALY to include social justice and fairness and make it an important factor for VBP observability. Cost-effectiveness is another factor identified from past literature and is an intersection after which the health authorities have to forego any opportunity of improved health due to additional costs associated with it [55]. The cost-effectiveness threshold plays a critical role in validating the results of VBP for prescription drugs since funding drugs above the threshold will lead to net health losses [52], [54], [56]. Finally, an important factor for observing the results of value-based agreement is the rebate period, which is negotiated during contracting phase by the payer and drug manufacturer. The rebate period is essentially the duration of the agreement and corresponding payment time frame in terms of rebates. Usually, it might take years for understanding the full benefit of a treatment, especially for chronic diseases. However, with such long lead times, drug manufacturers cannot afford to wait for periodic payments and this might impact their adoption [46], [56]. Alternatively, if the duration is too short, it might not show the real value of the medication and payers might be unsure of the full potential of the drug [40], [44].

Trialability for VBP allows payers and drug companies to gain enough confidence with initial tests before full adoption for all drugs and indications. Some of the important factors for successful trialability includes firm's level of maturity in terms of knowledge and technology [35], [47], [53] and nominating an internal champion to guide all relevant teams [44], [47]. Since incorporating RWE can be a complex process for an initial test, studies have suggested using available clinical studies data for initial contracts [39], [45], [57]. Key decision makers and management within an organization play an important role in trialability and their attitude and behavior influences the decision to proceed with an initial test for VBP [35], [47], [53].

## **Discussion**

In this section, we describe managerial implications, the limitations in our study, and the directions for future research.

### **Managerial Implications**

Healthcare companies are well aware that value-based agreements can help to manage high drug costs, in particular prescription drugs, and also improve adherence of the patients. Our study provides different implications for payers, drug manufacturers and government health ministries that are part of the health management ecosystem for prescription drugs. Defining the right outcomes has been the most frequent theme in previous studies and has a positive and

significant effect on the acceptance of VBP. Therefore, payers and drug manufacturers, along with health authorities, should work in a collaborative and sustained manner to evaluate and define outcome standards for each therapeutic class and brand indications.

In addition, technology plays a key role in improving the adoption. It will be important to have the right focus and investment in emerging health technologies. Smart devices like wearables will help in self-reporting patient outcomes, artificial intelligence will reduce the time and effort for analyzing this data and blockchain can help in improving transparency, security and privacy standards of the ecosystem involved in value-based agreements.

Alternatively, the study suggests that stakeholder's attitude has a significant deterring effect on intention. Including policy experts, internal champions and patient advocacy groups in initial discussions will help to mitigate their perception of risks associated with VBP implementation and encourage their adoption on a continuous basis over time.

### **Limitations and Future Research**

Even though the study provided a comprehensive review of VBP adoption for prescription drugs, we would like to highlight few limitations and corresponding future research areas. Firstly, there might be some apprehensions related to the search strings used in the study. We have tried to incorporate all possible terms related to different types of value-based agreements. Nevertheless, due to this rapidly evolving area and different variations of value-based agreements being tested worldwide, the review might not be exhaustive but does represent the overall understanding of VBP from the academic literature. Additionally, current literature provides an understanding of VBP implementation mainly from Europe and North America. With regards to these limitations, future research studies might cover new definitions of value-based pricing and incorporate broader sample of participants from Asia and Middle-East.

Secondly, the paper is based on literature review of past studies and lacks empirical evaluation. Further research can be undertaken using the suggested framework and validate the constructs using quantitative methods. Future research can also include additional constructs like organizational culture and maturity of the country's healthcare system.

### **Conclusion**

This study discusses the key variables that influence the adoption of VBP for prescription drugs. For this, we have studied the traditional Roger's Innovation Diffusion theory, with existing constructs of relative advantage, compatibility, observability and trialability, and extended it with additional variables of health information technology and value measurement. A total of 25 studies have been studied to identify the relevant factors impacting adoption of VBP for prescription drugs. With this aim, it is desirable that payers, drug manufacturers and government health authorities make necessary policy improvements adjust existing processes. The extension to the IDT framework could also influence the

adoption of new health information technologies to imbibe increased trust and mitigate uncertainties related to outcome measurement for prescription drugs.

## References

1. The Global Use of Medicine in 2019 and Outlook to 2023'. <https://www.iqvia.com/insights/the-iqvia-institute/reports/the-global-use-of-medicine-in-2019-and-outlook-to-2023> (accessed May 09, 2022).
2. S. Vincent Rajkumar, 'The high cost of prescription drugs: causes and solutions', *Blood Cancer J.*, vol. 10, no. 6, Art. no. 6, Jun. 2020, doi: 10.1038/s41408-020-0338-x.
3. S. S. Farid, M. Baron, C. Stamatis, W. Nie, and J. Coffman, 'Benchmarking biopharmaceutical process development and manufacturing cost contributions to R&D', *mAbs*, vol. 12, no. 1, p. 1754999, Jan. 2020, doi: 10.1080/19420862.2020.1754999.
4. F. P. Vlaanderen *et al.*, 'Design and effects of outcome-based payment models in healthcare: a systematic review', *Eur J Health Econ*, vol. 20, no. 2, pp. 217–232, Mar. 2019, doi: 10.1007/s10198-018-0989-8.
5. J. S. Yu, L. Chin, J. Oh, and J. Farias, 'Performance-Based Risk-Sharing Arrangements for Pharmaceutical Products in the United States: A Systematic Review', *JMCP*, vol. 23, no. 10, pp. 1028–1040, Oct. 2017, doi: 10.18553/jmcp.2017.23.10.1028.
6. A. M. Duhig, S. Saha, S. Smith, S. Kaufman, and J. Hughes, 'The Current Status of Outcomes-Based Contracting for Manufacturers and Payers: An AMCP Membership Survey', *JMCP*, vol. 24, no. 5, pp. 410–415, Dec. 2017, doi: 10.18553/jmcp.2017.16326.
7. E. M. Rogers, 'Diffusion of Innovations: Modifications of a Model for Telecommunications', in *Die Diffusion von Innovationen in der Telekommunikation*, M.-W. Stoetzer and A. Mahler, Eds. Berlin, Heidelberg: Springer, 1995, pp. 25–38. doi: 10.1007/978-3-642-79868-9\_2.
8. S. J. Barnes and S. L. Huff, 'Rising sun: iMode and the wireless Internet', *Commun. ACM*, vol. 46, no. 11, pp. 78–84, Nov. 2003, doi: 10.1145/948383.948384.
9. P.-Y. Yen, A. S. McAlearney, C. J. Sieck, J. L. Hefner, and T. R. Huerta, 'Health Information Technology (HIT) Adaptation: Refocusing on the Journey to Successful HIT Implementation', *JMIR Med Inform*, vol. 5, no. 3, p. e28, Sep. 2017, doi: 10.2196/medinform.7476.
10. D. J. Rees *et al.*, 'Collaborating to deliver value in health care: exploring conditions required for successful healthcare and life science sector collaboration', *TG*, vol. 15, no. 1, pp. 169–190, Mar. 2021, doi: 10.1108/TG-05-2020-0074.
11. J. Zolkiewski *et al.*, 'Strategic B2B customer experience management: the importance of outcomes-based measures', *JSM*, vol. 31, no. 2, pp. 172–184, Apr. 2017, doi: 10.1108/JSM-10-2016-0350.
12. E. M. ROGERS, A. SINGHAL, and M. M. QUINLAN, 'Diffusion of Innovations', in *An Integrated Approach to Communication Theory and Research*, 2nd ed., Routledge, 2008.
13. H. Taherdoost, 'A review of technology acceptance and adoption models and theories', *Procedia Manufacturing*, vol. 22, pp. 960–967, 2018, doi: 10.1016/j.promfg.2018.03.137.

14. L. LaCaille, 'Theory of Reasoned Action', in *Encyclopedia of Behavioral Medicine*, M. D. Gellman, Ed. Cham: Springer International Publishing, 2020, pp. 2231–2234. doi: 10.1007/978-3-030-39903-0\_1619.
15. F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, 'User Acceptance of Computer Technology: A Comparison of Two Theoretical Models', *Management Science*, vol. 35, no. 8, pp. 982–1003, 1989.
16. S. Naimi Baraghani, *Factors influencing the adoption of Internet banking*. 2008. Accessed: May 18, 2022. [Online]. Available: <http://urn.kb.se/resolve?urn=urn:nbn:se:ltu:diva-44140>
17. D. V. M. Nguyen, V. Ross, A. T. Vu, T. Brijs, G. Wets, and K. Brijs, 'Exploring psychological factors of mobile phone use while riding among motorcyclists in Vietnam', *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 73, pp. 292–306, Aug. 2020, doi: 10.1016/j.trf.2020.06.023.
18. F. F. Sniehotta, J. Presseau, and V. Araújo-Soares, 'Time to retire the theory of planned behaviour', *Health Psychology Review*, vol. 8, no. 1, pp. 1–7, Jan. 2014, doi: 10.1080/17437199.2013.869710.
19. M. D. Oliveira, I. Mataloto, and P. Kanavos, 'Multi-criteria decision analysis for health technology assessment: addressing methodological challenges to improve the state of the art', *Eur J Health Econ*, vol. 20, no. 6, pp. 891–918, Aug. 2019, doi: 10.1007/s10198-019-01052-3.
20. 'ATTRIBUTES OF "DIFFUSION OF INNOVATIONS" OF - ProQuest'. <https://www.proquest.com/docview/2060920937> (accessed May 18, 2022).
21. J. C. Ho, 'Disruptive innovation from the perspective of innovation diffusion theory', *Technology Analysis & Strategic Management*, vol. 34, no. 4, pp. 363–376, Apr. 2022, doi: 10.1080/09537325.2021.1901873.
22. E. Kaasinen, E. M. Mattila, H. Lammi, T. Kivinen, and P. Välikynen, 'Technology Acceptance Model for Mobile Services as a Design Framework', in *Human-Computer Interaction and Innovation in Handheld, Mobile and Wearable Technologies*, J. Lumsden, Ed. Hershey: IGI Global, 2011, pp. 80–107. doi: 10.4018/978-1-60960-499-8.ch005.
23. E. S. Alias, M. Mukhtar, and R. Jenal, 'Adoption of Unified Communications and Collaboration from the Perspective of Diffusion of Innovation and Service Dominant Logic: A Preliminary View', *International Journal on Advanced Science, Engineering and Information Technology*, vol. 8, no. 5, Art. no. 5, Oct. 2018, doi: 10.18517/ijaseit.8.5.6435.
24. G. C. Moore and I. Benbasat, 'Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation', *Information Systems Research*, vol. 2, no. 3, pp. 192–222, 1991.
25. J. P. Cohen, 'Is There a Future for Value-Based Contracting?', *Value in Health*, vol. 23, no. 4, pp. 416–417, Apr. 2020, doi: 10.1016/j.jval.2020.01.006.
26. N. Mahendraratnam *et al.*, 'Value-based arrangements may be more prevalent than assumed', *Am J Manag Care*, vol. 25, no. 2, pp. 70–76, Feb. 2019.
27. D. Helitzer, D. Heath, K. Maltrud, E. Sullivan, and D. Alverson, 'Assessing or predicting adoption of telehealth using the diffusion of innovations theory: a practical example from a rural program in New Mexico', *Telemed J E Health*, vol. 9, no. 2, pp. 179–187, 2003, doi: 10.1089/153056203766437516.
28. T.-T. Lee, 'Nurses' concerns about using information systems: analysis of comments on a computerized nursing care plan system in Taiwan', *Journal of*

- Clinical Nursing*, vol. 14, no. 3, pp. 344–353, 2005, doi: 10.1111/j.1365-2702.2004.01060.x.
29. L. Burley, H. Scheepers, and J. Fisher, 'Diffusion of Mobile Technology in Healthcare'.
  30. C. for D. E. and Research, 'Prescription Drugs and Over-the-Counter (OTC) Drugs: Questions and Answers', *FDA*, Apr. 2019, Accessed: May 18, 2022. [Online]. Available: <https://www.fda.gov/drugs/questions-answers/prescription-drugs-and-over-counter-otc-drugs-questions-and-answers>
  31. M. Drummond, D. Wilson, P. Kanavos, P. Ubel, and J. Rovira, 'Assessing the economic challenges posed by orphan drugs', *International journal of technology assessment in health care*, vol. 23, pp. 36–42, Feb. 2007, doi: 10.1017/S0266462307051550.
  32. Z. S. Almalki, A. K. Alahmari, J. J. Guo, and C. M. L. Kelton, 'Access to orphan drugs in the Middle East: Challenge and perspective', p. 5, 2012.
  33. N. J. Devlin and P. K. Lorgelly, 'QALYs as a measure of value in cancer', *Journal of Cancer Policy*, vol. 11, pp. 19–25, Mar. 2017, doi: 10.1016/j.jcpo.2016.09.005.
  34. S. Kesselheim, 'Outcomes-Based Pharmaceutical Contracts: An Answer to High U.S. Drug Spending?', p. 8, 2017.
  35. J. Hou and A. Neely, 'Investigating risks of outcome-based service contracts from a provider's perspective', *International Journal of Production Research*, vol. 56, no. 6, pp. 2103–2115, Mar. 2018, doi: 10.1080/00207543.2017.1319089.
  36. F. Steinbrenner and J. Turčínková, 'THE VALUE-BASED PRICING DETERMINATION MATRIX FOR PRICING METHOD SELECTION', *CEBR*, Feb. 2021, doi: 10.18267/j.cebr.267.
  37. E. T. Roberts, A. M. Zaslavsky, and J. M. McWilliams, 'The Value-Based Payment Modifier: Program Outcomes and Implications for Disparities', *Ann Intern Med*, vol. 168, no. 4, p. 255, Feb. 2018, doi: 10.7326/M17-1740.
  38. S. M. Liozu, 'State of value-based-pricing survey: Perceptions, challenges, and impact', *J Revenue Pricing Manag*, vol. 16, no. 1, pp. 18–29, Feb. 2017, doi: 10.1057/s41272-016-0059-8.
  39. P. R. Boscolo, G. Callea, O. Ciani, and R. Tarricone, 'Measuring Value in Health Care: A Comparative Analysis of Value-based Frameworks', *Clinical Therapeutics*, vol. 42, no. 1, pp. 34–43, Jan. 2020, doi: 10.1016/j.clinthera.2019.11.017.
  40. S. Michelsen, S. Nachi, W. Van Dyck, S. Simoens, and I. Huys, 'Barriers and Opportunities for Implementation of Outcome-Based Spread Payments for High-Cost, One-Shot Curative Therapies', *Front Pharmacol*, vol. 11, Dec. 2020, doi: 10.3389/fphar.2020.594446.
  41. A. Parmar, T. Jiao, R. Saluja, and K. K. W. Chan, 'Value-based pricing: Toward achieving a balance between individual and population gains in health benefits', *Cancer Medicine*, vol. 9, no. 1, pp. 94–103, 2020, doi: 10.1002/cam4.2694.
  42. E. Seeley, S. Chimonas, and A. S. Kesselheim, 'Can Outcomes-Based Pharmaceutical Contracts Reduce Drug Prices in the US? A Mixed Methods Assessment', *J Law Med Ethics*, vol. 46, no. 4, pp. 952–963, Dec. 2018, doi: 10.1177/1073110518821995.



43. D. M. Blumenthal, D. P. Goldman, and A. B. Jena, 'Outcomes-Based Pricing as a Tool to Ensure Access to Novel but Expensive Biopharmaceuticals', *Ann Intern Med*, vol. 166, no. 3, p. 219, Feb. 2017, doi: 10.7326/M16-1847.
44. P. Töytäri, J. Keränen, and R. Rajala, 'Barriers to implementing value-based pricing in industrial markets: A micro-foundations perspective', *Journal of Business Research*, vol. 76, pp. 237–246, Jul. 2017, doi: 10.1016/j.jbusres.2016.04.183.
45. F. R. Gonçalves, S. Santos, C. Silva, and G. Sousa, 'Risk-sharing agreements, present and future', *Ecancermedicalscience*, vol. 12, Apr. 2018, doi: 10.3332/ecancer.2018.823.
46. N. Bohm *et al.*, 'The Challenges of Outcomes-Based Contract Implementation for Medicines in Europe', *PharmacoEconomics*, vol. 40, no. 1, pp. 13–29, Jan. 2022, doi: 10.1007/s40273-021-01070-1.
47. S. A. Woznicki, 'The extent that manufacturing small-and-medium sized firms apply value-based pricing for their products', Jun. 12, 2019. <http://essay.utwente.nl/78024/> (accessed May 17, 2022).
48. F. Steinbrenner and J. Turčínková, 'Industry-Specific Factors Impeding the Implementation of Value-Based Pricing', *European Journal of Business Science and Technology*, vol. 7, no. 1, pp. 27–46, 2021.
49. R. Levaggi and P. Pertile, 'Value-Based Pricing Alternatives for Personalised Drugs: Implications of Asymmetric Information and Competition', *Appl Health Econ Health Policy*, vol. 18, no. 3, pp. 357–362, Jun. 2020, doi: 10.1007/s40258-019-00541-z.
50. F. Steinbrenner, *An evaluation of identified and unidentified obstacles to an implementation of value-based pricing*. 2019.
51. F. Steinbrenner, 'Future Disruptive Trends in Value-Based Pricing Methods', *European Scientific Conference of Doctoral Students*, 2019, Accessed: Feb. 26, 2021. [Online]. Available: <https://pefnet.mendelu.cz/>
52. Y. Hagiwara and T. Shirowa, 'Estimating Value-Based Price and Quantifying Uncertainty around It in Health Technology Assessment: Frequentist and Bayesian Approaches', *Med Decis Making*, p. 0272989X221079554, Feb. 2022, doi: 10.1177/0272989X221079554.
53. S. K. Taghizadeh, S. A. Rahman, and M. Marimuthu, 'Value co-creation and new service performance: mediated by value-informed pricing', *Journal of Business & Industrial Marketing*, vol. 37, no. 4, pp. 705–722, Jan. 2021, doi: 10.1108/JBIM-10-2020-0469.
54. C. Jommi, P. Armeni, F. Costa, A. Bertolani, and M. Otto, 'Implementation of Value-based Pricing for Medicines', *Clinical Therapeutics*, vol. 42, no. 1, pp. 15–24, Jan. 2020, doi: 10.1016/j.clinthera.2019.11.006.
55. 'Cost-Effectiveness Analysis | POLARIS | Policy and Strategy | CDC', Oct. 20, 2021. <https://www.cdc.gov/policy/polaris/economics/cost-effectiveness/index.html> (accessed May 18, 2022).
56. M. Fralick, J. J. Gagne, E. Paterno, R. Levin, and A. S. Kesselheim, 'Using Data From Routine Care to Estimate the Effectiveness and Potential Limitations of Outcomes-Based Contracts for Diabetes Medications', *Value in Health*, vol. 23, no. 4, pp. 434–440, Apr. 2020, doi: 10.1016/j.jval.2019.11.004.
57. 'On the Horizon for Value-Based Oncology Care: Predictive Analytics, Novel Therapy Pricing Pressures, New Payment Models, and a Rise in Complex Data Sources', *HMP Global Learning Network*.

- <https://www.hmpgloballearningnetwork.com/site/jcp/article/horizon-value-based-oncology-care-predictive-analytics-novel-therapy-pricing-pressures-new> (accessed Jun. 26, 2021).
58. Arnawa, I.K., Sapanca, P.L.Y., Martini, L.K.B., Udayana, I.G.B., Suryasa, W. (2019). Food security program towards community food consumption. *Journal of Advanced Research in Dynamical and Control Systems*, 11(2), 1198-1210.
59. Estevez, A. G., Espinosa, A. H. R., Rodríguez, D. L., & Leyva, T. F. (2019). Current approaches and controversies: legalization and non-legalization of drugs. *International Journal of Health & Medical Sciences*, 2(1), 26-32. <https://doi.org/10.31295/ijhms.v2n1.85>