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Case Report

Pharmacloud in Taiwan: The Effect Continues and the System Advances

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Abstract

PharmaCloud was implemented under the universal National Health Insurance (NHI) program in July, 2013. PharmaCloud makes medication history of all the insured people available to practitioners contracted with the NHI, and the initial impact was found to be effective in reducing medication duplications and in containing drug expenses incurred to the NHI. Case reports from the clinical floor offered examples how the use of PharmaCloud had reduced medication duplications, headed off potential drug-induced complications, and avoided fatal contraindications. More recent data suggested that the effect continued in reducing drug expenses, while the effect in reducing medication duplications had begun to level off. Beginning from the second half of this year, a penalty is imposed on the physicians who prescribe duplicated drugs without consulting PharmaCloud. Encouraged by the promising benefits, the NHI Administration initiated a new round of plans to upgrade the system, so that PharmaCloud will transform into a fully integrated health bank with more information, more functions, and also include non-reimbursable prescribed drugs for wider applications.

ABBREVIATIONS

NHIA: National Health Insurance Administration

INTRODUCTION

PharmaCloud was introduced under Taiwan's universal National Health Insurance (NHI) in July, 2013, which makes medication history of all the insured over the previous four months available to all the practitioners in the medical institutions contracted with the NHI. PharmaCloud is established at the warehouse of the NHI Administration (NHIA) information system, and can be accessed by the providers through the virtual private networking (VPN)–the closed network between the NHIA and all the contracted providers. As NHI is a single-payer program with a unified databank, PharmaCloud enables the practitioner to access the information of patients' prescribed drugs anywhere in the country, and therefore, enables the practitioner to avoid medication duplications, and to minimize possible drug contraindications. Although implemented on a voluntary basis, our previous study found that number of participating facilities increased fast, and number of inquiries increased by the order of millions per month two years into the implementation, and these numbers are still increasing. Our findings suggested that PharmaCloud was able to reduce medication duplications and medication errors, and therefore enhanced safety for the patient and contained drugs expenses incurred to the NHI [1].

Reports from the clinical floor provided vignettes describing how the use of PharmaCloud had headed off potential medication hazards, and had facilitated health education and management. Encouraged by the promising benefits, the NHIA, the authority responsible for the daily operation of the NHI, is initiating an advanced version of PharmaCloud with more sophisticated functions, and will usher in a far more ambitious system by the end of 2020 to establish a patient-centered, individually customized health databank.

This article is to summarize case reports from the clinical floor and give a profile of the applications brought by PharmaCloud, to update on the continued effect of PharmaCloud, and to introduce the more advanced version of PharmaCloud in the future.

CASE PRESENTATION

Taiwan launched its National Health Insurance program in 1995. The NHI provides comprehensive benefits to all its 23 million population, plus foreign workers with valid residency

permits. The insured people enjoy unlimited access to health care as there is no gatekeeper, and hold unfettered freedom of choice to the providers. As negative sides of such an unbounded freedom, doctor-shopping and drug-shopping were common, and medication duplications and medication safety became a grave concern. To guard against medication misuse, a medication monitoring scheme called "Caring Cloud List" (CCL) was first created to monitor the abuse of sedative and hypnotics prescription drugs. Individuals who received these drugs more than 250 DDDs (defined daily dose) within six months would be identified as over users, and would be put on CCL for constant monitoring. CCL was then augmented to become PharmaCloud, which includes all drugs prescribed under the NHI system.

Practitioners contracted with the NHI are granted the privilege to access PharmaCloud, and practitioners are encouraged to inquire medication history, especially of those with *three hypers* – hypertension, hyperglycemia, and hyperlipidemia. Our previous study found that the preliminary impact of PharmaCloud was rather significant in reducing medication duplications, NHI expenditures on drugs, and overlapping days of drugs of identical Pharmacodynamics [1]. As of November of 2015, 496 (100%) of the hospitals of various sizes and accreditation statuses, 8,812 (87%) of the western clinics, 4,634 (82%) of the pharmacies had participated in the program, and medication history of 17,821,562 patients (77% of the entirely population) had been inquired.

Case Reports from the Clinical Floor

The NHIA invited the participating hospitals to share their experiences in using PharmaCloud in February, 2015. A total of 48 cases were reported in the form of vignettes. The leading benefits as indicated in these vignettes included reduction in medication duplications (22), avoidance of adverse contraindications (16), assistance in patient's education and health management (14), and facilitation in closer collaboration between physicians and pharmacists (13). Uncoordinated medication can be fatal. These vignettes also revealed several potential fatal contraindications had been avoided with the aid of PharmaCloud. For instance, a patient was found to be high in serum creatinine (SCr) level. A check on PharmaCloud easily revealed that that was caused by the NSAIDs prescribed by the hospital previously visited by this patient. SCr was then controlled simply by taking out the duplicated NSAIDs. A patient with late stage of chronic kidney disease was suspicious of Stevens-Johnson syndrome. An inquiry on PharmaCloud quickly confirmed that Trileptal prescribed previously had caused the SJS. These security checks would not be possible without PharmaCloud that makes cross-hospital medication records accessible to the practitioners [2]. Regular conferences were sponsored by the NHIA for the participating hospitals to exchange their experiences and to discuss cases that are worthy of further scrutiny.

Continued and Renewed Impact of PharmaCloud

Our previous study found that PharmaCloud had significant impact on medication duplications and containment of drug costs by comparing the utilization of prescribed drugs before and after the implementation of PharmaCloud. Recent data, as shown in Table 1, suggested that the impact continued in reducing medication duplications and NHI expenditures on drugs. The difference-in-differences method showed that the expenses in the intervention group continued to decrease faster than that in the general population from 2014 to 2015, and the number of medications per prescription also declined faster in the intervention group than that in the general population over the same period of time. The effect on the overlapping days of drugs of identical pharmacodynamics, however, had begun to level off: the percentage differences between the general patients and the PharmaCloud-inquired patients over the period of 2014and 2015 were very close to each other (Table2), suggesting that PharmaCloud had reached its maximal effect on duplication of those drugs.

PharmaCloud began as a voluntary program; no penalty was imposed on the non-participants. Two years into its implementation, and virtually all the hospitals had participated, however, the NHIA started to tighten up the screw. Beginning in July of 2015, payments would be denied for duplicated prescribed drugs if the physician failed to check patient's medication history on PharmaCloud. This policy was phased in step by step: the large hospitals (medical centers and regional hospitals) were targeted first, followed by the median and small hospitals (district hospitals) and clinics; duplications within the same hospitals were scrutinized first, followed by duplications between hospitals [3]. As a result, the drug expenses for the NHI decreased substantially. Table 3 shows, for six categories of the most duplicated drugs, the expenses incurred to the NHI decreased by an average of 33% between the second and third season of 2015, and dispensing service fee decreased by an average of 37% over the same period (Table 4).

Plan to Upgrade PharmaCloud

In the following years, PharmaCloud will be upgraded with more functions, more information, and will be made available to practitioners of allied health services. In addition to medication history, information of pathological tests, details of surgeries, records of medication for hemophilia, alert on allergic agents, and chronicles of rehabilitative service, etc. will be included. Information of dental surgeries and Chinese medicine will be included, too. By 2020, PharmaCloud will gradually transform itself to become a fully integrated health databank, with graphic interfacing and medication Gantt charts; more importantly, drugs not reimbursed by the NHI will also be included [4].

DISCUSSION

One of the most advantageous features of a universal health program is the unified databank that it generates. Such a databank can prove to be a powerful and effective tool for managerial purposes, and now PharmaCloud of Taiwan's NHI is becoming a sort of Big Data, with which a number of applications can be made to create great values. Compared with the medication monitoring programs adopted in other countries, such as the Prescription Drug Monitoring Programs (PDMPs) in the US [5], PharmaNet in British Columbia of Canada [6], and Prescription Shopping Program (PSP) in Australia [7], PharmaCloud has several advantages: It operates under the universal NHI and therefore possesses comprehensive information, potentially able to allow for more applications; it makes the information to all

Table 1: Persistent Impact of PharmaCloud on Number of Medications and Expense of Drug for Outpatient Care.

	Intervention group				General population			
	Number of Patients	2nd Q, 2015 I1	2ndQ, 2014 I2	Difference 1 D1=I1-I2	2nd Q, 2015 (P1)	2nd Q, 2014(P2)	Difference 2 D2=P1-P2	Difference –in-difference (D1-D2)
All patients with outpatient care claims	9,283,827							
Number of medications per prescription		3.11	3.27	-0.16	3.04	3.09	-0.05	-0.11
Drug expense per patient (NT $)		1,889	2,656	-767	1,486	1,509	-23	-744
Patients with hypertension	1,100,240							
Number of medications per prescription		3.24	3.31	-0.07	3.12	3.15	-0.03	-0.04
Drug expense per patient (NT $)		1,270	1,477	-207	1,149	1,277	-128	-79
Patients with diabetes	704,661							
Number of medications per prescription		4.10	4.17	-0.07	4.07	4.07	0.00	-0.07
Drug expense per patient (NT $)		2,700	2,948	-248	2,552	2,707	-155	-93
Patients with hyperlipidemia	157,200							
Number of medications per prescription		2.73	2.84	-0.11	2.62	2.61	0.01	-0.12
Drug expense per patient (NT $)		1,219	1,444	-225	1,099	1,219	-120	-105

Note: Data were extracted from the service claims stored at NHIA's data warehouse. US$ 1≒NT$30.The "intervention group" is the patients whose medication history was obtained by healthcare providers on PharmaCloud. The general population is the patients who had ever received outpatient care. Patients whose medication is out of the physician's discretion were excluded. Patients with hypertension, diabetes, and hyperlipidemia are highlighted because these are the patients most likely to suffer from poly-medication.

Table 2: Converging Percentage Changes in Overlapping Days of Drugs of Identical Pharmacodynamics for Six Chronic Diseases Intervention Group vs. General Group.

	PharmaCloud-Inquired Patients			General Patients		
	2ndQ of 2014	2ndQ of 2015	Percentage Difference	2ndQ of 2014	2ndQ of 2015	Percentage Difference
Anti-hypertension Drugs	1.2%	0.8%	-0.3%	1.4%	1.1%	-0.3%
Lipid modifying agents	0.9%	0.6%	-0.3%	1.1%	0.8%	-0.3%
Drugs for diabetes	1.1%	0.7%	-0.4%	1.3%	1.0%	-0.3%
Drugs for Schizophrenia	2.0%	1.2%	-0.8%	2.1%	1.4%	-0.7%
Drugs for depression	1.4%	0.9%	-0.5%	1.6%	1.1%	-0.5%
Hypnotics and sedatives	3.5%	2.6%	-0.9%	4.1%	3.0%	-1.1%

Note: Data were extracted from the service claims stored at NHIA's data warehouse these drugs may be prescribed across hospitals or at the same hospital. The denominator of the percentage of overlapping days is the sum of the days the drugs were prescribed for, the numerator is the sum of the days for which multiple drugs of identical Pharmacodynamics were prescribed.

Table 3: Reduced Expenses in Duplicated Drugs*, by Drug Category.
(in NT$1000, US$ 1≒NT$30).

	Expenses of Duplicated Drugs		% of Change
Drug Categories	2nd Q of 2015	3rd Q of 2015	
Anti-hypertension drugs	12,108	8,208	-32%
Drugs for diabetes	11,561	5,828	-50%
Lipid modifying agents	8,496	7,891	-7%
Drugs for schizophrenia	5,125	3,031	-41%
Hypnotics and Sedatives	2,239	600	-73%
Drugs for depression	1,006	1,450	44%
Total	40,534	27,007	-33%

*Data were extracted from the service claims stored at NHIA's data warehouse. Duplicated Drug: multiple prescriptions with identical form and Pharmacodynamic drugs.

Table 4: Reduced Expenses and Dispensing Service Fee in Duplicated Drugs*, by Medical Facility.
(in NT$1000, US$ 1≒NT$30)

	Expenses of Duplicated Drugs		% of Change	Dispensing ServiceFee of Duplicated Drugs		% of Change
	2nd Q of 2015	3rd Q of 2015		2nd Q of 2015	3rd Q of 2015	
Medical Centers	9,316	6,426	-31%	2,322	1,453	-37%
Regional Hospitals	10,500	6,749	-36%	2,964	1,779	-40%
District Hospitals	4,422	2,707	-39%	1,312	771	-41%
Clinics	7,593	5,256	-31%	1,716	1,121	-35%
Pharmacists	8,703	5,869	-33%	3,125	2,048	-34%
Total	40,534	27,007	-33%	11,438	7,172	-37%

*Data were extracted from the service claims stored at NHIA's data warehouse. Duplicated Drug: multiple prescriptions with identical form and Pharmacodynamics drugs belonging to six categories (Anti-hypertension drugs, Drugs for diabetes, Lipid modifying agents, Drugs for schizophrenia, Hypnotics and Sedatives, Drugs for depression)

practitioners contracted with the NHI, making synergizing and creative innovations in delivery modes possible; it is a nationwide program, able to make use of the complete information for an all-encompassing managerial tool.

One disadvantage, however, appears when compared with PharmaNet: PharmaNet collects data from community pharmacies, and therefore includes drugs reimbursable *and* non-reimbursable by the provincial health plan, while PharmaCloud leaves out the self-pay drugs, for currently it relies only on the NHI database. This shortcoming will be made up when the above-mentioned upgrading plan is implemented, and all the prescribed drugs will be covered.

PharmaCloud remains a voluntary program, just like many other aspects of Taiwan's NHI. Imposing penalties on the duplicated prescribed drugs seems to be striking a balance between making it a compulsory program and leaving it as a tiger totally without teeth.

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