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A Preliminary Assessment of Availability and Pricing of Paediatric Medicines in Public- and Private-Sector Facilities in a District of Bihar, India

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Abstract

Background: Access to essential medicines in age-appropriate formulations is a key part of paediatric care, but facility-level data from Bihar, India, are limited. We assessed the availability and patient prices of 20 tracer paediatric medicine formulations in selected public- and private-sector sites in Patna district.

Methods: A cross-sectional survey was conducted in 12 purposively selected sites (six public, six private) in Patna district between November and December 2022. A structured form recorded availability on the day of the visit and the price a patient would pay for the cheapest available version. Results are descriptive; 95% confidence intervals (Wilson) are given for sector-level proportions.

Results: All 12 sites participated. Of 120 medicine-site observations per sector, 66 (55.0%; 95% CI 46.1-63.6) were available in public sites and 95 (79.2%; 95% CI 71.1-85.5) in private sites; overall, 161 of 240 (67.1%) were available. Availability was higher in the private sector for 17 of the 20 medicines and equal for three; it was never higher in the public sector. Oral rehydration salts, paracetamol syrup, and mebendazole chewable tablets were available at all six sites in both sectors. Carbamazepine suspension and nevirapine syrup were not found at any public site. Where available, the median recorded price was ₱0 for 10 medicines and ₱2-₱12 for eight in public sites, versus ₱10-₱420 in private sites (for example, amoxicillin suspension ₱0 versus ₱48; ceftriaxone injection ₱5 versus ₱120). Several medians rest on very few observations.

Conclusions: In this preliminary survey, availability of the selected paediatric formulations was lower in the sampled public sites than in the sampled private sites, and was incomplete in both. Prices were lower in public sites where medicines were available. The findings are descriptive, do not establish reasons for non-availability, do not assess affordability, and cannot be generalised to the entire state of Bihar. Larger studies with a defined sampling frame, facility-level stocking norms, and affordability analysis are warranted.

Categories: Family/General Practice, Health Policy, Public Health
Keywords: availability, bihar, children medicines, essential medicines, india, paediatric formulations, paediatric medicines, pricing, public health, retail pharmacies

Introduction

Access to essential medicines is a component of universal health coverage. In paediatric care, suitable strengths and dosage forms are needed in addition to the medicines themselves, and these may differ from products commonly stocked for adults [1,2]. The WHO/Health Action International (HAI) methodology provides a standardised approach to measuring medicine availability and prices [3].

Surveys in low- and middle-income settings have reported gaps in the availability of essential medicines for children [1], and multi-country analyses have generally found lower availability in the public than in the private sector [4]. Studies of paediatric medicines in Indian public facilities have likewise reported incomplete availability [5-7]. A WHO/HAI survey in West Bengal, India, in 2004, which covered mainly adult medicines, reported that only 13 of 32 surveyed medicines were found in public facilities, whereas generic equivalents were widely available in private pharmacies [8].

In India, public-sector availability depends on state procurement and distribution arrangements, facility-level essential medicine lists, national health programmes, and level of care. Public lists are guided by the National List of Essential Medicines (NLEM) 2022 [9]. Prices in the private market are partly regulated through national ceiling prices under the Drugs (Prices Control) Order [10], and the Jan Aushadhi scheme supplies lower-cost generic medicines through dedicated outlets [11]. These arrangements are relevant context but were not evaluated in this survey.

To our knowledge, facility-level data on the availability and prices of paediatric medicines in Bihar, India,

have not been published earlier. The primary objective of this preliminary survey was to describe the availability of 20 predefined paediatric tracer medicine formulations in 12 purposively selected public- and private-sector sites in Patna district of Bihar. The secondary objective was to record the patient prices where the medicines were available. The study was not designed to estimate availability or prices across Bihar.

Materials And Methods

Study design and setting

This was a cross-sectional survey of medicine availability and patient prices in Patna district, Bihar, India. Data collection began on November 23, 2022, and continued until December 2022. Patna district includes urban, suburban, and rural areas, allowing sites at different levels of care to be included.

Selection of sites

Twelve sites were purposively selected, six in each sector, to cover a range of levels of care in the public sector and a range of provider types in the private sector. The public-sector sites were one tertiary teaching hospital, one state-level government drug-distribution facility (drug store), two sub-divisional hospitals, and two primary health centres. The private-sector sites were one dedicated children's hospital, one private teaching hospital, four retail pharmacies located near the two sub-divisional hospitals, and two primary health centres. Pairing public facilities with nearby retail pharmacies follows the general WHO/HAI approach [3], but the sample was not drawn from a sampling frame and was not probability-based. The drug store was retained in the public-sector group because the sampled medicines were available through it as part of the public system. The two private hospitals and four retail pharmacies were pooled in the private-sector group.

Survey form and tracer medicines

A structured paediatric medicines survey form adapted from the WHO/HAI methodology [3] was used. For each tracer medicine, the form recorded the strength, dosage form and specified pack size, any alternative pack size found, availability on the day of the visit, and the price to the patient. Availability was defined as the specified product being on the shelf (or in stock) and able to be supplied on the day of the visit. Price was defined as the amount a patient would be required to pay for the cheapest available version, originator or generic.

Twenty tracer formulations were selected from the WHO Model List of Essential Medicines for Children [12] and national programme lists, including the Integrated Management of Childhood Illness (IMCI) [13] and national tracer drug lists [9]. Mebendazole was included as two formulations (chewable tablet and syrup), each counted as a separate tracer entry. Only the specified strength and dosage form of each medicine were counted.

Data collection

Two trained data collectors visited each site on weekdays between 9:00 AM and 4:00 PM. At each site, they met the designated contact person (pharmacist, store manager, or facility in-charge), explained the purpose of the survey, and completed the form by direct observation of shelves and stock records. Prices were recorded as the amount a patient would pay at the point of service; in public sites, medicines supplied free of charge were recorded as ₱0, and in private pharmacies, the retail price was recorded. Forms were checked for completeness on the same day, and missing information was resolved by telephone or by a revisit within 48 hours.

Data analysis

Data were entered and analysed descriptively in Microsoft Excel (Microsoft Corporation, Redmond, Washington, United States). For each medicine, availability was the number of sites in the sector at which it was available, out of six. Sector-level availability was the number of medicine-site observations available out of 120 per sector (20 medicines × 6 sites), and 240 overall. Availability below 20% was described as very low; 95% confidence intervals (CIs) for sector-level proportions were calculated using the Wilson method. Because observations are clustered within sites and medicines, these intervals are approximate and are given as descriptive guides only. No inferential comparison between sectors was performed.

Prices were reported in Indian rupees (₱) as the median and range, with the number of sites contributing, and only for sites where the medicine was available. Medians based on fewer than three observations were flagged. Ratios were not reported where the public-sector price was zero.

Ethical considerations

The study was approved by the Clinical Research Ethics Committee (Human Studies) of Netaji Subhas Medical College & Hospital (approval number CREC/2022/25, dated November 23, 2022). The survey involved no patient contact, intervention, or identifiable patient-level data. Permission to collect data was

obtained from the medical superintendent or pharmacy in-charge of each site.

Results

Availability

Of 120 medicine site observations per sector, 66/120 (55.0%; 95% CI 46.1-63.6) were available in the public sector and 95/120 (79.2%; 95% CI 71.1-85.5) in the private sector. Overall, 161/240 observations (67.1%; 95% CI 60.9-72.7) were available, and 79/240 (32.9%) were not. Medicine-wise results are shown in Table *1* and Figure *1*. Availability was higher in the private sector for 17 of the 20 medicines and equal in the two sectors for three; it was never higher in the public sector.

Medicine	Strength, dosage form; specified pack size	Public sector (N=6), n (%)	Private sector (N=6), n (%)
Aciclovir	Suspension 200 mg/5 mL; 125 mL	2 (33.3)	4 (66.7)
Amoxicillin	Suspension 125 mg/5 mL; 100 mL	4 (66.7)	6 (100)
Amoxicillin + clavulanic acid	Suspension 125 mg + 31.25 mg/5 mL; 100 mL	3 (50.0)	5 (83.3)
Artemether + lumefantrine	Tablet 20 mg + 120 mg; 16 tablets	4 (66.7)	6 (100)
Beclometasone	Inhaler 50 µg/dose; 200 doses	1 (16.7)	3 (50.0)
Carbamazepine	Suspension 100 mg/5 mL; 100 mL	0 (0)	3 (50.0)
Ceftriaxone	Injection 1 g; 1 vial	5 (83.3)	6 (100)
Co-trimoxazole	Suspension 200 mg + 40 mg/5 mL; 100 mL	5 (83.3)	6 (100)
Ferrous salt	Suspension 30 mg/mL; 250 mL	4 (66.7)	5 (83.3)
Isoniazid	Tablet 50 mg; 1,000 tablets	3 (50.0)	4 (66.7)
Mebendazole	Chewable tablet 100 mg; 6 tablets	6 (100)	6 (100)
Mebendazole	Syrup 100 mg/5 mL; 30 mL	5 (83.3)	6 (100)
Nevirapine	Syrup 50 mg/5 mL; 100 mL	0 (0)	1 (16.7)
Nystatin	Drops 100,000 IU/mL; 30 mL	1 (16.7)	3 (50.0)
Oral rehydration salts	Powder packet; to prepare 500 mL or 1 L	6 (100)	6 (100)
Paracetamol	Syrup 120 mg/5 mL; 100 mL	6 (100)	6 (100)
Rifampicin + isoniazid	Tablet 60 mg + 30 mg; 1,000 tablets	2 (33.3)	4 (66.7)
Salbutamol	Inhaler 100 µg/dose; 200 doses	2 (33.3)	5 (83.3)
Vitamin A	Capsule 100,000 IU; 1,000 capsules	3 (50.0)	4 (66.7)
Zinc	Dispersible tablet 20 mg; 100 tablets	4 (66.7)	6 (100)

TABLE 1: Availability of 20 tracer paediatric medicine formulations in the sampled public- and private-sector sites (six sites per sector)

Sector totals: public 66/120 (55.0%); private 95/120 (79.2%). Only the specified strength, dosage form and pack size were counted.

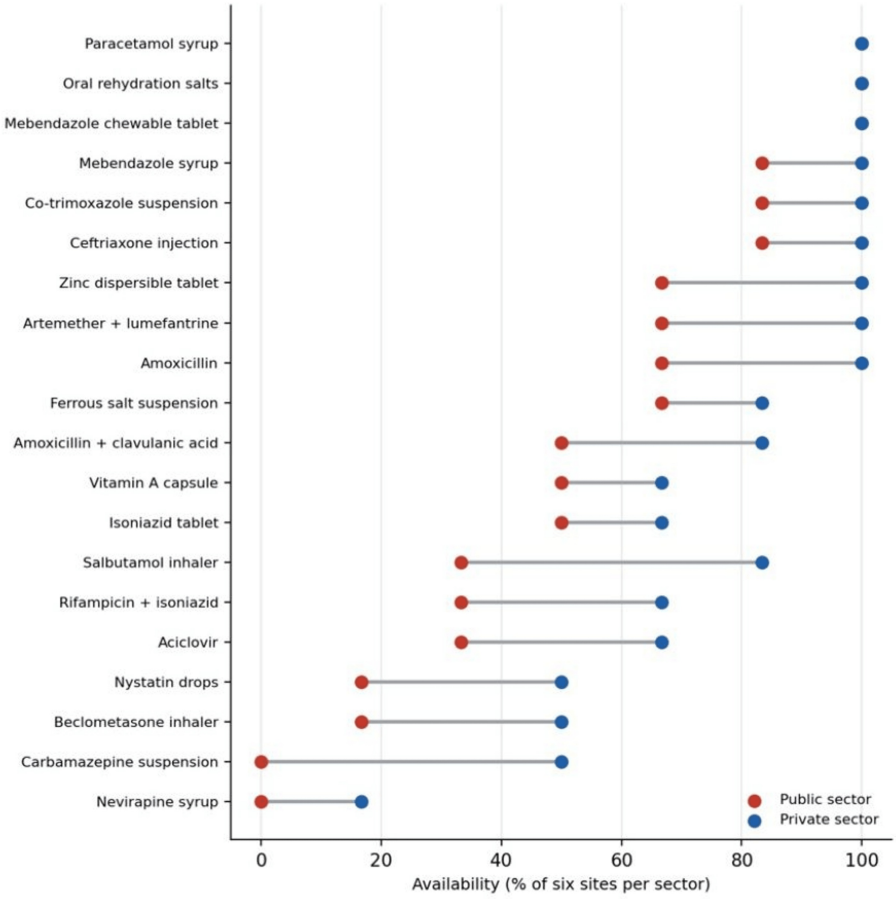


FIGURE 1: Availability of each tracer medicine at the six public (red) and six private (blue) sites, ordered by public-sector availability.

Oral rehydration salts, paracetamol syrup, and mebendazole chewable tablets were available at all six sites in both sectors. In the public sector, carbamazepine suspension and nevirapine syrup were not found at any site (0/6), and beclometasone inhaler and nystatin drops were each found at one site (1/6; 16.7%). In the private sector, nevirapine syrup was the least available medicine (1/6; 16.7%). Ten medicines were available at four or more of the six public sites, and nine at all six private sites. These findings apply only to the sampled sites.

Recorded patient prices

Prices are summarised in Table *2* for sites where the medicine was available. In the public sector, the median recorded price was ₽0 for 10 medicines and between ₽2 and ₽12 for eight; carbamazepine suspension and nevirapine syrup had no public sector price because they were not found. In the private sector, median prices ranged from ₽10 (oral rehydration salts) to ₽420 (nevirapine syrup, one site). For the eight medicines with non-zero median prices in both sectors, the private sector median was 7-32 times the public sector median; the highest ratios were based on a single public-site observation (beclometasone, nystatin). Several medians rest on very few observations (Table *2*), and these should be read as individual observations rather than summary statistics.

Medicine	Public sector, median price (range); n	Private sector, median price (range); n
Aciclovir suspension	₹0; n=2†	₹245 (₹220–₹280); n=4
Amoxicillin suspension	₹0; n=4)	₹48 (₹40–₹55); n=6
Amoxicillin + clavulanic acid	₹0 (n=3)	₹95 (₹85–₹110); n=5
Artemether + lumefantrine	₹0 (n=4)	₹125 (₹110–₹145); n=6
Beclometasone inhaler	₹10 (n=1)†	₹320 (₹290–₹360); n=3
Carbamazepine suspension	Not available	₹180 (₹165–₹200); n=3
Ceftriaxone injection	₹5 (₹0–₹10); n=5	₹120 (₹100–₹140); n=6
Co-trimoxazole suspension	₹0; n=5	₹55 (₹45–₹65); n=6
Ferrous salt suspension	₹3 (₹2–₹5); n=4	₹75 (₹65–₹85); n=5
Isoniazid tablet	₹0; n=3	₹90 (₹80–₹105); n=4
Mebendazole chewable tablet	₹2 (₹0–₹5); n=6	₹15 (₹12–₹18); n=6
Mebendazole syrup	₹5 (₹3–₹8); n=5	₹35 (₹28–₹42); n=6
Nevirapine syrup	Not available	₹420; n=1†
Nystatin drops	₹12; n=1†	₹195 (₹175–₹220); n=3
Oral rehydration salts	₹0; n=6	₹10 (₹8–₹12); n=6
Paracetamol syrup	₹0; n=6	₹35 (₹28–₹40); n=6
Rifampicin + isoniazid	₹0; n=2†	₹210 (₹185–₹240); n=4
Salbutamol inhaler	₹8 (₹5–₹10); n=2†	₹150 (₹135–₹170); n=5
Vitamin A capsule	₹2 (₹0–₹5); n=3	₹25 (₹20–₹30); n=4
Zinc dispersible tablet	₹0; n=4	₹18 (₹15–₹22); n=6

TABLE 2: Patient price and number of contributing sites

n = number of sites at which the medicine was available and a price was recorded. Price, given in Indian Rupees (₹), is the cheapest available version of the specified formulation and pack size. ₹0 indicates the medicine was supplied free of charge.

† Based on fewer than three observations; a single value is shown where n=1.

Discussion

Principal findings

In this preliminary survey of 12 purposively selected sites in Patna district, 55.0% of public sector and 79.2% of private sector medicine site observations were recorded as available. Availability was higher in the private sector for most medicines, but about one-third of all observations indicated non-availability, so availability was incomplete in both sectors. A few formulations, including oral rehydration salts, paracetamol syrup, and mebendazole chewable tablets, were available at every site. Carbamazepine suspension and nevirapine syrup were not found at any sampled public site. Recorded patient prices were lower in public sites than in private sites for the medicines that were available.

Comparison with other studies

Lower availability in public than private facilities is consistent with multi-country evidence [4] and with Indian studies of paediatric medicines [5-7]. In the 2004 WHO/HAI survey in West Bengal, only 13 of 32 medicines (40.6%) were found in public facilities; no antiepileptic, including carbamazepine, was found, and generic equivalents were widely available in private pharmacies [8]. In our survey too, carbamazepine was absent from sampled public sites. However, direct numerical comparison is not appropriate. The West Bengal survey covered mainly adult formulations, sampled 26 public facilities and 35 pharmacies in seven districts, used a different availability metric, and was conducted nearly two decades earlier. Some formulations also differed markedly: co-trimoxazole suspension and ceftriaxone were found in 3.8% and 19.2% of West Bengal

public facilities, respectively [8], compared with 83.3% in our public sites.

Interpretation of non-availability and prices

This survey did not assess stocking norms, procurement records, prescribing patterns, or programme distribution arrangements, so the reasons for non-availability cannot be determined. Non-availability at a site should not be read as a supply-chain failure if a medicine is expected to be supplied only at certain levels of care or through a designated national programme. The West Bengal report likewise listed possible explanations, including formulary selection, supplier participation, channelling of supplies to particular facility types, distribution problems and budget limits, as speculative [8]. Comparing availability with the stocking list for each facility level would be needed before drawing such conclusions. Both the West Bengal survey [8] and our study, however, note that strict adherence to a specified strength and dosage form means that non-availability of the specified product does not exclude availability of an alternative form.

The recorded prices suggest that patients may pay more in private outlets, while a number of medicines were supplied free in public sites. Some public sites recorded nominal charges for certain items; the basis of these charges was not established. The survey also did not assess household income, treatment costs, or daily wages, so it cannot show whether medicines were affordable or unaffordable. It also did not compare prices with reference prices, National Pharmaceutical Pricing Authority (NPPA) ceiling prices [10] or Jan Aushadhi prices [11], and therefore does not by itself support conclusions about price regulation. A standard WHO/HAI affordability analysis, as used in West Bengal [8], would be needed for that purpose.

Strengths and limitations

Strengths include the focus on paediatric formulations, the inclusion of both sectors and several levels of care, a structured WHO/HAI-adapted form, direct observation of stock, and participation of all 12 selected sites. The survey also provides facility-level information for a district where we found no published data.

The findings should be interpreted in light of several limitations. First, the sample was small, purposive, and restricted to one district; it was not probability-based or weighted, and each site changes sector percentages by 16.7 percentage points. Second, the public and private groups contained different facility types, including a drug store, hospitals, and retail pharmacies, so they are not like-for-like, and results were not stratified by facility level. Third, medicine-site observations are clustered within sites and medicines, and the CIs are approximate. Fourth, availability was a snapshot over about six weeks and may vary with season, disease patterns, and replenishment cycles. Fifth, availability was not benchmarked against facility-specific stocking norms or programme supply arrangements. Sixth, information was partly obtained from facility staff and may be subject to reporting bias. Seventh, the tracer list was not formally validated, and some specified pack sizes (for example, 1,000 tablets) are institutional rather than patient-level packs, which limits interpretation of the corresponding prices. Eighth, several price medians are based on very few observations, and the price unit and the basis of nominal public charges were not independently verified. Finally, affordability, quality, expiry, storage conditions, dispensing practice, and patient access were not assessed.

Implications

The findings support routine facility-level audits of paediatric medicine stocks against the stocking list for each level of care. A systematic review of the public medicine distribution system in Bihar may be warranted to identify gaps in selection, procurement, distribution, and stock management, including whether paediatric formulations are adequately covered. Larger multi-district studies should use a defined sampling frame, record visit dates, include facility-level stocking norms, repeat observations over time, report results by facility level, and include a WHO/HAI affordability analysis based on standard treatment regimens.

Conclusions

In this preliminary cross-sectional survey of 12 purposively selected sites in Patna district, the availability of 20 tracer paediatric medicine formulations was 55.0% in the sampled public sites and 79.2% in the sampled private sites, and was incomplete in both. Recorded prices were lower in public sites where medicines were available. These descriptive findings cannot be generalised to Bihar and do not establish the reasons for non-availability or the affordability of the medicines. They suggest the need for facility-level stock audits, a review of public paediatric medicine distribution, and larger studies across Bihar.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Ishteyaque Ahmad, Amritanshu Shekhar, Shantanu Vats, Harihar Dikshit, Shilpi Mishra

Acquisition, analysis, or interpretation of data: Ishteyaque Ahmad, Amritanshu Shekhar, Shantanu Vats, Harihar Dikshit, Shilpi Mishra

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Supervision: Harihar Dikshit

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Clinical Research Ethics Committee(Human Studies) of Netaji Subhas Medical College & Hospital issued approval CREC/2022/2025. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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