

Trends in cardiovascular medicine use in 65 middle-and high-income countries

Brief title: Cardiovascular medicine use in middle- and high-income countries

Authors

Vincent KC Yan, BPharm¹; Joseph E Blais, BScPharm¹; Xue Li, PhD^{1,2}; Celine SL Chui, PhD^{1,3,4}; Li Wei, PhD⁵; Bryan P Yan, MBBS⁶; Martin RJ Knapp, PhD⁷; Chung Wah Siu, MD⁸; Ian CK Wong, PhD^{1,5}; Esther W Chan, PhD¹

Affiliations

¹ Centre for Safe Medication Practice and Research, Department of Pharmacology and Pharmacy, LKS Faculty of Medicine, University of Hong Kong, Hong Kong Special Administrative Region, China

² Department of Medicine, LKS Faculty of Medicine, University of Hong Kong, Hong Kong Special Administrative Region, China

³ Department of Paediatrics and Adolescent Medicine, LKS Faculty of Medicine, University of Hong Kong

⁴ Department of Social Work and Social Administration, Faculty of Social Science, University of Hong Kong

⁵ Research Department of Practice and Policy, UCL School of Pharmacy, London, UK

⁶ Division of Cardiology, Department of Medicine and Therapeutics, The Chinese University of Hong Kong, Hong Kong Special Administrative Region, China

⁷ Care Policy and Evaluation Centre, London School of Economics and Political Science, Houghton Street, London, UK

⁸ Division of Cardiology, Department of Medicine, University of Hong Kong, Hong Kong Special Administrative Region, China

Funding

This study was supported through internal seed funding from the Li Ka Shing Faculty of Medicine, The University of Hong Kong.

Disclosures

XL reports grants from Research Fund Secretariat of the Food and Health Bureau (HMRF, HKSAR), research and educational grants from Janssen, Pfizer, grants from University of Hong Kong, consulting fees from MSD, outside the submitted work. CSLC reports research grants from Pfizer and Amgen, personal fees from Primevigilance Limited, outside the submitted work. ICKW reports personal fees and non-financial support from IQVIA, outside the submitted work. EWC has received honorarium from the Hospital Authority, research grants from Research Grants Council (RGC, HKSAR), Research Fund Secretariat of the Food and Health Bureau (HMRF, HKSAR), National Natural Science Fund of China, National Health and Medical research Council (NHMRC, Australia), Wellcome Trust, Bayer, Bristol-Myers Squibb, Pfizer, Janssen, Amgen, Takeda, and Narcotics Division of the Security Bureau of HKSAR, outside the submitted work. All other authors declare no competing interests.

Address for correspondence

Dr Esther W Chan

Centre for Safe Medication Practice and Research

Department of Pharmacology and Pharmacy

General Office, L02-56 2/F

Laboratory Block LKS Faculty of Medicine

The University of Hong Kong
21 Sassoon Road, Pokfulam
Hong Kong SAR, China
Tel: +852 2831 5110
Fax: +852 2817 0859
E-mail: ewchan@hku.hk

Acknowledgments

We thank Salman Rizvi and Ashwin Oberoi from IQVIA for their assistance and information regarding the use of IQVIA-MIDAS data. JEB is supported by the Hong Kong Research Grants Council as a recipient of the Hong Kong PhD Fellowship Scheme.

Data sharing

The statements, findings, and suggestions in this Article are based on data obtained under license from IQVIA: IQVIA-MIDAS monthly sales data, 2008–2018; all rights reserved. The statements, findings, and suggestions are not necessarily those of IQVIA or any of its affiliated or subsidiary entities. We alone are responsible for the views expressed in this Article and they do not necessarily represent the views, decisions, or policies of the institutions with which we are affiliated.

Abbreviations

ATC = WHO Anatomic Therapeutic Chemical code
CAGR = compound annual growth rate
CVD = cardiovascular disease
DDDTID = defined daily dose per 1000 inhabitants per day
HICs = high-income countries
IQVIA-MIDAS = IQVIA Multinational Integrated Data Analysis System
MICs = middle-income countries
WHO = World Health Organization

Introduction

Access to cardiovascular medicines remains a global health challenge.(1) By 2025, the World Health Organization (WHO) Global Action Plan aims for at least 50% of eligible people to receive drug therapy for the prevention of myocardial infarction and stroke. Yet, the accessibility and affordability of cardiovascular medicines varies across countries with different income levels (2) posing barriers to the prevention and treatment cardiovascular diseases (CVDs). Timely monitoring of cardiovascular medicine consumption can help identify potential treatment gaps and track implementation of WHO's global targets. Therefore, we aimed to describe recent trends in cardiovascular medicine consumption in middle-income countries (MICs) and high-income countries (HICs).

Methods

We conducted a descriptive study using aggregated pharmaceutical sales data from the IQVIA Multinational Integrated Data Analysis System (IQVIA-MIDAS). IQVIA-MIDAS captures the volume of medicines sold to retail and hospital pharmacies from wholesalers in different countries and unifies the data to facilitate global-level analysis. In countries with limited raw data, projections have been applied in IQVIA-MIDAS to represent 100% of the total market sales volume based on knowledge of market share. Patient-level data is not available in IQVIA-MIDAS; hence this study was exempt from ethics approval by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster.

We included data from 2008 to 2018 in 65 countries. Countries were stratified into 38 HICs and 27 MICs (6 lower-middle and 21 upper-middle income) according to the World Bank income classification 2018. We obtained population estimates from the UN World Population Prospects (2019 Report). We included medicines belonging to the *cardiovascular*

system and *antithrombotic agents* classes in the WHO Anatomic Therapeutic Chemical (ATC) Classification System.

Sales volume was expressed in defined daily dose per 1000 inhabitants per day (DDDTID), which estimates the proportion of population receiving a particular medicine daily in a particular year, accounting for differences in population and medicine dosage. The

compound annual growth rate ($CAGR = \left(\sqrt[10]{\frac{\text{Annual consumption (DDDTID) in 2018}}{\text{Annual consumption (DDDTID) in 2008}}} - 1 \right) \times 100$)

was used to quantify changes in consumption over time. Data were analyzed using R (version 3.6.1).

Results

Consumption of all cardiovascular medicines increased from 113.58 DDDTID in 2008 to 153.52 DDDTID in 2018, corresponding to 3.06% annual growth. Consumption and growth of cardiovascular medicines classes differed in MICs and HICs (Figure 1). The CAGR for all cardiovascular medicines was greater in MICs (9.96%) than HICs (0.98%). Total consumption was about 15-fold higher in HICs than MICs in 2008 (HICs: 410.54 DDDTID, MICs: 27.69 DDDTID), and remained 6-fold higher in 2018 (HICs: 452.52 DDDTID, MICs: 71.57 DDDTID).

Discussion

From 2008 to 2018, consumption of cardiovascular medicines increased by approximately 3% each year, outpacing the estimated 2.5% annual increase in global CVD prevalence.(3) This may suggest expanded access and availability of cardiovascular medicines in the included countries. Despite higher growth in cardiovascular medicine consumption in MICs than HICs, consumption of cardiovascular medicines remained about 6-fold higher in HICs than MICs in 2018. In contrast, the prevalence of CVDs in HICs was

only about 2-fold of that in MICs,(3) suggesting that factors other than CVD prevalence contribute to differences in consumption between HICs and MICs.

Limited access to cardiovascular medicines creates additional barriers to treatment and prevention of CVDs in MICs. Previous studies indicate the availability of four cardiovascular medicines in urban communities was higher in HICs (95%) than upper MICs (80%) and lower MICs (62%) and were potentially unaffordable in one-third of households in MICs.(2) Furthermore, few patients with CVDs in 17 lower-middle income countries received antiplatelets (25.3%), beta-blockers (17.4%), renin-angiotensin system (RAS) blockers (19.5%), or statins (14.6%).(4) Our results support previous findings that country income influences use of cardiovascular medicines more than patient-based factors such as age, sex, body mass index, hypertension.(4)

This study is limited in that it did not use patient-level data and did not include low-income countries, where further research is needed.

Conclusion

Despite recent improvement, a treatment gap persists for cardiovascular medicines between HICs and MICs. To meet the goals in the WHO action plan, additional efforts are needed to improve access to cardiovascular medicines, particularly in MICs.

References

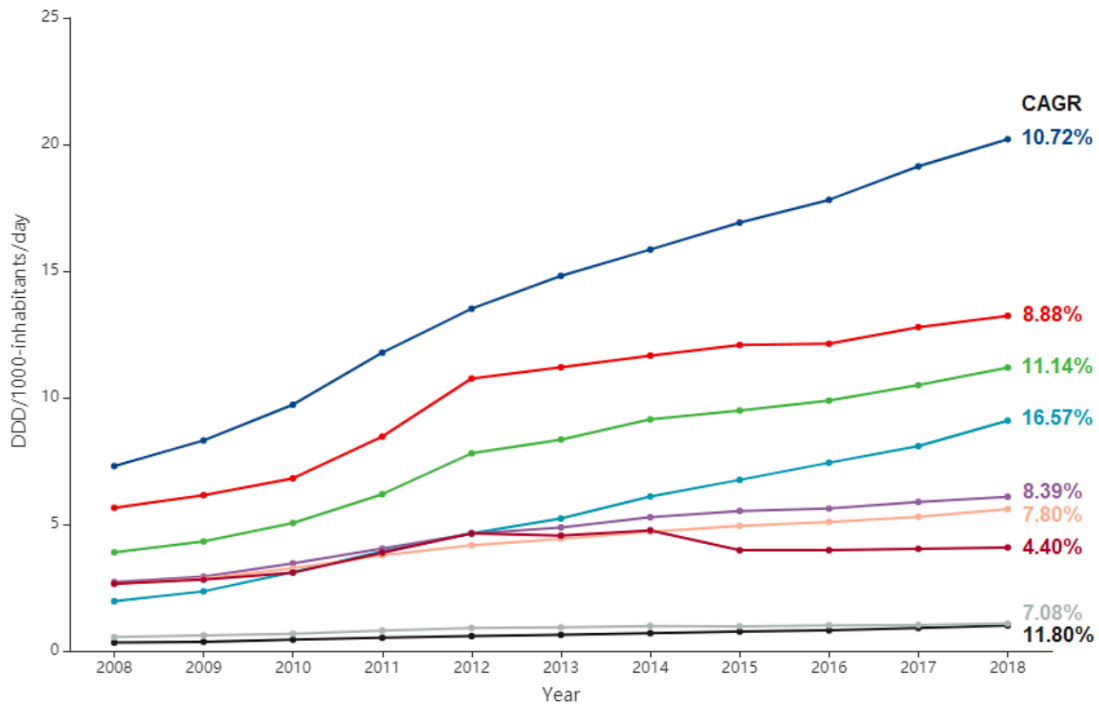
1. Wirtz VJ, Kaplan WA, Kwan GF, Laing RO. Access to medications for cardiovascular diseases in low- and middle-income countries. *Circulation* 2016;133:2076–2085.
2. Khatib R, McKee M, Shannon H, et al. Availability and affordability of cardiovascular disease medicines and their effect on use in high-income, middle-income, and low-income countries: An analysis of the PURE study data. *Lancet* 2016;387:61–69.
3. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2017 (GBD 2017) results. Available at: <http://ghdx.healthdata.org/gbd-results-tool>. Accessed September 1, 2020.
4. Yusuf S, Islam S, Chow CK, et al. Use of secondary prevention drugs for cardiovascular disease in the community in high-income, middle-income, and low-income countries (the PURE study): A prospective epidemiological survey. *Lancet* 2011;378:1231–1243.

Figure legend

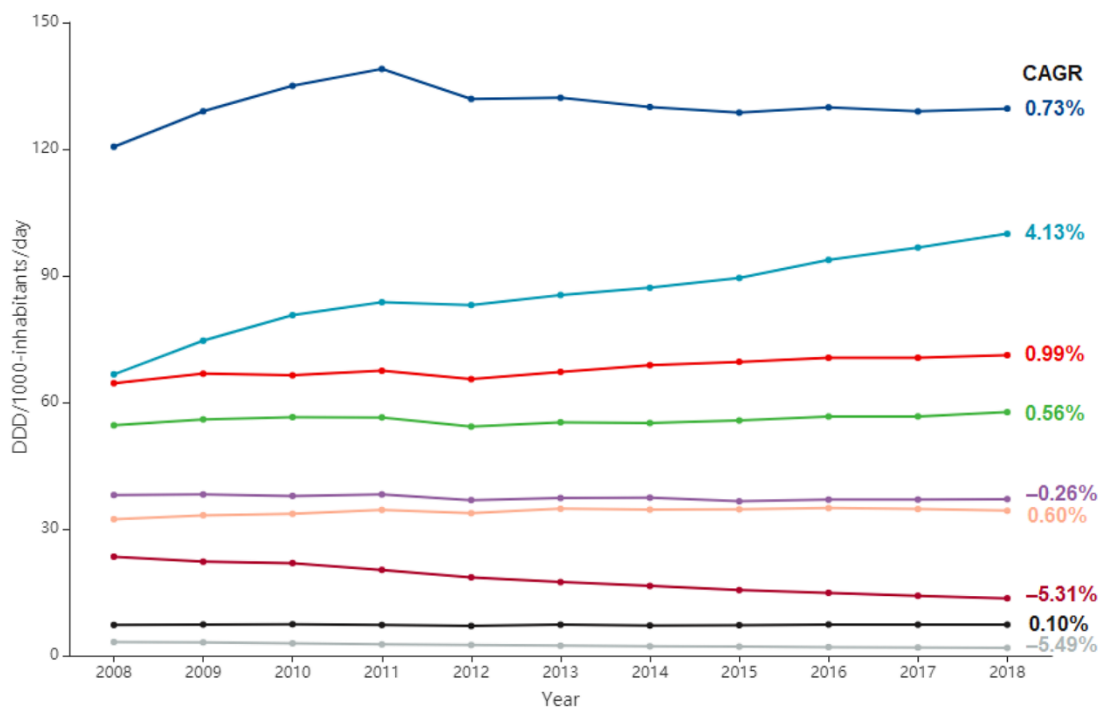
Figure 1: Global trends of cardiovascular medicine consumption in middle- and high-income countries, 2008-2018

RAS: renin-angiotensin system, CAGR: compound annual growth rate. Drug classes were defined in WHO ATC index (https://www.whocc.no/atc_ddd_index/).

Middle-income countries



High-income countries



- RAS agents (ATC C09) ●
- Antithrombotic agents (ATC B01) ●
- Calcium channel blockers (ATC C08) ●
- Lipid modifying agents (ATC C10) ●
- Diuretics (ATC C03) ●
- Beta blocking agents (ATC C07) ●
- Cardiac therapy (ATC C01) ●
- Peripheral vasodilators (ATC C04) ●
- Other antihypertensives (ATC C02) ●