


# BMJ Open Price and affordability of key essential medicines for children in Sri Lanka, a lower-middle-income country: comparison of two national cross-sectional surveys done 8 years apart

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## ABSTRACT

**Objective** To describe the price and affordability of key essential medicines for children in the private sector in Sri Lanka in 2017/2018, and compare the findings with 2009 data.

**Design** National cross-sectional descriptive survey using the WHO/Health Action International medicine price methodology.

**Setting and participants** Data were collected from a representative sample of 54 private sector pharmacies selected from all 9 provinces in Sri Lanka using a multistage clustered approach.

**Main outcomes** Median price ratio (MPR) and affordability of originator brand (OB) and lowest priced generics (LPG) of 25 key essential medicines for children.

**Results** The median MPR was 2.69 for OBs and 1.45 for LPGs compared with 3.7 and 1.35 in 2009. MPR of OB of all but one (chlorphenamine syrup) were higher than that of the LPG. MPR-OB>5 was observed for ceftriaxone injection, amoxicillin capsule, mebendazole chewable tablet and metronidazole tablet. This was documented in 2009 as well except for amoxicillin capsule. Prices of LPGs of seven medicines (amoxicillin capsule, amoxicillin suspension, clotrimazole cream, mebendazole chewable tablet, metronidazole tablet) were estimated as excessive (MPR ≥2.5) compared with chlorphenamine syrup, clotrimazole topical cream, ibuprofen syrup and paracetamol syrup in 2009. Compared with 2009, MPRs of OBs of 8 medicines and LPGs of 12 medicines were higher in 2017/2018. Compared with 2009, no change in affordability was noted except for asthma, which has been assessed as affordable in 2017/2018. Standard drug therapy for mild lower respiratory tract infections and acute gastroenteritis remained affordable, and treating epilepsy with carbamazepine syrup remained unaffordable. **Conclusion** Economic access to key essential medicines for children has not improved in Sri Lanka in the 8 years' time since the initial survey in 2009.

## BACKGROUND

The concept of essential medicines was introduced by the WHO with the intention of improving access to necessary medicines that

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The survey included a representative sample from the entire country.
- ⇒ The survey used the WHO/Health Action International medicine price methodology.
- ⇒ We were able to compare the findings with the data of our first survey in 2009, both followed the same methodology.
- ⇒ Median price ratio (MPR) was calculated based on the prices obtained from the survey pharmacies which had the survey medicines on the day of the survey. This might not be reflective of the prices over the year.
- ⇒ Although, the survey was done in 2017/2018, we had to use international reference unit price reported in 2015 in calculating MPRs as it was the nearest information we were able to access.

would satisfy the priority healthcare needs of the population.<sup>1</sup> The WHO launched the first model essential medicine list (EML) in 1977, and updates it regularly every 2 years. However, until 2007, the WHO model EML was mainly focusing on medicines and formulations meant for adults.<sup>2</sup>

Children differ significantly from adults in terms of pharmacotherapy mainly because of ongoing developmental processes substantially affecting the medicine exposure and response.<sup>3 4</sup> Accepting this diversity, in 2007, the World Health Assembly passed the 'Better Medicines for Children' resolution which urged the 193 member states to promote access to essential medicines for children and devise measures to monitor prices.<sup>5</sup>

Embracing the challenge, the WHO launched the first model EML for Children (EMLc) in 2007 and spearheaded the 'make medicines child size' campaign.<sup>2 6</sup> From 2007 onwards, the WHO updates EMLc also every

2 years together with the adult list, and the last version was published in 2021.<sup>7</sup> Many countries including the low-income and middle-income countries (LMICs) introduced several initiatives to ensure better medicines for children.<sup>8,9</sup>

Despite these efforts, lack of physical (availability) and economic (affordability) access to key essential medicines for children had been reported from many LMICs.<sup>10–14</sup> Although medicines are given free of charge in the public sector in many LMICs including Sri Lanka, patients are compelled to pay out-of-pocket to buy medicines from private sector because of low availability in the public sector.<sup>15,16</sup> The WHO has estimated that up to 90% of the population had to pay out-of-pocket to buy medicines in LMICs.<sup>16</sup>

We conducted a national survey in Sri Lanka in 2009 and documented that the availability of key essential medicines for children was less in the public sector compared with private pharmacies.<sup>13</sup> When we reassessed the situation in 2017/2018, the mean percent availability has been improved in public sector (from 52% to 68.1%) whereas a drop was observed in private pharmacies (from 80% to 65.4%).<sup>17</sup> In both surveys, availability was surveyed in both public and private sectors, whereas prices and affordability were surveyed only in the private sector as medicines are supplied free of charge to the patients in the public sector.

This paper describes the price and affordability of key essential medicines for children in the private sector in Sri Lanka in 2017/2018, and compares the findings with 2009 data.<sup>14</sup>

## METHODOLOGY

Data on prices were obtained from a cross-sectional descriptive country survey conducted in 2017/2018 to reassess the availability, price and affordability of key essential medicines for children in Sri Lanka. The methodology of this survey was adapted from WHO/HAI medicine price methodology,<sup>18</sup> and almost similar to our initial survey in 2009. Publications reported the findings of 2009 survey<sup>13,14</sup> and the comparison of availability between 2009 and 2017/2018<sup>17</sup> give detailed account of the methodology.

### Survey settings

Survey was conducted in all nine provinces of Sri Lanka. From each province (survey area), data were collected from a representative sample of five private retail pharmacies and one Rajya Osusala Pharmacy (ROS) using multi-stage cluster sampling, which resulted in having 54 survey settings. The ROS pharmacies are retail arm of the State Pharmaceuticals Corporation (SPC) of Sri Lanka. As per the WHO/HAI methodology, in each province, public hospitals of different levels were used to select the private pharmacies.<sup>13,14,17,18</sup> The pharmacies were the same ones we surveyed in 2009 except in Northern Province, which was not surveyed in 2009 and in few instances in other

eight provinces where we could not locate the pharmacies surveyed in 2009 due to reasons beyond our control such as closure or relocation. In these instances, we followed the same principle and selected a private pharmacy that was closest to the particular public hospital.

### Survey medicines

They were the same key essential medicines for children surveyed in 2009.<sup>13,14</sup> Of the 25 medicines, 2 were excluded from price analysis; ferrous salt suspension as the preparations in the survey settings were of different strengths and had varying amounts of elemental iron, and domperidone syrup as it did not have an international reference unit price (IRP).

### Data collection

Investigators or trained data collectors personally visited the survey settings and collected the required data, namely price of the originator brand (OB) and the lowest price generic (LPG) of the survey medicines if they were available on the day of data collection.

### Data analysis

A detailed account of data analysis is given in our previous publication reporting the 2009 survey findings.<sup>14</sup> Prices were converted from Sri Lankan rupees to US\$ using the exchange rate (US\$1=SLR150.97) on the first day of data collection.<sup>19</sup> Median price ratio (MPR), ratio between median local unit price and IRP, was calculated for OB and LPG of each survey medicine. The supplier median unit prices given in 2015 International Medical Product Guide were taken as IRP.<sup>20</sup>  $MPR \leq 2.5$  and  $\leq 5$  were considered as acceptable local price respectively for LPG and OB.<sup>14,21</sup> High/low ratio was used to compare highest and lowest unit prices of LPGs.<sup>20</sup> Per cent changes were determined to compare the prices between 2017/2018 and 2009.

Affordability was estimated using median local prices and the average salary of the lowest paid unskilled government worker (LPUGW),<sup>22</sup> and expressed as 'number of days' wages that it would cost an LPUGW to purchase standard drug therapy. Affordability of treatment of common childhood diseases such as epilepsy, asthma, acute mild bacterial infections and acute gastroenteritis in a 5-year-old child of average body weight (18–20 kg) were calculated. Standard drug therapies that cost 1 day's income or less for 7 days' treatment for an acute condition and 30 days' treatment for a chronic condition were considered as affordable.<sup>14,23</sup> All the necessary precautions were taken to ensure accuracy of data collection, entry and analysis.

### Patient and public involvement

No patient involved.

## RESULTS

Survey sample included 45 private and 9 ROS pharmacies: OBs of beclomethasone inhaler, clotrimazole cream,

**Table 1** Number of settings which had the survey medicines

Medicines	All pharmacies (n=54)		Private pharmacies (n=45)		Rajya Osusala pharmacies (n=9)	
	OB	LPG	OB	LPG	OB	LPG
Amoxicillin suspension 125 mg/5 mL	29	49	22	43	7	6
Amoxicillin 250 mg capsule	24	51	18	42	6	9
Amoxicillin+clavulanic acid suspension 125 mg /5 mL	42	48	35	39	7	9
Beclometasone-Metered Dose Inhaler 100 µg/dose	NA	37	NA	31	NA	6
Carbamazepine suspension 100 mg/5 mL	7	NA	3	NA	4	NA
Ceftriaxone injection 1 g vial	5	3	NA	NA	5	3
Chlorphenamine syrup 2 mg/5 mL	41	51	36	42	5	9
Clotrimazole topical cream 1 %	NA	43	NA	34	NA	9
Cloxacillin syrup 125 mg/5 mL	NA	41	NA	38	NA	3
Co-trimoxazole suspension 200 mg+40 mg/5 mL	NA	39	NA	31	NA	8
Diazepam injection 5 mg/mL (2 mL ampoule)	NA	1	NA	NA	NA	1
Diethylcarbamazine citrate 50 mg tablet	NA	20	NA	11	NA	9
Erythromycin syrup 125 mg/5 mL	29	29	26	20	3	9
Ibuprofen syrup 100 mg/5 mL	29	24	27	15	2	9
Mebendazole chewable tablet 100 mg	36	27	27	23	9	4
Mebendazole syrup 100 mg/5 mL	23	NA	17	NA	6	NA
Metronidazole 200 mg tablet	41	49	34	40	7	9
Oral rehydration salt packet to make 1 L solution	NA	53	NA	44	NA	9
Paracetamol syrup 120 mg/5 mL*	51	51	43	42	8	9
Paracetamol 500 mg tablet	51	53	42	44	9	9
Salbutamol—Metered Dose inhaler 100 µg/dose	32	46	29	37	3	9
Salbutamol respiratory solution 0.5 %	9	29	8	20	1	9
Vitamin C 100 mg tablet	NA	52	NA	43	NA	9

\*Paracetamol syrup 120 mg/5 mL was available as either 60 mL/100 mL. LPG, lowest price generic; NA, not available; OB, originator brand.

cloxacillin syrup, co-trimoxazole suspension, diazepam injection, diethylcarbamazine tablet, ORS and vitamin C were not available in the market whereas only the OB was available for carbamazepine suspension and mebendazole syrup. This was almost similar to 2009 survey.<sup>14</sup> **Table 1** shows the number of study pharmacies which had the OBs and LPGs of survey medicines.

### Median MPR of survey medicines

**Table 2** gives the MPR of OBs and LPGs of survey medicines. The median MPR was 2.69 for OBs and 1.45 for LPGs compared with 3.7 and 1.35 in 2009 (14). When private and ROS pharmacies were separately analysed, the median MPR was 2.44 (range 0.54–21.51) for OBs and 1.52 (range 0.14–4.59) for LPGs in private pharmacies compared with 2.54 (range 0.45–35.99) and 1.15 (range 0.13–6.70) in ROS pharmacies. To compare prices of the OBs and LPGs, the median MPR was recalculated considering only the medicines (N=13) which were available in both product types (OB and LPG). Median MPR of those 13 medicines was 3.27 for OBs and 1.45 for LPGs.

### MPR of OBs

MPR of OB of all but one (chlorphenamine syrup) were higher than that of the LPG. MPR >5 was observed for ceftriaxone injection, amoxicillin capsule, mebendazole chewable tablet and metronidazole tablet (**table 2**). This was documented in 2009 as well except for amoxicillin capsule.<sup>14</sup> MPR <1 indicating that the median local unit price is cheaper than IRP was observed for OB of salbutamol respiratory solution and amoxicillin+clavulanic acid suspension in 2017/2018 compared with only salbutamol MDI in 2009. MPR of OBs of all but three survey medicines were the same in private and ROS pharmacies; mebendazole syrup and salbutamol respiratory solution had a higher MPR in private pharmacies whereas carbamazepine suspension had a higher MPR in ROS pharmacies. Compared with 2009, MPR of OBs has increased for eight medicines and decreased for seven medicines with mean percentage change of 7.4% (**table 3**), indicating a rising trend in prices of OBs.

**Table 2** Median price ratio of key essential medicines for children

Medicines	All pharmacies				Private pharmacies				Rajya Osusala pharmacies			
	Median price ratio (25–75th percentile)				Median price ratio (25–75th percentile)				Median price ratio (25–75th percentile)			
	OB-MPR	LPG-MPR	H/L	H/L	OB-MPR	LPG-MPR	H/L	H/L	OB-MPR	LPG-MPR	H/L	H/L
Amoxicillin suspension 125 mg/5 mL	3.89 (3.89–3.89)	2.59 (1.58–3.60)	4.1	4.1	3.89 (3.89–3.89)	2.59 (1.60–3.60)	4.1	4.1	3.89 (3.89–3.89)	1.15 (1.10–1.15)	3.9	3.9
Amoxicillin 250mg capsule	5.80 (5.80–5.80)	1.45 (1.26–2.90)	6.1	6.1	5.80 (5.80–5.80)	2.79 (1.45–2.90)	6.1	6.1	5.80 (5.80–5.80)	1.24 (1.22–1.43)	5.6	5.6
Amoxicillin+clavulanic acid suspension 125mg /5mL	0.94 (0.94–0.94)	0.91 (0.90–0.94)	1.5	1.5	0.94 (0.94–0.94)	0.93 (0.91–0.94)	1.5	1.5	0.94 (0.94–0.94)	0.90 (0.90–0.90)	1.05	1.05
Beclometasone -Metered Dose inhaler 100 µg/dose	NA	0.40 (0.36–0.40)	1.3	1.3	NA	0.40 (0.40–0.40)	1.2	1.2	NA	0.36 (0.35–0.36)	1.1	1.1
Carbamazepine suspension 100mg/5 mL*	2.35 (2.27–2.35)	NA	1.1	1.1	2.19 (2.15–2.27)	NA	1.1	1.1	2.35 (2.35–2.35)	NA	1.0	1.0
Ceftriaxone injection 1 g vial	35.99 (35.99–35.99)	6.70 (6.70–7.14)	5.4	5.4	NA	NA	NA	NA	35.99 (35.99–35.99)	6.70 (6.70–7.14)	5.4	5.4
Chlorphenamine syrup 2 mg/5mL*	1.66 (1.66–1.66)	1.96 (0.86–1.96)	3.4	3.4	1.66 (1.66–1.66)	1.96 (1.66–1.96)	2.8	2.8	1.66 (1.66–1.66)	1.43 (0.57–1.96)	3.4	3.4
Clotrimazole topical cream 1 %	NA	4.27 (1.08–4.27)	7.3	7.3	NA	4.27 (1.75–4.27)	7.3	7.3	NA	0.98 (0.98–4.27)	4.4	4.4
Cloxacillin syrup 125 mg/5mL	NA	0.79 (0.79–0.82)	2.1	2.1	NA	0.79 (0.79–0.82)	2.1	2.1	NA	0.65 (0.65–0.65)	1.0	1.0
Co-trimoxazole suspension 200 mg+40mg/5 mL	NA	1.88 (1.60–1.88)	2.3	2.3	NA	1.88 (1.60–1.88)	2.3	2.3	NA	1.88 (1.80–1.88)	1.2	1.2
Diazepam injection 5 mg/mL (2 mL ampoule)	NA	3.42	1.0	1.0	NA	NA	-	-	NA	3.42	1.0	1.0
Diethylcarbamazine citrate 50 mg tablet	NA	0.59 (0.59–0.64)	1.4	1.4	NA	0.64 (0.59–0.64)	1.2	1.2	NA	0.59 (0.59–0.62)	1.4	1.4
Erythromycin syrup 125 mg/5 mL	3.27 (3.27–3.27)	1.45 (1.45–1.45)	4.3	4.3	3.27 (3.27–3.27)	1.45 (1.45–1.70)	4.3	4.3	3.27 (3.27–3.27)	1.45 (1.45–1.45)	2.3	2.3
Ibuprofen syrup 100mg/5mL	3.36 (3.36–3.36)	1.41 (1.41–2.16)	2.5	2.5	3.36 (3.36–3.36)	1.52 (1.41–2.16)	2.5	2.5	3.36 (3.36–3.36)	1.41 (1.41–1.41)	2.4	2.4
Mebendazole chewable tablet 100 mg	21.51 (21.51–25.09)	4.59 (2.74–5.38)	49.7	49.7	21.51 (21.51–25.09)	4.59 (3.67–6.45)	49.7	49.7	21.51 (21.51–21.51)	1.80 (0.84–2.74)	30.9	30.9
Mebendazole syrup 100 mg/5 mL	2.69 (2.46–2.71)	NA	1.3	1.3	2.69 (2.46–2.82)	NA	1.3	1.3	2.54 (2.47–2.65)	NA	1.2	1.2
Metronidazole 200 mg tablet	5.04 (5.04–5.04)	2.16 (0.88–4.34)	7.1	7.1	5.04 (5.04–5.04)	3.00 (0.97–4.34)	7.1	7.1	5.04 (5.04–5.04)	0.88 (0.88–0.88)	5.7	5.7
Oral rehydration salt packet to make 1 L solution	NA	1.71 (1.71–1.71)	7.6	7.6	NA	1.71 (1.71–1.71)	2.7	2.7	NA	1.71 (1.71–1.71)	7.0	7.0
Paracetamol syrup 120 mg/5ML†	2.17 (2.17–2.17)	1.34 (0.90–1.91)	2.7	2.7	2.17 (2.17–2.17)	1.40 (1.34–1.97)	2.4	2.4	2.17 (2.17–2.17)	0.89 (0.89–0.90)	2.7	2.7

Continued

**Table 2** Continued

Medicines	All pharmacies				Private pharmacies				Rajya Osusala pharmacies			
	Median price ratio (25–75th percentile)		H/L		Median price ratio (25–75th percentile)		H/L		Median price ratio (25–75th percentile)		H/L	
	OB-MPR	LPG-MPR	H/L		OB-MPR	LPG-MPR	H/L		OB-MPR	LPG-MPR	H/L	
Paracetamol 500 mg tablet	1.96 (1.96–1.96)	1.62 (1.22–1.96)	9.3		1.96 (1.96–1.96)	1.81 (1.42–1.96)	5.8		1.96 (1.96–1.96)	1.20 (1.13–1.22)	3.8	
Salbutamol–Metered Dose inhaler 100 µg/dose	1.12 (1.12–1.12)	1.06 (1.04–1.12)	1.5		1.12 (1.12–1.12)	1.12 (1.04–1.12)	1.5		1.12 (1.12–1.12)	1.04 (1.04–1.04)	1.1	
Salbutamol respiratory solution 0.5 %	0.54 (0.54–0.54)	0.13 (0.13–0.14)	4.3		0.54 (0.54–0.54)	0.14 (0.13–0.17)	4.3		0.45 (0.45–0.45)	0.13 (0.13–0.13)	3.6	
Vitamin C 100 mg tablet	NA	0.85 (0.83–0.87)	17.9		NA	0.87 (0.83–0.87)	17.9		NA	0.78 (0.78–0.89)	1.1	

\*Buyer median price was used for calculation of median price ratio as supplier median price was not available.  
 †Only the 100 mL pack size was considered for calculation of MPR (OB was available in 29 out of 45 private and 7 out of 9 ROS pharmacies; LPG was available 23 out of 45 private and 9 and out of 9 ROS pharmacies).  
 H/L, high price/low price ratio; LPG-MPR, lowest price generic–median price ratio; NA, not available; OB-MPR, originator brand–median price ratio; ROS, Rajiya Osusala.

### MPR of LPGs

For each medicine, LPG varied from one pharmacy to other with wide interpharmacy variability in price. This has resulted wide range in the MPR especially in private pharmacies. This was noted in 2009 as well. Prices of the LPGs of majority of medicines were more than the IRP (ie,  $MPR > 1$ ) in both private and ROS pharmacies except amoxicillin+clavulanic acid suspension, beclomethasone MDI, cloxacillin syrup, diethylcarbamazine citrate tablet, salbutamol respiratory solution and vitamin C tablet. In 2009 also, prices of the LPGs of majority of medicines were more than the IRP. The MPR of the LPG was considerably higher in private than ROS pharmacies for clotrimazole cream (4.27 vs 0.98), mebendazole tablets (4.59 vs 1.80) and metronidazole tablet (3.00 vs 0.88).

Prices of LPGs of five medicines (amoxicillin capsule, amoxicillin suspension, clotrimazole cream, mebendazole chewable tablet, metronidazole tablet) in private and two (ceftriaxone, diazepam) in ROS pharmacies were estimated as excessive ( $MPR \geq 2.5$ ). In 2009, prices of LPGs of chlorphenamine syrup, clotrimazole topical cream, ibuprofen syrup and paracetamol syrup were estimated as excessive.<sup>14</sup> High/low ratio was 1.0–49.7 in private compared with 1.0–30.9 in ROS pharmacies. Maximum variation was noted with mebendazole chewable tablet in both private and ROS pharmacies. Compared with 2009,<sup>9</sup> MPR of LPGs has increased for 12 medicines and decreased for nine medicines with a mean percentage change of 54.2% (table 3) indicating a rising trend in prices of LPGs.

Only 13 medicines were available in both product types (OB and generics) in the survey sample. Mean per cent difference in price between OB and LPGs of these 13 medicines was 149.6% (range –15.31 to 437.16). In 2009, 15 medicines were available in both product types, and the mean per cent difference in price between OB and LPGs of those 15 medicines was 365% (range –21 to 2343).

Table 4 shows affordability calculation. Daily wage for the LPUGW in 2017/2018 was LKR1053.17 compared with LKR400 in 2009. Standard drug therapy for the included conditions was deemed to be affordable (for both OB and LPGs in private and ROS pharmacies) except epilepsy treated with carbamazepine syrup. This was documented in 2009 as well. For a child on 150 mg carbamazepine/day, purchasing 1 month supply of syrup carbamazepine cost 2.3 and 5 days' wages for the LPUGW, respectively, in 2017/2018 and 2009. No change in affordability was noted from 2009 except for asthma. Purchasing one inhaler each of salbutamol and beclomethasone cost between 1.5 (LPG) and 2.17 (OB) days for the LPUGW in 2009 compared 0.72 days in 2017/2018 (beclomethasone OB was not available in the market in 2017/2018).

### DISCUSSION

In this paper, prices of key essential medicines for children in a lower-middle-income country in 2017/2018

**Table 3** Comparison of median price ratio of survey medicines between 2009 and 2017/2018 surveys (all pharmacies)

Medicines	Originator brand median price ratio		Lowest price generic median price ratio		Percentage change in price (%)*	
	2009	2017/18	2009	2017/2018	OB	LPG
Amoxicillin suspension 125 mg/5 mL	3.37	3.89	1.37	2.59	15.43 (i)	89.05 (i)
Amoxicillin 250 mg capsule	4.56	5.80	1.08	1.45	27.19 (i)	34.26 (i)
Amoxicillin+clavulanic acid suspension 125 mg /5 mL	1.08	0.94	0.77	0.91	12.96 (d)	18.18 (i)
Beclometasone—Metered Dose Inhaler 100 µg/dose	NA	NA	0.57	0.40	–	29.82 (d)
Carbamazepine suspension 100 mg/5 mL†	2.10	2.35	NA	NA	11.90 (i)	–
Ceftriaxone injection 1 g vial	14.46	35.99	1.31	6.70	148.89(i)	411.45 (i)
Chlorphenamine syrup 2 mg/5 mL†	4.29	1.66	2.89	1.96	61.31 (d)	32.18 (d)
Clotrimazole topical cream 1 %	NA	NA	3.74	4.27	–	14.17 (i)
Cloxacillin syrup 125 mg/5 mL	NA	NA	1.31	0.79	–	39.69 (d)
Co-trimoxazole suspension 200 mg+40 mg/5 mL	NA	NA	1.35	1.88	–	39.26 (i)
Diazepam injection 5 mg/mL (2 mL ampoule)	7.69	NA	1.75	3.42	–	95.43 (i)
Diethylcarbamazine citrate 50 mg tablet	NA	NA	0.76	0.59	–	22.37 (d)
Erythromycin syrup 125 mg/5 mL	2.56	3.27	2.09	1.45	27.73 (i)	30.62 (d)
Ibuprofen syrup 100 mg/5 mL	2.65	3.36	3.37	1.41	26.79 (i)	58.16 (d)
Mebendazole chewable tablet 100 mg	19.89	21.51	0.81	4.59	8.14 (i)	466.67 (i)
Mebendazole syrup 100 mg/5 mL	7.70	2.69	NA	NA	65.06 (d)	–
Metronidazole 200 mg tablet	5.87	5.04	1.01	2.16	14.14 (d)	113.86 (i)
Oral rehydration salt packet to make 1 L solution	NA	NA	1.98	1.71	–	13.64 (d)
Paracetamol syrup 120 mg/5 mL	3.29	2.17	3.18	1.34	34.04 (d)	57.86 (d)
Paracetamol 500 mg tablet	4.02	1.96	1.38	1.62	51.24 (d)	17.39 (i)
Salbutamol—Metered Dose Inhaler 100 µg/dose	2.26	1.12	0.97	1.06	50.44 (d)	9.28 (i)
Salbutamol respiratory solution 0.5 %	0.23	0.54	0.05	0.13	134.78 (i)	160.00 (i)
Vitamin C100 mg tablet	NA	NA	1.60	0.85	–	46.88 (d)

\*Per cent difference in price =  $\frac{2017/18 \text{ MPR} - 2009 \text{ MPR}}{2009 \text{ MPR}} \times 100$ (i)=increased in 2017/2018; (d)=decreased in 2017/2018.

†Buyer median price was used for calculation of median price ratio as supplier median price was not available.  
LPG, lowest price generic; NA, not available; OB, originator brand.

are compared with the prices we have reported from a similar survey in 2009. To the best of our knowledge, no prior studies have reported such a comparison. Passage of 'Better Medicines for Children' resolution by the World Health Assembly and subsequent launch of the first model EMLc by the WHO happened in 2007. The resolution categorically urges the member states including Sri Lanka to promote access to essential medicines for children and to devise measures to monitor prices.<sup>5</sup> Documenting the changing trend in prices from 2009 to 2017/2018 would provide the required data to monitor prices of key essential medicines for children in Sri Lanka.

In Sri Lanka, private and ROS pharmacies are pivotal source of medicines for children because significant

proportion of children receive outpatient treatment from general practitioners and specialists in the private sector.<sup>24</sup> In Sri Lanka, the public health system is free of charge. However, even if the children receive treatment in the public sector, parents had to buy medicines from private sector as the prescribed medicines are often not available in the public sector.<sup>13 15 17</sup> We selected the survey settings as per the WHO/HAI methodology for monitoring prices.<sup>18</sup> Survey medicines were also carefully selected.<sup>13</sup> Findings of this survey could be considered as a valid, reliable and generalisable indicator of economic access to key essential medicines for children in Sri Lanka.

Although, the median MPR of OBs was lower in 2017/2018 compared with 2009, this was not evident

**Table 4** Treatment affordability in number of day's wages of the lowest paid unskilled government worker

Condition	Medicine preparation	Treatment schedule (unit dose × frequency × duration)	No of day's wages needed for treatment			
			Private pharmacies		Rajya Osusala pharmacies	
			Median OB	Median LPG	Median OB	Median LPG
Respiratory tract infection	Amoxicillin suspension 125 mg/5 mL	250 mg (=2×5 mL) × 3×7 days = 210 mL	0.54	0.36	0.54	0.16
Respiratory tract infection, urinary tract infection	Amoxicillin+clavulanic acid suspension 125 mg /5 mL	250 mg (=2×5 mL) × 3×7 days = 210 mL	0.57	0.57	0.57	0.55
Asthma	Beclometasone—MDI inhaler 100 µg/dose	one inhaler (200 doses)	NA	0.48	NA	0.44
Asthma	Salbutamol—MDI inhaler 100 µg/dose	one inhaler (200 doses)	0.29	0.29	0.29	0.28
Seizure disorder	Carbamazepine suspension 100 mg/5 mL	5 mg/kg × 18×3 × 30 days = 8100 mg (405 mL)	4.11	NA	4.42	NA
Respiratory tract infection	Erythromycin syrup 125 mg/5 mL	250 mg (=2×5 mL) × 3×7 days = 210 mL	0.81	0.36	0.81	0.36
Worm treatment	Mebendazole chewable tablet 100 mg	100 mg (=1 tablet) × 2×3 days = 6 tablets	0.14	0.03	0.14	0.01
Worm treatment	Mebendazole syrup 100 mg/5 mL	100 mg (=5 mL) × 2×3 days = 30 mL	0.30	NA	0.28	NA
Acute gastroenteritis (dehydration)	Oral rehydration salt packet to make 1 L solution	Some dehydration; 75 mL × 18 kg=1350 mL	NA	0.03	NA	0.03

LPG, lowest price generic; NA, not available; OB, originator brand.

with LPGs. In 2017/2018, not only the median MPR of LPGs has increased, MPR of the LPG of 12 of the 23 medicines also showed an increase (table 3). Generics are generally cheaper than the OB; this was evident in our survey as well. Owing to this price difference, generics are commonly purchased. Hence, increase in the prices of generics impedes access to essential medicines for children. Although the median MPR of OBs showed a considerable drop in 2017/2018, it was still higher than the median MPR of the LPGs. In addition, MPR of the OB of 8 of the 23 medicines showed an increase in 2017/2018 (table 3); hence a drop in the median MPR of the OBs would not have contributed to ease the economic access.

A recent (2021) systematic review of accessibility of medicines<sup>20</sup> has pooled the results of 18 surveys published between 2011 and 2018, including our 2009 survey.<sup>13 14</sup> Similar to our surveys, medicines have been selected based on the WHO model EML in 15 out of the 18 surveys. The median MPRs of both OBs (2.69) and LPGs (1.45) in 2017/2018 in Sri Lanka are lower than that was reported in the systematic review (3.8 and 1.54). This suggests that the prices of key essential medicines for children in the private sector in Sri Lanka are reasonable when compared with the countries reported in the systematic review.

A survey of some key paediatric essential medicines from Odisha State in India reported that the largest contributor to add-on costs was at the level of retailer shop.<sup>25</sup> The survey further reported that for branded products, the MSP was the largest contributor to final price (around 65%) whereas for the branded generic, the retail markup

was the largest contributor (61%–67%), with the Manufacturer Selling Price (MSP) only accounting less than a third of the final price. This observation could explain the discrepancy noted in the trend between OBs and LPGs in our survey: Since, generics are in higher demand than OB, wholesale and retail markets could have increased the add-on costs to boost the profits. On the other hand, as market for OB is limited, add-on prices could have been kept to a minimum to increase the sales.

The National Medicine Regulatory Authority introduced maximum retail Prices of 48 selected medicinal product formulations in October 2016.<sup>26</sup> Only four survey medicines, amoxicillin-clavulanic acid suspension, beclomethasone MDI, paracetamol tablet and salbutamol MDI were within the 48. Of these four medicines, price of OBs of three were same as the controlled price, and price of LPGs of all four were slightly lower than the controlled price. This shows that some form of price control for key essential medicines for children would improve the economic access and affordability. However, with the current, economic crisis, the controlled prices have been considerably increased in Sri Lanka. We have not analysed the price components (MSP, taxes, mark ups at different levels) in our survey. Add-on prices at the different levels of supply chain of these medicines therefore remains unknown. Monitoring the price components, and regulating add-on prices are two initiatives that would ease economic access to essential medicines.

When individual medicines were considered, MPR of LPGs of all but one (chlorphenamine syrup) was lower than that of the OB (table 2). This is a common

phenomenon and reported in many studies.<sup>16 22 27 28</sup> The MPR of OBs was the same in private and ROS pharmacies for majority of medicines. This is an expected observation as there is only one OB for a medicine. Prices of the LPGs tend to be lower in ROS than private pharmacies with narrower H/L ratio. Better performance in ROS pharmacies was observed in our 2009 survey as well.<sup>13 14 17</sup> In addition, the prices of both OBs and LPGs are same in all ROS pharmacies, irrespective of their geographical location since they come under the same organisation (SPC). Knowing the prices from one ROS pharmacy allows the patients to buy from any branch without worrying about any difference in prices. Rajya Osusala pharmacies are the retail arm of the SPC which sell medicines in reasonable prices. The SPC tends to market few generics and promote the generics manufactured locally by the State Pharmaceutical Manufacturing Corporation. This accounts for the narrow variation in the H/L ratio and consistently lower MPRs compared with private pharmacies. However, in Sri Lanka, the total number of ROS pharmacies is 50<sup>29</sup> compared with about 2000 private pharmacies.<sup>30</sup> In addition, the ROS pharmacies are mostly located in main cities compared with PPs, which are located all over the country. Contribution of ROS pharmacies towards improving economic access to essential medicines needs to be expanded and strengthened.

Prices of LPGs of many key essential medicines for children remain above the acceptable local prices in private pharmacies both in 2009 and 2017/2018. This is in agreement with other studies.<sup>11 21 27 31–33</sup> In addition, MPRs of many OB and LPGs have increased in 2017/2018. Majority of population in Sri Lanka had to depend on private pharmacies for their medicines as ROS pharmacies are mainly located in cities. Our findings confirm that the economic access to key essential medicines for children has room for improvement in Sri Lanka. This survey was done before the COVID-19 pandemic and the current economic crisis in Sri Lanka.<sup>34</sup> Therefore, the economic access would have further deteriorated denying the children's access to key essential medicines.

Despite the daily wage has doubled, affordability has not changed except for inhaler therapy for asthma. Improvement in the affordability for inhaler therapy for asthma is a welcome observation. Since the WHO has removed salbutamol tablet and syrup from its model EML in 2007, availability of inhaled medications has increased in the public hospitals<sup>13 17</sup> though the last version of Sri Lankan EML still has the tablet and syrup. This could have contributed for the reduction in prices and improvement in affordability in private pharmacies. However, treatment of seizure disorders, the other major childhood non-communicable disease, remains unaffordable. This definitely needs the intervention. Although tablets of carbamazepine and sodium valproate<sup>26</sup> were included in the 48 medicines that were subjected to price control, liquid dosage forms of these medicines were not included. Children's access to medicines has not been prioritised in the decision-making processes. Price

surveys from other LMICs have shown varying findings depending on the local determinants: For example, an Ethiopian study<sup>11</sup> reported MPRs similar to ours, but differed in affordability whereas a Mongolian study<sup>31</sup> has reported a comparable affordability with relatively higher MPRs.

The WHO has classified antibacterials into three categories, access, watch and reserve (AwaRe): Antibacterials in the access group are expected to be available at all times in all places to minimise irrational use of watch and reserve category antibacterials and to ensure successful treatment of common infections at primary care level.<sup>35</sup> Seven out of the eight antibacterials included in our survey come under access category. Their physical availability was not 100%<sup>13 17</sup> though it has improved in 2017/2018. MPRs of the LPGs of five of these antibacterials have increased in 2017/2018 with three having excessive local price. Improving physical and economic access to these access category antibacterials is an important step in combating antibacterial resistance.

Despite many initiatives, both globally and nationally, taken place during this period to improve the access to essential medicines for children, it appears that there was not much effect on economic accessibility to key essential medicines for children in Sri Lanka. Even increased availability of the medicines in the public sector<sup>13</sup> reducing the demand for these medicines in the private sector has not produced much impact on prices of medicines in the private sector. Although, the price data are not very recent, we feel reporting the changing trend before the pandemic and economic crisis is important to plan sustainable initiatives to improve access to essential medicines for children in Sri Lanka.

MPR was calculated based on the prices obtained from the survey pharmacies which had the survey medicines on the day of the survey. This might not be reflective of the prices over the year. Although, the survey was done in 2017/2018, we had to use IRPs reported in 2015 in calculating MPRs as it was the nearest information we were able to access. We have used standard treatment plan in calculating affordability, however, this may not be the case in real-time practice.

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