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PRICE VARIATION OF ESSENTIAL MEDICINES ACROSS RETAIL PHARMACIES

NAVEEN JOSHI^{1*}, THIBAUT CHASTAIN², JOOST HOEKSTRA³

Affiliation

¹Department of Pharmacoeconomics, Sahyadri Institute of Pharmaceutical Education, Karad, India

²Department of Health Economics, Jura Centre for Medicinal Chemistry, Lons-le-Saunier, France

³Department of Pharmaceutical Management, Twente Institute of Pharmaceutical Technology, Hengelo, Netherlands

*Corresponding author: Naveen Joshi, n.joshi2@sipe.ac.in

ORCID iD: Naveen Joshi 0000-0001-4366-9589; Thibault Chastain 0000-0001-1358-3725; Joost Hoekstra 0000-0001-4795-8927

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1. INTRODUCTION

A medicine only helps the person who can obtain it, and obtaining it usually means paying. In many countries, most spending on medicines is out of pocket and falls on households at the moment of illness, which makes the price at the counter a direct determinant of whether treatment is started, completed or abandoned [1, 2, 3]. The concept of essential medicines was introduced to focus limited resources on products that meet priority health needs, with the intention that they should be available at all times in adequate amounts and at a price the individual and community can afford [3, 4]. Price variation between pharmacies strains

Abstract

Essential medicines are meant to be available at a price that individuals and health systems can afford, yet published surveys repeatedly show that the same product can cost very different amounts from one pharmacy to the next. This review, which reports no new price data, synthesises published work on why retail prices vary, how variation is measured, what surveys have found in different settings, and what the variation means for affordability. Brand-versus-generic choice, sector, regulation, trade margins and limited price information all contribute. Evidence is consistent in direction but heterogeneous in method, with few studies following the same outlets over time or linking price differences to patient outcomes.

that intention, because the patient who happens to enter the wrong shop pays more for exactly the same tablet. For chronic conditions such as hypertension and diabetes, which need years of uninterrupted supply, the cumulative effect of a consistent price premium can be considerable [5, 6].

The study of medicine prices has become a field of its own. Standardised survey methods developed by the World Health Organization and Health Action International made it possible to compare prices, availability and affordability across settings in a consistent way [7, 8]. Surveys in dozens of countries have since shown that prices to patients are often several times the international reference level, that originator brands cost far more than lowest-priced generics, and that private retail pharmacies usually charge more than public facilities where those facilities can supply the medicine at all [9, 10, 11]. Within any one retail market, though, the spread of prices for a single product receives less attention than the average. Variation of this kind is not captured by national averages, yet it is the form of price difference that individual patients actually encounter [7, 9].

This review is a narrative synthesis of the published literature on retail price variation for essential medicines. It does not report a price survey of its own and does not claim systematic coverage of every study. Indian experience is used for many examples, because the country has a large, mixed retail market, a national list of essential medicines and a statutory price control system, but the findings are read alongside studies from other regions [9, 12, 13]. The sections that follow set out why variation occurs, how it is measured, what surveys have found, what it means for patients, and what policy tools have been tried [14, 15, 16]. Findings are treated cautiously where methods differ, and no new numerical estimates are offered.

Two definitions help. Price variation here means differences in the price charged to patients for the same product, at the same strength and pack size, between outlets. Price dispersion in the economics literature carries a similar meaning, though it often includes differences between close substitutes such as different brands of one molecule [17, 18]. Both concepts are used below, and the text indicates which applies. The distinction matters mainly when interpreting studies that pool brands, as a wide brand-level spread can hide a narrow spread for one product. Throughout, wording follows the cited authors where terminology differs.

2. WHY PRICES DIFFER

Lists of essential medicines also shape the market. The national list for India, revised in 2022, names several hundred formulations that the health system should be able to supply, and it provides the basis for scheduled formulations under price control [12, 13]. The global model list, updated every two years, performs a similar function internationally and informs national selection [4]. Inclusion on a list tends to increase the volume of demand and procurement for a product, which can lower its price, but it also draws regulatory attention to its margins. Products outside the list face weaker controls, so a patient's price exposure depends on which side of the list boundary their medicine falls [4, 12, 13].

Economic theory long ago established that identical goods can sell at different prices when buyers have to search for information. If looking for a lower price is costly, some sellers can charge more and still keep customers, and dispersion persists even in a competitive market [17]. Later models showed that when some buyers are fully informed and others are not, firms may rationally mix high and low prices, with sales and discounts aimed at the informed [18]. Medicines suit these models well. Patients are often ill, hurried and unsure what a fair price is, and they usually buy on the advice of a prescriber or pharmacist, not by comparing shops [14, 15, 17]. Because the market for medicines combines these features with the asymmetry between prescriber and payer, theory predicts persistent dispersion even in the absence of any cost difference between outlets [14, 18].

A second source of variation lies in the brand structure of the market. For most off-patent molecules, many brands of the same active ingredient compete, each with its own price and marketing, and the prescriber's choice of brand name often decides what is dispensed [15, 19]. Originator brands usually command a premium, which in some surveys is several times the price of the lowest-priced generic equivalent [9, 10]. Policies that encourage generic use are widespread, but substitution depends on prescribing habits, pharmacy incentives and public confidence in generic

quality [20, 21]. Where the generic is not stocked, the patient has no choice to make. In Europe, where competition among off-patent products has been studied more closely, price competition is often weaker than expected because purchasers are not the people who choose the product [15].

Regulation shapes what retailers may charge. Many governments set ceilings on prices of essential medicines, regulate wholesale and retail mark-ups, or fix reimbursement levels [16, 22]. In India, the Drugs (Prices Control) Order of 2013 fixed ceiling prices for scheduled formulations, based on the simple average of prices of brands with a meaningful market share together with a retailer margin, and allowed limited annual increases for non-scheduled products [13]. The printed maximum retail price is a ceiling, not a fixed price, and outlets may sell below it. Mark-up regulation, where it exists, is often applied as a percentage, which can increase absolute margins on costlier products [13, 16, 22]. Whether the cap also influences prices of closely related uncontrolled products remains unclear, and surveys that record both categories side by side are valuable [9, 13].

Costs and location matter as well. Rents, scale of operation, stock turnover, proximity to wholesalers and the share of cash customers all influence what an outlet needs to charge. Urban chains buying in bulk may undercut small independent shops, while remote pharmacies carry higher transport costs and sell fewer units [9, 23]. Supply chains involve several layers of distribution, each taking a margin, which has been shown in price component studies to account for a large part of the difference between manufacturer price and price to the patient in some countries [7, 16]. The structure of these layers differs between public and private sectors, and between countries [3, 7, 16]. Seasonal factors, short expiry dates and stock clearance sales can add further noise, which is one reason single-visit surveys may exaggerate or understate true differences [9, 23].

Quality perceptions add a final layer. If patients and prescribers associate high price with high quality, outlets can charge more for the same molecule, and this perception is not always wrong or always right. A

multi-country analysis found that price was an imperfect signal of quality, meaning that higher cost did not reliably indicate a better product [24]. Substandard and falsified medicines exist in many markets and are an additional reason why cheap products cause suspicion [25]. Confidence in regulatory oversight is therefore itself a determinant of how much price variation a market sustains [21, 24, 25]. For a patient with no means of testing a product, the retailer's reputation becomes a proxy for quality, and a trusted outlet may legitimately charge a little more [24, 25].

3. MEASURING PRICE VARIATION

The standard tool is the WHO and Health Action International methodology, first published in 2003 and revised in 2008 [7]. It specifies a core list of medicines, a sampling frame of public and private outlets, collection of the price actually paid by patients for the originator brand and the lowest-priced generic, and conversion into a median price ratio, the median local unit price divided by an international reference price [7, 8]. The ratio makes prices comparable across currencies and countries. A validation study in Peru examined which elements of the design most influenced the results and supported the robustness of the approach when applied with a sensible sample of outlets [8]. Outlets are classified by sector and by size, and the lists of medicines are chosen to reflect common conditions so that results speak to everyday prescribing rather than to rare products [7, 8].

The choice of reference price deserves comment. International reference prices used in the median price ratio come from published procurement catalogues, which reflect what buyers who purchase in large volumes pay for generic products [7, 8]. They are not a measure of the lowest conceivable price, and they are not tied to any particular market. A median price ratio of one therefore does not signal an absence of mark-up; it signals that the local price is similar to a competitive procurement price. This is helpful as a yardstick, though a reader must remember that patients are retail buyers of small quantities and that some distribution cost is unavoidable [7, 16].

Median price ratios describe the middle of a distribution, not its width, and variation between outlets needs additional statistics. Authors commonly report the range, the ratio of highest to lowest price, the interquartile range, and the coefficient of variation, which expresses the standard deviation as a share of the mean [9, 23]. Each has weaknesses. The range is dominated by outliers, the coefficient of variation is unstable when the mean is small, and the ratio of extremes says nothing about how many outlets lie near either end. Reporting several measures together, and showing the distribution itself, gives a fairer picture [7, 9]. Graphical display, such as box plots of unit prices by outlet type, adds more information than a table of summary values, and allows readers to see skew directly [9, 23].

Expressing each price as a ratio to a reference price has a practical advantage: it removes the need to convert between currencies, so results from different settings and survey years can sit side by side [7, 8]. The ratio still has to be read with care. A median ratio of two means that half of the sampled outlets charged at least double the reference, but says nothing about how wide the spread was around that median. For that reason, many reports add the lowest and highest ratios found, or a coefficient of variation, to show dispersion [7, 9]. The latter is sensitive to a single extreme outlet, so it is safer to examine the distribution itself before drawing conclusions about how unequal pricing is within one product. Reporting the interquartile range alongside the median is a simple and widely understood way to do this [7, 9].

Discounting adds hidden variation. In many retail markets, outlets sell below the printed maximum retail price, with discounts that depend on the customer, the volume of the purchase and local competition. Patients who know to ask, or who belong to a loyalty scheme, may pay noticeably less than those who do not. Surveys that record only the printed price therefore understate both the average discount and its spread, while those that record the price paid depend on how willingly staff disclose it [9, 23]. Where possible, collecting both values for each product would show how much of the

observed variation comes from discounting rather than from different list prices [7, 9].

Statistical comparison of groups needs care because price data are rarely normally distributed. Prices are bounded below by zero, skewed to the right and affected by regulation that creates clusters at ceiling values. Non-parametric tests such as the Kruskal-Wallis test, which compares several independent groups through ranks, are therefore commonly used when comparing, for example, chain pharmacies, independent shops and hospital-based pharmacies [26]. Where comparisons are made across many medicines, correction for multiple testing is desirable, but is often absent in the pricing literature [9, 26]. Differences that are statistically significant in a large sample may still be too small to matter to a patient, so effect sizes and absolute rupee or dollar differences deserve reporting alongside p values [26].

Practical decisions affect comparability. The unit of comparison should be cost per defined quantity such as a tablet or a course of treatment, since pack sizes differ. Collection by visiting a mystery shopper or by recording the listed price may give different values, because discounts negotiated at the counter do not appear on the pack. Sampling is usually by region and outlet type, with a few outlets per region, and results can depend heavily on which outlets are chosen [7, 8]. Studies conducted at a single time point cannot separate stable differences between outlets from short-lived promotions or supply disruptions [9, 23]. These design choices explain a good part of the contradictions between published estimates, a point returned to in the limitations [7, 8].

Shortcomings of the data also arise from the choice of outlets. Chain pharmacies, hospital dispensaries, independent shops and online sellers each follow different pricing practices, and a sample that over-represents one type will give a biased view of the market as a whole [7, 8]. Surveys in large cities are easier to carry out than those in remote areas, which leads to an urban tilt. Authors should state how outlets were selected, how many were visited, and what proportion refused to take part, because these details determine how far

the results can be generalised [8, 9]. Such reporting is rarely complete in published papers.

4. EVIDENCE FROM RETAIL SURVEYS

The largest body of evidence comes from the multi-country surveys. Reviews of medicine use in developing countries stress that supply, financing and prescribing interact, and that gaps in public sector supply push patients towards the private market [27]. Essential medicines were generally more available than other medicines, which suggests that the policy has had some effect on supply [11]. These patterns recur in later work, although the precise ratios differ between countries and over time [3, 11, 27]. Differences between countries nevertheless remain large, and the pattern in a given country depends on its regulation, market structure and income level [3, 10].

Surveys of households and of outlets show the same picture from different angles. Household surveys in five low- and middle-income countries found that access to medicines for chronic diseases was low, that the private sector was a major source of supply, and that the poorest were least likely to obtain treatment [28]. In India, surveys at several sites found considerable variation in prices of the same medicine across outlets and between brand and generic versions, with private retail prices that were high compared with the reference [9]. A later study of Delhi, undertaken as the government planned wider free medicine provision, again documented high private sector prices and limited public availability [23]. Studies in other countries show comparable gaps [5, 10, 28]. These results fit the theoretical expectation that a thin public sector and an unregulated private sector produce the widest dispersion [10, 14].

Essential medicines lists appear to influence not only what is prescribed but also what is stocked. A comparison of survey data from low- and middle-income countries found that medicines on essential lists were more often available than those outside them [11], a pattern consistent with the argument that selection supports procurement and supply [1, 4]. The finding concerns availability rather

than price, and it would be wrong to assume that a listed product is also cheap in the private market. Listing may help in the public sector, where purchasers can pool demand, while retail outlets set prices according to local competition and regulation. Surveys that report availability and price together are therefore more informative than those reporting either alone. Differences between countries in how lists are written and enforced further complicate comparison [1, 11].

The distinction between chronic and acute disease medicines is informative. Medicines for chronic conditions are less available and more costly relative to income than those for acute conditions, especially in the public sector [29]. Surveys of cardiovascular and diabetes medicines in low- and middle-income countries found limited availability and, for the poorest households, substantial costs [5, 6]. Insulin is an instructive example, since prices and affordability varied considerably between countries and sectors, and in some settings patients faced prices that were high relative to income [30]. Such findings suggest that variation matters most where treatment is lifelong [6, 29, 30]. Higher prices for the same medicine in poorer countries, relative to wages, sharpen the problem further [5, 6].

Across surveys, the literature supports a small number of regularities, which are collected in table 1 and grouped by type of evidence in fig. 1. Retail prices vary between outlets and sectors; brand and generic choice is the largest single driver; regulation compresses variation for controlled products but may not reach the whole market; and the affordability burden falls hardest on those who pay out of pocket for chronic treatment [9, 28, 29]. Studies that follow the same outlets over several rounds are rare, which means that conclusions about stability are mostly inferred, not observed [9, 23]. Because surveys differ in design, trends should be read as indicative rather than as exact estimates, and agreement of several independent studies carries more weight than any one figure [7, 8].

Comparisons with high-income countries are helpful. In the United States, what a purchaser pays depends heavily on bargaining power

and market structure, so the same product is sold at different prices to different purchasers [19]. In Europe, cross-national differences in medicine prices are partly explained by pricing policies, reference pricing systems and differences in distribution margins [14, 31]. The broad lesson is that no market is free of price variation, though the sources differ with the institutional setting [14, 15, 31]. These contrasts are also a reminder that findings from one health system cannot simply be transferred to another [14, 31]. Whether similar contrasts exist within a single country, between states or regions, is another question that needs local data [9, 23].

5. AFFORDABILITY AND ACCESS

For households, medicine prices translate into out-of-pocket spending, and out-of-pocket spending is a major route to financial hardship. In India, medicines are the largest component of out-of-pocket health expenditure, and the share of households incurring such spending has been high across surveys over two decades [2]. Out-of-pocket health spending in India, much of it on medicines, pushes a measurable share of households below the poverty line, and the burden falls unevenly between states and between rural and urban areas [32]. International analyses find that the poorest households face the heaviest burden relative to income, and that out-of-pocket spending on health care can push households into catastrophic expenditure [33, 34]. Surveys of household spending show that this burden is concentrated among the elderly and among families with a member who has a chronic disease [2, 34].

Table 1: Main findings from published studies of medicine price variation and affordability

Topic	Reported finding	Ref.
Private sector prices international comparison	Patient prices often well above reference levels; originators far above lowest-priced generics.	[9, 10]
Generic policies low- and middle-income	Pro-generic policies are widespread; uptake depends on prescribers, pharmacists and public trust.	[20, 21]
Essential medicines list availability	Essential medicines are generally more available than other medicines.	[4, 11]

Topic	Reported finding	Ref.
Public sector supply India	Limited stock in public facilities pushes patients to private retail.	[23, 35]
Retail price spread Indian sites	Same medicine varied considerably in price across outlets and brands.	[9, 23]
Chronic disease medicines five countries	Access is lowest among the poorest; the private sector is a major source of supply.	[10, 28]
Chronic disease medicines low- and middle-income countries	Less available and less affordable than acute-care medicines.	[5, 6, 29]
Insulin 13 countries	Prices and affordability varied widely between countries and sectors.	[29, 30]
Out-of-pocket spending India	Medicines form the largest part of household health spending.	[2, 32]
Price ceilings DPCO 2013	Controlled formulations capped; uncontrolled products may still vary.	[13, 16]

Price variation interacts with these burdens in two ways. First, a patient who pays above the going rate loses money that could have been spent on other needs. Second, the expectation of high or unpredictable cost can lead patients to skip doses, split tablets or stop treatment early, which risks poor control of chronic disease and, for antimicrobials, the development of resistance [6, 34]. Evidence linking measured price differences to measured adherence is sparse, and most of the argument relies on the plausibility of the link and on indirect findings from studies of affordability and use of medicines in different income groups [6, 29]. In that sense price variation is not only a matter of fairness but also a clinical issue, even though direct proof is lacking [6, 29].

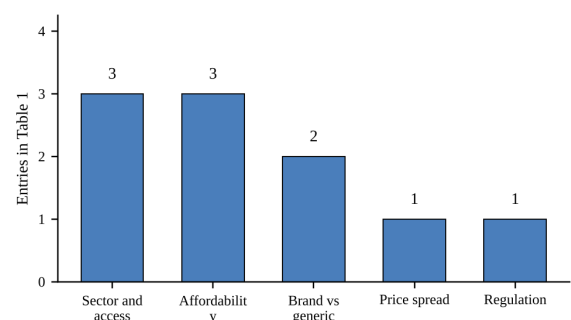


Fig. 1: Number of entries in table 1 by theme

Cumulative cost matters as much as the price of a single purchase. A course of antibiotics is paid for once, whereas treatment for hypertension, diabetes or epilepsy is bought month after month, so even a small price difference per pack accumulates over a year. Studies of household spending in India describe medicines as the largest component of out-of-pocket health payments, with chronic conditions contributing substantially [2, 32]. A family may respond by buying fewer units than prescribed, stretching the interval between refills or switching to a cheaper brand without advice. None of these strategies shows up in a price survey, yet each has clinical consequences. This is one reason why price comparisons are best interpreted together with household-level evidence on spending and treatment adherence. Spending on long-term therapy is therefore best expressed per year of treatment, not per purchase [2, 32].

Availability and price cannot be separated. Public facilities usually supply essential medicines at low or no cost, but stock-outs push patients to private retail pharmacies, where prices are higher [27, 35]. Studies in Indian states found that availability of essential medicines in public facilities was limited, and that patients bought large shares of their prescriptions elsewhere [35]. A country that spends effort to regulate retail prices without strengthening public supply may therefore see a modest benefit, because the people with least ability to pay still end up in the private market [3, 16, 35]. Policies that regulate retail prices therefore work best alongside investment in public supply and in reliable procurement systems [3, 35]. The extent to which evidence from small surveys can guide national policy depends on how representative the sample of outlets was [7, 8].

Distributional issues extend within the private sector. Rural patients often have fewer outlets to choose from and less ability to shop around, so they may face a higher average price and a narrower choice of brands. Low-income patients are more likely to purchase small quantities, such as a few tablets, which can carry a higher price per unit than a full strip. Women, older people

and those with limited literacy may be less able to ask for generics or compare prices [14, 22, 23]. These effects are mostly argued from theory and anecdote, and need more direct measurement [17, 18].

6. POLICY RESPONSES

Policy tools to address price variation fall into three groups. The first is price control, through ceiling prices, mark-up regulation or reference pricing. The second is competition and substitution, through generic policies, pharmacist substitution rights and incentives. The third is information, through price transparency, comparison tools and public reporting [15, 16, 21]. Countries differ greatly in which tools they use, and few evaluations compare them directly. A review of generic medicine policies in eight countries concluded that success depended on a package of measures, including prescribing rules, patient education and pharmacy incentives, not on any single policy [21]. The balance between these approaches depends on the capacity of regulators to monitor compliance, which is limited in many settings [16, 22]. Ready access to price information would also help staff in public facilities who refer patients to private outlets for items out of stock [23, 35].

Price controls can reduce prices of the controlled products, but they raise their own questions. Ceilings set too low can lead to withdrawal of products or shortages, while ceilings set from market averages can anchor prices at relatively high levels [13, 16]. Where only a list of essential medicines is controlled, manufacturers may shift attention to uncontrolled formulations, including fixed-dose combinations, which weakens the effect on total spending [2, 13]. Evidence from several European countries shows that cuts in prices and margins, together with generic promotion, lowered spending during fiscal pressure, though the effects on access are less well documented [31]. Careful monitoring of the effect of price caps on availability is a necessary part of any control scheme [13, 16]. Pooled purchasing by public bodies often yields lower prices than fragmented buying, though capacity to manage tenders is a prerequisite [16, 36].

Transparency is the cheapest tool and often the least used. If patients and prescribers could see local prices for equivalent products, the models of search costs suggest that dispersion would narrow, as informed buyers shift to cheaper outlets and sellers respond [17, 18]. Practical versions include printed price lists, mobile applications that compare generic and branded options, and publication of national survey results. Evidence on effectiveness is limited, and information alone may not help patients who depend on the prescriber's choice of brand [15, 21]. Prescriber education and generic prescribing by international non-proprietary name are therefore usually proposed in tandem with transparency [20, 21]. Evaluation designs that compare regions or outlets before and after introduction would produce better answers than the simple descriptive reports now common [15, 21].

Supply-side measures, such as pooled procurement and local manufacturing, influence prices upstream. Evidence from African countries suggests that industrial policy can affect the availability and cost of medicines, although it demands sustained investment and quality assurance [36]. Strengthening public sector supply may be the most direct way to protect patients from retail variation, since a reliable free or low-cost source removes the need to shop around [3, 16, 36]. In practice, countries combine these tools, and the right mix depends on how much of the market is formal, regulated and monitored [16, 22]. Describing these gaps plainly would let local planners target them.

7. LIMITATIONS AND FUTURE DIRECTIONS

The evidence base has limits that a reader should keep in view. Most surveys are cross-sectional and based on small samples of outlets, which restricts conclusions about variation within a market [7, 8]. Methods vary, with differences in medicine lists, price definitions and reference prices, so numbers cannot always be compared across studies [7, 8]. Some surveys capture the maximum retail price printed on the pack, while others record the price actually paid, and the two can differ [9, 23]. Publication is also uneven across

regions, leaving large parts of the retail sector undescribed, and online and informal channels are seldom covered [3, 11].

Future work could usefully follow the same outlets over several rounds, so that persistent differences can be told apart from temporary ones. Linking price data to dispensing records would show what patients actually pay and which brands they receive. Studies that connect price differences with adherence and health outcomes would convert a plausible concern into measured evidence [6, 29]. Finally, evaluations of transparency and substitution interventions, ideally with comparison groups, would tell policy makers whether information alone can narrow dispersion or whether stronger regulation is needed [15, 16, 21]. A modest, well-designed programme of repeated surveys would answer many of these questions at reasonable cost [7, 8].

8. CONCLUSION

Retail prices of essential medicines vary between pharmacies, between brands and between sectors, and published surveys from many countries describe the same pattern: patient prices well above international reference levels, a large premium for originator brands, and a heavier burden on those who pay out of pocket for chronic treatment [9, 10, 29]. Search costs, brand structure, margins and weak public supply together explain why such differences persist [15, 16, 17, 18]. These patterns have been found repeatedly, which gives them credibility despite differences in method [11, 27].

The strongest evidence concerns the existence and direction of the variation, and the weakest concerns its consequences for adherence and health. Policies that combine price control, support for generic use, price transparency and reliable public supply look more promising than any single measure [3, 21, 36]. Future studies should follow the same outlets over time, report the distribution of prices and not only the average, and test interventions rigorously, so that policy rests on measured effects rather than on plausible reasoning [6, 7, 8]. Patients, in the meantime, benefit from simple advice to ask for generic

equivalents and to compare outlets [20, 21].

9. ABBREVIATIONS

WHO-World Health Organization, HAI-Health Action International, MPR-Median price ratio, MRP-Maximum retail price, DPCO-Drugs (Prices Control) Order, NLEM-National List of Essential Medicines, IRP-International reference price, OOP-Out-of-pocket, CV-Coefficient of variation

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11. AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

12. CONFLICT OF INTERESTS

Declared none

13. REFERENCES

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