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Antibiotic restriction policy paradoxically increased private drug consumptions outside Taiwan's National Health Insurance

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Sir,

In contrast to the rapid increase in antibiotic consumption worldwide, antibiotic consumption recorded in Taiwan's National Health Insurance Research Database (NHIRD) has been decreasing since the implementation of an antibiotic restriction policy in 2001.^{1,2} This policy is highly effective because Taiwan's National Health Insurance (NHI) system is a single-payer compulsory social insurance plan that covers 99.6% of the Taiwanese population with >90% of Taiwan's healthcare providers in hospitals and clinics under contract and the revenue of the contracted healthcare providers is largely leveraged by NHI payment systems.³ Despite this, increasing antibiotic resistance continues to be observed.⁴⁻⁶ The discordance may be attributable to unmeasured consumption outside the NHI.⁷ However, data about the drug consumptions outside the NHI have seldom been reported.

This study compared systemic antibiotic consumption registered in Taiwan's NHIRD with that recorded in Intercontinental Marketing Services (IMS) Health's Taiwan database to estimate the amount of antibiotic consumption not recorded by the NHI. We focused on community consumption, given previous reports of increasing community resistance.⁴⁻⁶ Data on sales of systemic antibiotics in the community sector from 2000 to 2009 were

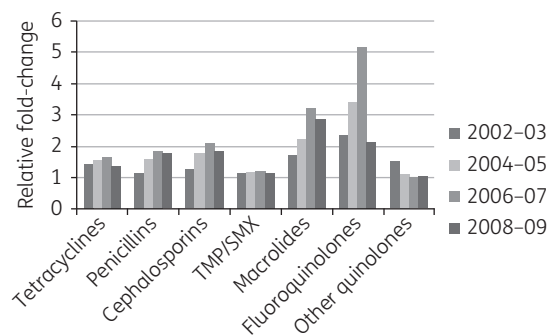


Figure 1. Changes in antibiotic consumption recorded in the IMS Health Taiwan database, relative to data from Taiwan's NHIRD. Biennial changes in the consumption of specific antibiotics recorded in the NHIRD and IMS were first standardized internally using 2000-01 consumption. Relative changes were then calculated from dividing changes reflected in the IMS by those of NHIRD. TMP/SMX, trimethoprim/sulphonamides.

extracted from the IMS Health database. NHI data on systemic antibiotic consumption in the community were derived from the NHIRD visit-based sampling datasets, which represent 0.2% of all outpatient medical service claims each year for the period 2000-09. The 10 year study period was divided into five 2 year periods. The classification and daily dose of each systemic antibiotic were defined in accordance with the criteria of the WHO's Collaborating Centre for Drug Statistics Methodology (http://www.whocc.no/atc_ddd_index/).

To measure the impact of the antibiotic restriction policy, we first measured biennial changes in the consumption of specific antibiotic classes reflected in the NHIRD or IMS by dividing the antibiotic amount (in DDD) in each period by that recorded for 2000-01 (Tables S1 and S2, available as Supplementary data at JAC Online). All NHIRD ratios were <1.0, indicating decreased antibiotic consumption after implementation of the policy in 2001. However, these results were not in accordance with the findings for the IMS; the consumption of fluoroquinolone (code J01MA) recorded in IMS even increased over time. We further compared changes in the consumption of each antibiotic class recorded in the two databases by dividing biennial changes reflected in the IMS by those reflected in the NHIRD (Figure 1). Discrepancies between databases were observed for most antibiotic classes throughout the study period, with the exception of sulphonamides/trimethoprim (code J01E) and quinolones (code J01MB). The IMS showed greater consumption of most antibiotics, particularly fluoroquinolones (code J01MA) and macrolides (code J01FA), compared with the NHIRD. We also divided antibiotics by whether they are first-line antibiotics, defined by the Taiwan NHI Administration⁸ (Table S1). The discrepancies between databases were mainly in non-first-line antibiotics (Figure S1). These results indicate that antibiotic use outside the NHI system has been very common, particularly non-first-line agents.

Incentives for physicians to prescribe antibiotics outside the NHI system and for patients' self-pay exist in the current system. The NHI Administration performs the review of medical claims by random audit of medical records. No claim will be paid to healthcare providers if any drug or medical services are deemed 'unnecessary' or 'inappropriate' by the peer review committee. Furthermore, a penalty of 10-100 times of the total claims is charged to the healthcare providers according to the regulations of the NHI Administration. However, no detailed indication for antibiotic use has been published by the NHI. Thus, physicians avoid prescribing highly scrutinized non-first-line

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antibiotics, such as fluoroquinolones and macrolides, under the NHI, even when they are indicated. In contrast, the two databases indicated nearly equivalent consumption of first-line antibiotics, particularly sulphonamides/trimethoprim and non-fluorinated quinolones, likely because the NHI does not strictly control inexpensive first-line agents.⁸ Almost all antibiotics are affordable for patients in Taiwan. For example, the average daily prices for respiratory and other fluoroquinolones range from US\$4 to \$6 and from US\$1 to \$4, respectively (Figure S2); the minimum hourly wage in Taiwan is US\$4.

The study, however, has some limitations. Direct comparison of two different datasets may introduce bias, which was likely minimized by internal standardization to 2000–01 data. The similar relative ratios for first-line antibiotics in the two databases validated the effectiveness of this internal standardization. In addition, we were not able to identify the nature of consumption outside the NHI system.

In conclusion, Taiwan's antibiotic restriction policy has successfully constrained antibiotic prescriptions within the NHI system, but it has also had the unintended consequence of creating a two-tiered prescription system due to the affordability of antibiotics and lack of clear guidelines. Several measures, including monitoring antibiotic use through pharmacy exit interviews, reinforcement of existing regulation of private antibiotic use, and education on the potential risks of drug resistance,^{9,10} may be taken to avoid the possible adverse impacts of antibiotic consumption outside the NHI system on community antibiotic resistance.

Ethics approval of research

The study was approved by the Institutional Review Board of the National Health Research Institutes (EC1031105-E).

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Transparency declarations

None to declare.

Author contributions

Y.-C. C. had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: all authors.

Acquisition, analysis or interpretation of data: C. A. H.

Drafting of the manuscript: S.-C. K.

Critical revision of the manuscript for important intellectual content: all authors.

Statistical analysis: S.-M. S. and L.-Y. H.

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Administrative, technical or material support: C. A. H. and Y.-C. C.

Study supervision: C. A. H. and Y.-C. C.

Supplementary data

Tables S1 and S2 and Figures S1 and S2 are available as Supplementary data at JAC Online (<https://academic.oup.com/jac>).

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