

Drug Utilization Pattern and Pharmacoeconomics of Multivitamins Prescribed to Pediatric Patients at a Tertiary Care Hospital

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Abstract

Background: Vitamins and minerals are vital for normal physiological and metabolic functions of the body. These micronutrients are not synthesized within the body; hence, they are commonly prescribed as dietary supplements in medical practice. Children aged <5 years suffer due to malnutrition. They experience micronutrient deficiency and subsequent complications. The aim of this study was to understand drug use patterns and Pharmacoeconomics of multivitamin prescriptions in pediatric patients in a tertiary care hospital setting.

Materials and Methods: This was a single-center, prospective, observational study conducted in patients admitted to the pediatric ward of a tertiary care hospital. Patients of either gender, aged <5 years, and who were receiving any vitamin supplements during their treatment were included in the study. Data for demographics, medical records, and medicines prescribed were recorded in a case report form and analyzed descriptively. Pharmacoeconomic aspects of multivitamin use were also studied. Descriptive data were reported as numbers, percentages, and means. Demographic variables were assessed using the Chi-square test, and a P value of 0.05 was considered significant.

Results: A total of 57 patients who met the inclusion criteria were included in the study. The majority of the patients were male (64.9%), and the mean age was 9.3 months. Vitamin D was prescribed to 70.2% of patients. Other vitamins prescribed were vitamin B6, B7, B complex, vitamin K, vitamin C, vitamin E, and leucoverine. The cost of vitamins prescribed for patients accounted for 8.3% of the total cost of the prescribed medications (₹9904 out of ₹119636).

Conclusions: We were able to understand the drug utilization patterns and Pharmacoeconomics of multivitamin prescriptions in pediatric patients in a tertiary care hos-

pital setting. We found out that multivitamins were prescribed rationally, and the cost of multivitamins was less than 1/10th of the total cost of the prescribed medications.

Introduction

Vitamins and minerals are crucial elements of various metabolic processes that maintain the body's fundamental cellular functions.^[1] They are not just essential for physical health, but they also play an important role in maintaining our mental health and wellbeing.^[2] The human body cannot synthesize the vitamins endogenously. Therefore, there is a need to consume vitamins and minerals through diet or dietary supplements.^[3] According to the World Health Organization, more than 2 billion people worldwide are experiencing vitamin and mineral deficiencies. A deficiency of these micronutrients impacts overall health and increases the risk of diseases and infections.^[4] Multivitamin and multimineral supplements (MVMS) could improve the micronutrient intake; therefore, they are commonly prescribed in medical practice.^[5,6]

Malnutrition among children under the age of 5 years is a serious global concern.^[7] Deficiency of vitamins and minerals in children could hamper their physical and cognitive development.^[8,9] Regular use of appropriately formulated MVMS can help in achieving the recommended intake levels of these micronutrients and fulfilling the necessary vitamins and minerals requirements of the body.^[6] There are guidelines and recommendations for daily intake of vitamins and minerals. However, there are no regulations, and there is a lack of consensus on how to prescribe MVMS.^[10,11] Therefore, pediatricians may end up prescribing supplements that might turn out to be excessive or inadequate.^[12] Another challenge is that the prices of MVMS are not regulated.^[5,13] Sometimes, the cost of the prescribed MVMS could be more than the cost of medications prescribed for the root cause of the disease.

Generally, there is no scientific rationale for how MVMS are prescribed.^[14] Understanding the drug utilization patterns could help in deciphering the prescription patterns and practices followed by physicians in a given setup. Furthermore, there are not many studies evaluating the Pharmacoeconomics of MVMS in pediatric settings. Studies describing these aspects in a semiurban region in a developing country are rare. Therefore, we planned this study with an aim to understand drug use patterns and Pharmacoeconomics of multivitamin prescriptions in pediatric patients in a tertiary care hospital setting.

Materials And Methods

Participants and study design

This was a prospective, observational study that was conducted in the pediatric ward of a tertiary care hospital in Karad, Maharashtra, India. Patients of either gender with age below 5 years who were admitted in the pediatric ward of the hospital between April and August 2022 and were prescribed a vitamin or mineral supplement during their stay were included in the study.

Data collection and analysis

Data for demographics and drugs prescribed during hospital stay were captured in a case report form. Data were pooled, and descriptive analysis was performed. We calculated the cost of vitamins as well as other medication based on the price at which they were purchased. We compared the total treatment cost during their stay in the hospital with the cost of vitamin supplements prescribed during that period. The observations were manually entered into an Excel sheet, and analysis was performed using the formulas available in Excel. All statistical analysis was done by using window-based software SPSS, Version 20. Data were summarized into numbers, percentages, and means. Demographic variables were assessed using the Chi-square test, and a P-value of 0.05 was considered significant.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and good clinical practices. The study was approved by the Institutional Ethics Committee and Institutional Review Board. Parents or guardians signed the informed consent on behalf of the patient.

Results

Demographic characteristics

Of the 100 patients screened during the study period, 57 met the inclusion criteria. The majority of the patients were male (64.9%), and the mean age was 9.3 months (Table 1). Analysis of patients using distribution by age and gender did not show any statistically significant difference (Table 2). The majority of the patients stayed at the hospital for a shorter duration (average stay of 5–6 days). Twenty-three patients were admitted for a duration of 1–3 days, while 18 were admitted for 4–7 days. Very few patients were admitted for 15 days or more (Table 1). Patients were admitted for one or more health conditions, including physiological jaundice, respiratory distress, gastroenteritis, loose motions, dehydration, low birth weight, viral fever, fever/pyrexia, and dengue (Table 1).

Prescription pattern of MVMS

When we analyzed the prescribed MVMS, we found vitamin D was the most commonly prescribed (40 patients) vitamin supplement in our study. Vitamin B complex, B6, B7, and vitamin K were prescribed in 12, 5, 5, and 4 patients, respectively (Table 3). Eight patients were prescribed MVMS.

Other prescribed medications

Along with multivitamins, we also studied the drug utilization pattern of other drugs that were prescribed to these patients (Table 4). Antibiotics were the most commonly prescribed medication (34 patients), followed by antipyretics (21 patients). Steroids were prescribed to 21 patients, antihistamines to 8, and bronchodilators and antacids were prescribed to 6 patients each (Table 4). Ceftriaxone, ampicillin, and dicloxacillin were the most prominently prescribed antibiotics. The overall prescription pattern is presented in Figure 1.

Pharmacoeconomic aspects

The total expenditure on prescribed medications among the enrolled patients was ₹119636. Of this, the expenditure on vitamins was ₹9904 (Figure 2). Overall, the cost of vitamins per patient was ₹173.8, and it did not differ significantly when analyzed based on gender (male, ₹177.2 vs. female, ₹167.3). The highest per-patient cost of prescribed vitamins was observed in patients aged 1 to 2 years (₹180.4), whereas the lowest was in patients aged 3 to 4 years (₹145.0; Figure 3). Figure 4 presents an overview of the expenditure on vitamins by age and gender distribution.

Discussion

In this prospective, observational study, we studied the drug utilization pattern and Pharmacoeconomics of multivitamins prescribed to 57 pediatric patients aged below 5 years admitted to the pediatric ward of a tertiary care hospital in Karad, India. Although the majority of the patients were male, the analysis using distribution by age and gender did not show any statistically significant difference. Vitamins were prescribed rationally, and the most commonly prescribed vitamin was vitamin D. The expenditure on vitamins was almost 1/10th of the total expenditure on prescribed medications.

Jadhav et al. and Kumar et al., in their studies evaluating drug utilization in pediatric patients, have reported a preponderance of males.^[15,16] In our study too, we observed that the number of male patients was higher than female patients (64.9% vs. 35.1%). However, the analysis by age and gender distribution did not show any statistically significant difference. Our study was conducted in a tertiary care hospital, and the infants might have been

admitted there due to complications during and/or after birth. This could be a possible reason that the majority of patients in this study (66.7%) were aged below one year.

Acute gastroenteritis and respiratory disorders have been reported as the most common causes for hospitalization in infants.^[17,18] In our study, the most common reasons for hospitalization were physiological jaundice/neonatal hyperbilirubinemia (33.3%). Eight patients (14%) had respiratory distress, while six (10.5%) patients had gastroenteritis, diarrhea, or dehydration. As mentioned previously, most of the patients included in our study were neonates, and physiological jaundice was the most common clinical condition seen in these newborns. We assume that these patients might have been admitted to the hospital as a precautionary measure to prevent further complications.

Although there is no clear mechanism to understand the relationship between vitamin D and neonatal jaundice, studies have shown that lower levels of vitamin D could be a risk factor for neonatal jaundice.^[19-21] In the guidelines on prevention and treatment of vitamin D deficiency and rickets, IAP has recommended a daily dose of 400 U of vitamin D in infants.^[22] Vitamin D was the most commonly prescribed vitamin in our study, with 70.2% of patients receiving vitamin D supplements. We assume that having patients with physiological jaundice and neonatal hyperbilirubinemia could have been the reason behind this. Although vitamin D toxicity is rare, if it occurs, it could lead to hypercalcemia and hypercalciuria. To prevent vitamin D toxicity in children who are supposed to receive long-term vitamin D supplementation, it is advised to check the serum 25-hydroxyvitamin D levels.^[23]

Vitamin B deficiency is considered one of the etiological factors in the development of a wide range of pathological states and neurological conditions.^[24] Low levels of vitamin B complex during the first year of life increase the risk of unfavorable neurocognitive outcomes. Therefore, it is recommended to administer vitamin B complex supplements. In our study, vitamin B complex was prescribed to 21.1% of the patients, while 8.8% of patients each received vitamins B6 and B7. Vitamin C was prescribed mainly for children suffering from dengue fever. Leucovorin was prescribed for three patients suffering from thalassemia with congestive cardiac failure.

Along with multivitamins, we also studied the drug utilization patterns of other drugs that were prescribed during the study duration. Antibiotics topped the list and were given to 59.6% of patients. The other key medications prescribed in our study were antipyretics (36.8%), steroids (17.5%), and antihistamines (14%). Studies in hospitalized as well as outpatients have reported that antimicrobials were the most commonly prescribed drugs.^[15,25,26]

Results from our study seem to concur with the data reported in the published literature.

Pharmacoeconomics of multivitamins in pediatric age groups is very important. We calculated the cost of vitamins as well as other medications based on their purchase cost. We compared the total cost of prescribed medications during the stay in the hospital with the cost of vitamins prescribed in that period. We found the total expenditure on vitamins is 8.3%. The per-patient cost of prescribed vitamins was ₹173.8 compared with ₹2094 for all prescribed medicines. We did not find any significant difference in the cost when we analyzed the data based on gender distribution. When we analyzed the data based on age distribution, we realized that the data were skewed towards patients aged up to 12 months and there were no patients aged 25 to 36 months. Maximum expenditure on vitamins was found in children up to one year of age (13.0% of the total prescribed medication). The cost of prescribed vitamins in patients aged 1 to 2 years was 2.4%, and it was 6.1% each for patients aged 3 to 4 and 4 to 5 years. Pediatric patients are usually prescribed vitamin supplements that contain more than one vitamin and mineral. Therefore, it is difficult to capture the amount spent on individual vitamins. Furthermore, when we searched the literature for studies reporting costs for individual components, we did not find any relevant reference. Therefore, we cannot comment on whether the cost of vitamins in this setting was over, under, or at par with the outcomes of other studies or standards.

It is necessary to give vitamin supplements whenever required. But at the same time, overuse of any vitamin should be avoided, as it is always dangerous. In a country like India, deficiency of multivitamins and multiminerals is very common, so rational use is always recommended.

To the best of our knowledge, this is one of the very few studies first study to evaluate the drug utilization pattern and Pharmacoeconomics of MVMS in pediatric setting in western part of India. This study provides important evidence for rational use of MVMS in pediatric settings. The Pharmacoeconomics data provides valuable information on the cost of the prescribed MVMS stratified by age and gender.

The limitations of the study include a short duration and a small sample size. This was a single-center study; therefore, the data on drug utilization patterns and Pharmacoeconomics was limited to the pediatric patients admitted in a single tertiary care hospital in Karad. Therefore, the outcomes could not be generalized. Another limitation was that we did not capture the cost of each vitamin and mineral supplement separately. Irrespective of these limitations, the study results provide an important insight into the prescription pattern of MVMS in pediatric patients and the associated pharmacoeconomic aspects.

There is no doubt that vitamins and minerals play a vital role in the physical and cognitive development of children. To prevent malnutrition and the associated life-threatening complications, pediatricians can prescribe MVMS. However, they should be prescribed rationally whenever they are necessary. Owing to the safety and costs of the supplements, over- or under-prescribing should be avoided. Instead of prescribing blindly, some of the MVMS should be prescribed after proper running diagnostic tests. It can help in avoiding complications arising due to hypervitaminosis.

Using data from 57 pediatric patients aged below 5 years, we were able to understand the pattern of use and Pharmacoeconomics of multivitamin prescriptions in pediatric patients in a tertiary care hospital setting. We found that the vitamins were prescribed rationally. There was no extensive expenditure on MVMS, and their cost was less than 1/10th of the total cost of the medications prescribed. A large, multicenter study with a larger patient pool would give a broad and more specific understanding about the utilization pattern and Pharmacoeconomics of multivitamins prescribed to pediatric patients.

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Conflict of interest: Authors do not have any financial or non-financial competing interests to declare for this study.

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Ethical approval and informed consent statements: The study was conducted in accordance with Declaration of Helsinki and good clinical practice guidelines. Parents or guardians signed the informed consent on behalf of the patient. The study was approved by Institutional Ethics Committee (KIMSDU/IEC/06/2022) and Institutional Review Board of Krishna Vishwa Vidyapeeth (Deemed to be University) Karad, India.

Data availability statement: Entire data from the study are reported in this manuscript. Anonymized patient level data can be shared by the corresponding author upon request with a valid rationale.

Author contributions: Both the authors equally contributed towards conceptualization and conduct of the study, data collection and analysis, drafting and critically reviewing the manuscript. Both authors have reviewed and approved the final draft of the manuscript before submission.

Tables

Table 1. Demographic characteristics

Characteristic	Proportion of patients n(%)
Total number of patients	57 (100)
Gender	
Male	37 (64.9)
Female	20 (35.1)
Duration of hospital stay, days	
1-3	23 (40.4)
4-7	18 (31.6)
8-15	10 (17.5)
>15	6 (10.5)
Medical condition*	
Anemia	2 (3.5)
Birth asphyxia	2 (3.5)
Bronchopneumonia	3 (5.3)
Dengue	4 (7.0)
Febrile convulsions/seizures/epilepsy	2 (3.5)
Follow-up after croup	1 (1.8)
Follow-up of cerebral palsy	1 (1.8)
Gastroenteritis/loose motions/dehydration	6 (10.5)
Hyperactive airway disease	1 (1.8)
Hyaline membrane disease	2 (3.5)
Laryngomalacia	1 (1.8)
Low birth weight	5 (8.8)
Lower respiratory tract infection	1 (1.8)
Neonatal hyperbilirubinemia	2 (3.5)
Physiological jaundice	17 (29.8)
Respiratory distress	8 (14.0)
Staphylococcal scalded skin syndrome	1 (1.8)
Upper respiratory tract infection	1 (1.8)
Viral fever/fever/pyrexia	5 (8.8)

*A patient might have presented with more than one medical condition

Table 2. Patient distribution by age and gender

Age, months	Gender, n (%)		Total, n (%)
	Male n=37	Female n=20	
0-1	27 (73.0)	11 (55.0)	38 (66.7)
2-12	3 (8.1)	3 (15.0)	6 (10.5)
13-60	7 (18.9)	6 (30.0)	13 (22.8)

Chi square = 1.38; df - 2; P = 0.5006

Table 3. Vitamins prescribed to patients*

Vitamin/mineral prescribed	Gender, n (%)		Total, n (%)
	Male n=37	Female n=20	
Pyridoxine (vitamin B6)	2 (5.4)	3 (15.0)	5 (8.8)
Biotin (vitamin B7)	2 (5.4)	3 (15.0)	5 (8.8)
Leucovorin (vitamin B9)	0 (0.0)	1 (5.0)	1 (1.8)
Vitamin B complex	5 (13.5)	7 (35.0)	12 (21.1)
Vitamin C	2 (5.4)	1 (5.0)	3 (5.2)
Vitamin D	29 (78.4)	11 (55.0)	40 (70.2)
Vitamin E	1 (2.7)	0 (0.0)	1 (1.8)
Vitamin K	3 (8.1)	1 (5.0)	4 (7.0)
Iron	1 (2.7)	3 (15.0)	4 (7.0)
Zinc	2 (5.4)	8 (40.0)	10 (17.5)
Calcium (alone or in combination with vitamin D)	5 (13.5)	6 (30.0)	11 (19.3)
Multivitamin and multimineral supplement	4 (10.8)	4 (20.0)	8 (14.0)

*A patient might have been prescribed more than one supplement or the prescribed supplement may have more than one vitamin.

Table 4. Other drugs prescribed during the study

Drug	Gender, n (%)		Total, n (%)
	Male n=37	Female n=20	
Analgesic	0 (0.0)	1 (5.0)	1 (1.8)
Antacid	4 (10.8)	2 (10.0)	6 (10.5)
Antibiotic	20 (54.0)	14 (70.0)	34 (59.6)
Antiemetic	2 (5.4)	2 (10.0)	4 (7.0)
Antiepileptic	1 (2.7)	1 (5.0)	2 (3.5)
Antihistamine	3 (8.1)	5 (25.0)	8 (14.0)
Antipyretic	13 (35.1)	8 (40.0)	21 (36.8)
Appetizer	1 (2.7)	1 (5.0)	2 (3.5)
Bronchodilator	3 (8.1)	3 (15.0)	6 (10.5)
Leukotriene antagonist	2 (5.4)	2 (10.0)	4 (7.0)
Mucolytic	2 (5.4)	3 (15.0)	5 (8.8)
Nasal drops	2 (5.4)	2 (10.0)	4 (7.0)
Other medications	7 (18.9)	4 (20.0)	11 (19.3)
Potassium	2 (5.4)	0 (0.0)	2 (3.5)
Probiotic	1 (2.7)	4 (20.0)	5 (8.8)
Sodium bicarbonate	0 (0.0)	2 (10.0)	2 (3.5)
Steroid	5 (13.5)	5 (25.0)	10 (17.5)

Figures

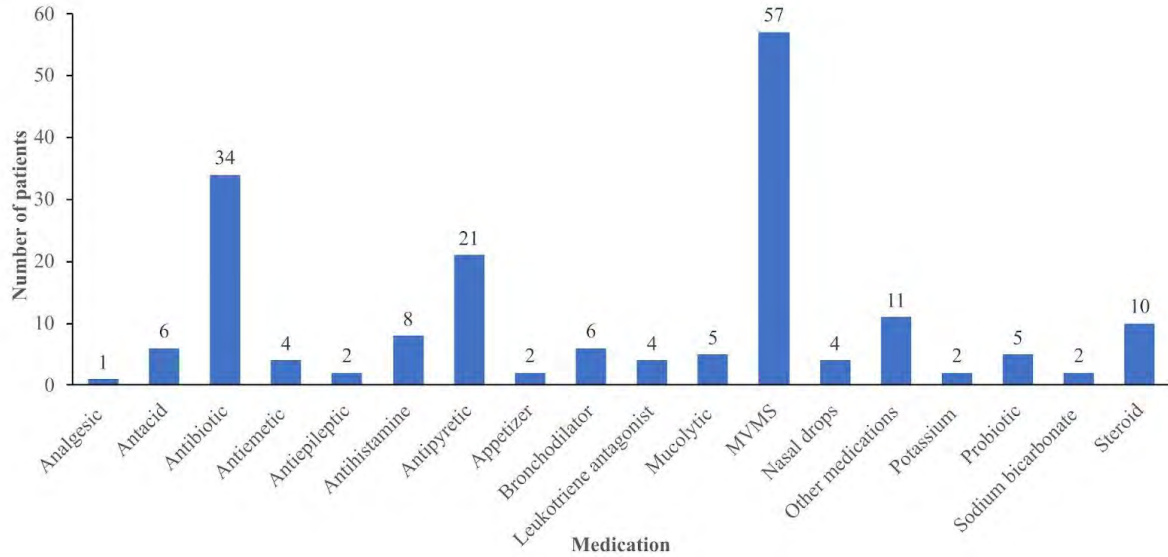


Figure 1. Drug utilization pattern

MVMS includes either one or more vitamin and/or mineral prescribed.
 MVMS, multivitamin multimineral supplement

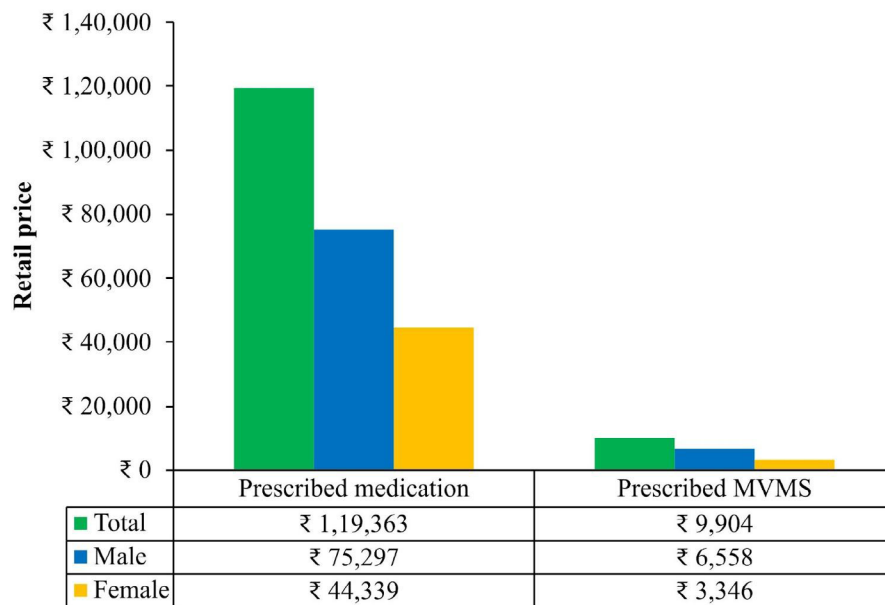


Figure 2. Total expenditure on prescribed medication versus expenditure on vitamin by gender distribution

MVMS includes either one or more vitamin and/or mineral prescribed.
 MVMS, multivitamin multimineral supplement

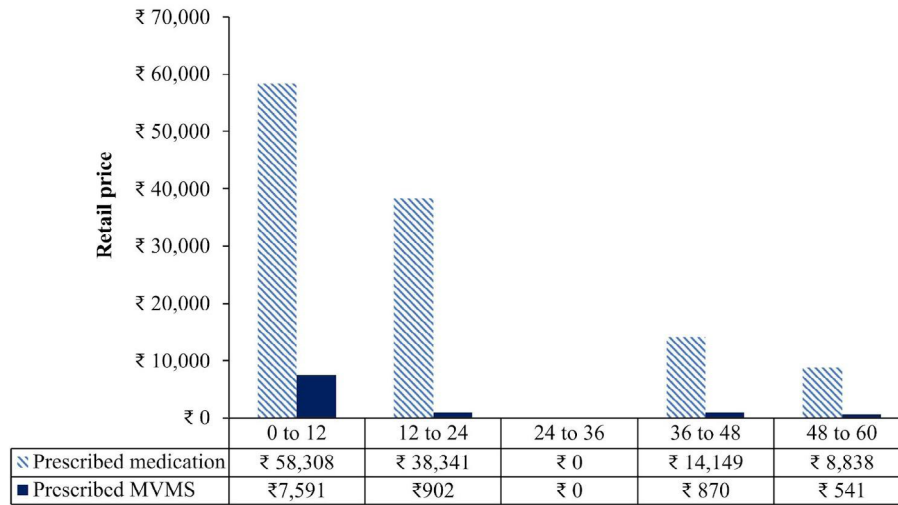


Figure 3. Total expenditure on prescribed medication versus expenditure on vitamin by age distribution

X-axis represents age groups in months.
 MVMS includes either one or more vitamin and/or mineral prescribed.
 MVMS, multivitamin multimineral supplement

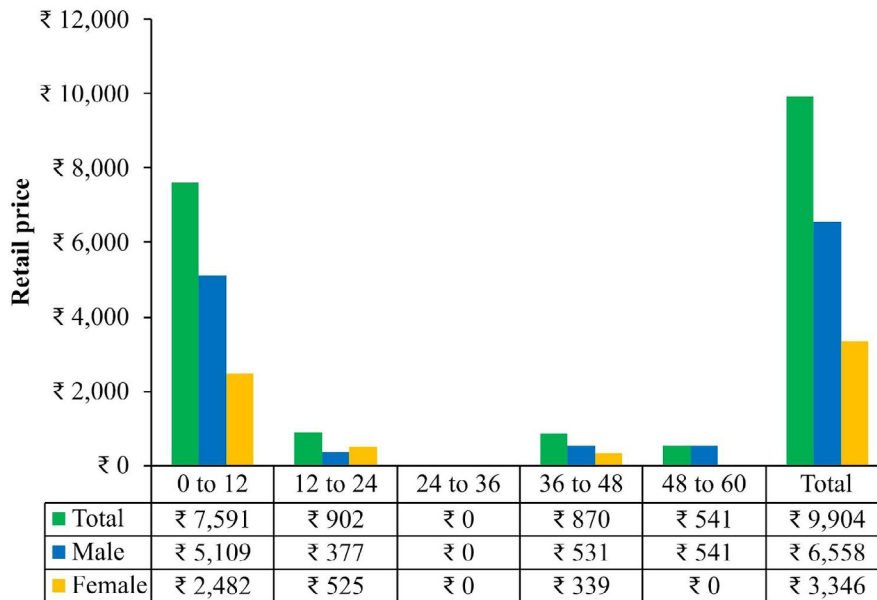


Figure 4. Expenditure on MVMS by age and gender distribution

X-axis represents age groups in months.
 MVMS includes either one or more vitamin and/or mineral prescribed.
 MVMS, multivitamin multimineral supplement

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