Prescribing Patterns and Drug Cost Among Cardiovascular Patients in Hospital Universiti Kebangsaan Malaysia

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SUMMARY

A prevalence study was conducted, measuring drug cost and prescribing patterns of clinicians treating cardiovascular patients in UKM Hospital (HUKM). One Hundred and thirty-five patients' case-notes were selected from the Case-Mix database of HUKM. The average and median number of drugs prescribed per patient was 7.56 (± 3.37) and 7.0 (± 3) respectively. Generic drug prescription rate was still low (45.2%). Significant relationship was observed between generic drug prescriptions with age of patients, types of wards and different levels of clinicians' training. Younger patients, admitted to Coronary Care Unit (CCU) and Cardiology Rehabilitation Ward (CRW) were more likely to be prescribed with branded drugs. Lower generic drugs prescription and higher cost of drugs were mostly practised by Consultants. CCU and CRW wards were the only predictor to having low generic drugs prescriptions. Ninety-nine percent of the total RM28,879.25 drug cost was used to purchase branded drugs. Mean drug cost for a patient is RM213.92 (± RM333.36) and median cost is RM102.46 (± RM240.51). Higher drug cost and its' predictors were patients with severity level II and III, length of stay of ≥6 days, number of drugs types of ≥7, generic drugs prescription rate <50% and patients admitted in CCU and CRW wards. This study is important for short and long-term decision-making, controlling of providers behaviour and resources.

KEY WORDS:
Drug Cost, Prescribing Pattern, Generic Drugs Prescribing Rate, Case-Mix

INTRODUCTION

Around the world more than 50% of all medicines are prescribed, dispensed, or sold inappropriately. These ineffective and inefficient uses of drugs commonly occur at health facilities in developing and developed countries. Pharmaceuticals are frequently being used irrationally, mainly due to market imperfections in health care and often a key factor for the success of a health sector reform [1]. Therefore it is crucial to ensure that expenditures for drug purchases are fully optimized by selecting drugs from the essential drug list and promoting the rational use of drugs. Evidence suggests that more appropriate utilisation of prescription drugs has the potential to lower total expenditure and improve the quality of care [2]. Effective plan design and strategies such as generic substitution, rational prescribing and use of formulary can help manage costs while maintaining quality and customer satisfaction. However, before such strategies can be implemented, prescribing patterns by clinicians must first be explored. Factors influencing prescribing pattern and its relation to drug cost must be studied if educational programs and regulatory processes are to succeed in promoting safer and more cost-effective practices.

Evidence suggests that a few doctors have preconceived ideas that generic drugs are 'second class drugs' that do not hold the same clinical and medicinal properties as original brand drugs[1,2]. Brand name is the protected propriety name or trademark and registered with the local drug regulatory bodies under which a manufacturer markets its products in the country.

The seniority of doctors and higher post they hold, the more expensive drugs they will prescribe. Thus, advocating clients to purchase these drugs at a higher cost, even though less expensive generic drugs are available in the market [3,4,5]. Clinical courses that have a high level of intensity such as older patients, patients from the intensive care units, higher existence of co-morbidity and complications will be prescribed more expensive and usually branded original drugs rather than generic drugs that is considered less superior efficacy. However, few studies suggest that younger patients will be prescribed more branded drugs because of their lower satisfaction levels and difficulty to please [1]. Patients' preconceived ideas of what treatment they get at a higher cost are of some indicators that these drugs are of higher quality. Thus younger clients would prefer original branded drugs rather than generic drugs, inclining clinicians to prescribe these drugs to them. Clinicians inability to advocate and educate their patients of the same clinical properties of generic medicines will lead to escalating cost imposed on government and clients [2,3,6].

In countries practising insurance-based health system, the prescribing pattern and drug cost are mainly influenced by strategies used by Managed Care Organisations to control drug expenditures. These include formularies, generic substitution, drug benefit design, prior approval, product price control, profit control, target drug programs, therapeutic interchange, patients' co-payments and reference

This article was accepted: 17 February 2007
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drug listing [6]. Studies suggest that use of formularies, may have changed the prescribing attitude of physicians, increasing quality of drug prescribing thus reducing costs of drug therapy [2,5].

The number of people who die or are disabled by coronary heart disease could be halved with wider use of drugs combination (generic and branded) that costs just US$14 a year[7]. World Health Organization established "generic drug prescription rate" as measure of generic drugs prescription by physician. By definition, a product identified by its official chemical name rather than an advertised brand name is called a generic. It exerts its pharmacological effects at the same site, supposed to show the same potency, same dosage form and same bioavailability as a brand name [11]. The higher the generic drug prescription rate is, the more generics medications are being prescribed, the less branded drugs it is (and vice versa) implicating less cost on healthcare even with similar efficacy in clinical results [7].

The five highest value drugs classes in Malaysia's Ministry of Health are from cardiovascular drugs (70.2 million), antibiotics (60.7 million), neuromuscular drugs (39.4 million), metabolism drugs (38.1 million) and antimicrobials (21.1 million) [8]. In Malaysia, ischemic heart disease was among the leading cause of death and hospital admissions. The average number of admissions related to cardiovascular systems was 11.5 with a 4.9 days average length of stay. In HUKM, from July 2002 till June 2004, as many as 3622 or 10.2% out of 35568 in patient cases recorded was of cardiology cases [9]. Out of these, 86.5% were from Medical Cardiology and the remaining 13.3% were from Surgical Cardiology. In a top-down cost analysis study, the mean cost per episode of care for Medical Cardiology cases was RM4,277 (SD 2501) with an average length of stay of 6.3 days (SD 3.7 days). Whereas for Surgical Cardiology cases, the mean cost per episode of care was RM6,530 (SD 4588) and a 5.8 days average length of stay. Three biggest components from the Medical Cardiology cases are the Intensive Care Unit (ICU) i.e. 38% of total cost, Pharmaceuticals (14.2%) and Ward Services (12.7%). From Surgical Cardiology, the biggest component of cost was Operation Theatre (27.9%), Ward Services (25.4%) and Pharmaceuticals (8.5%). Hence this study was conducted to study prescribing pattern and drug cost in general. This research also focused on determining patient-related factors, treatment-related factors and provider-related factors in influencing generic prescribing pattern and drug cost exclusively for cardiovascular patients in Hospital Universiti Kebangsaan Malaysia (HUKM). Findings will provide baseline data and insights to service providers towards in advancing, optimizing and refining existing drug policies. This study is also important for both short-term and long-term decision-making and for appropriate resource allocation.

MATERIALS AND METHODS

Patients Selection

This study was carried out in HUKM which is a teaching hospital owned by Universiti Kebangsaan Malaysia. Patients were selected from HUKM Case-Mix database, created using the International Refined Diagnosis Related Groups (IR DRG) software. From July 2002 till June 2004, a total of 35,568 in-patient cases were grouped using the IRDRG-Version 1.1 case-mix grouper.

As much as 3,622 cases or 10.2% of the total cases recorded were cardiology cases from the Major Diagnostic Category 05. Patients selected for cost analysis were patients discharged for cardiovascular conditions from the Medical 1 (for male patients), Medical 2 (for female patients), Coronary Care Unit (CCU) and Cardiac Rehabilitation Wards (CRW). Subjects were randomly chosen using the Fischer Random Table. The sample size calculation was based on proportion of physicians prescribing branded medications is 62% and generic prescription is 38% [10]. The minimum sample size required for this study was 91. The sample size was inflated another 50% to cover for incomplete data, thus making a total of 135 patients records were finally used in the final data cost analysis.

Data Collection Procedures

Patients were randomly selected from the Case-Mix database but patients records were traced from the Medical Records Unit of HUKM. Data collected during admission included ethnicity, occupation, date of diagnosis, prescriber and drug prescriptions (drug name, form, dosage, frequency, duration and quantity), age, gender, year of birth, date of admission/discharge, IRDRG group, discharge status, length of stay, types of wards and severity of illness. Prescribers' level of training was obtained from HUKM Department of Medicine. Pharmaceutical department was consulted to confirm if drugs dispensed was generic or branded, formulary or non-formulary. Under the IR-DRG version 1.1, patients' severity of illness was coded 1, 2 or 3 (with increasing severity), based on presence of co-morbidity, complications, age and discharge status. For severity level 1, the patients did not suffer from any complication or pre-existing co morbidity. Severity level 2 implicates that the patient suffers from minor complications (with a second diagnosis) and co morbidity that prolongs the length of patients' stay by one day. For severity level 3 implies that the patient had a major complication and co morbidity that prolonged the in-patient day minimum of 3 to 4 days.

Analysis of Total Costs

Drug prescriptions included medicines prescribed during hospital stay either via oral, intravenous, intramuscular and other routes of administrations. A patients' total costs of drugs per admission was calculated by multiplying all drugs prescribed (during ward stay) with the unit cost of each drug. The unit costs of each drug were obtained from the pharmacy department. For that particular admission further analysis was calculated based on gender, ethnicity, length of stay, severity of illness and clinicians' background.

Instrument

The tool that was used in this study was based on the patient medical records and case mix records.

Data Analysis

Data collected was analysed using SPSS package version 13.0. T-test and ANOVA was used to compare means while non-parametric tests (U Mann-Whitney and Kruskal-Wallis) were conducted to determine significant differences in medians. Multiple logistics regression was performed to identify significant contributing factors in this study.

For analysis purposes, prescribers level were divided into five categories.
- Category 1 (MO/Specialist)
- Category 2 (MO & Specialist)
- Category 3 (MO & Consultant)
- Category 4 (Specialist & Consultant)
- Category 5 (MO, Specialist & Consultant)

Types of wards
- Type I (Consists of Medical Ward Male or Medical Ward Female)
- Type II (CCU or CRW)
- Type III (Combination of Type I & II)

Age group of patients
- <60 years
- ≥60 years

Occupation
- Government
- Non Government
- Elderly/Pensioner
- Unemployed

Severity
- Level I
- Level II
- Level III

Patient's length of stay
- <6 days
- ≥6 days

Patients' duration of illness
- <1 year
- ≥1 year

Number of drugs received
- <7 drugs
- ≥7 drugs

Generic Drug Prescription Rate (GDPR) Classification
- GDPR <50%
- GDRR ≥ 50%

Study Limitations

This study did not include discharge prescriptions, vaccines, medical apparatus or physiotherapy prescriptions. This study also only looked at the providers cost but did not take into account the patients' indirect cost. The trend of cost used in the past years or comparisons with other public hospitals were also not analysed. Limitation encountered in this study includes discrepancies between the case notes and the medication charts. The drugs that were ordered and prescribed by the physician might differ from the actual drugs that were given to the patients as non availability will demand a substitute recommended by the pharmacy. The drug cost is total/ overall cost and not adjusted for severity or types of treatment.

RESULTS

135 patients' case notes were accepted for data extraction. Majority of patients were males (n=89; 65.9%). There was an equal number of Malays (42.2%) and Chinese (42.2%) followed by Indians (10.4%). The average and median age of the patient was 60.45 (±12.45) and 61 (±17) years respectively. Patients aged 60 and above were of the highest age group (54.1%). The patients were mainly comprised of elderly and pensioners (56.4%). Majority of patients came from the diagnosis of "Acute Myocardial Infarction without Complications and Co-Morbidities" (IR-DRG 5331).

46.7% (n=63) patients were of severity level 1, 28.1% (n=38) patients were of severity level 2 and 25.2% (n=34 patients) were from severity level 3 respectively. The average length of stay is 6.44 (±4.90) days and median of 6 (±5) days. 49.6% (n=67) were patients with length of stay of less than five days. The highest length of stay was recorded by a patient admitted under the IR-DRG code of 5333 (Acute Myocardial Infarction with Minor Complications and Co-morbidity). The top three highest therapeutic drug class prescribed in this study were antihypertensive drugs, anticoagulants and haemostatics and anti-hyper lipidemic agents.

The total number of drugs prescribed for all 135 patients was 1020. The average number of drugs prescribed is 7.56 (±3.37) with the median of 7 (±3). Generic drugs prescription rate for this study is 45.2% (n=461). The rate is considered to be low according to WHO standard [7]. Only 28.7% of the total number of drugs in this study was found to be from the Ministry of Health Drug List. Major proportions (96.37%) of the drugs prescribed in this study were drugs from local HUKM formulary. This shows the freedom of choice the clinicians enjoy.

The overall cost of drugs calculated for all 135 patients was RM28,879.25. The mean cost for each patient is RM213.92 (±RM333.36) and the median cost is RM102.46 (±RM240.51). Branded drugs contributed a major proportion of the overall cost (90.9%).

Age was the only patient-related factors that was found to be statistically significant ($p<0.05$) with generic drugs prescribing rate (Table I). Older patients' ≥ 60 years old were prescribed with higher generic drug prescriptions rate. As for treatment-related factors, type of wards was the only factor that has significant association with generic drugs prescribing rate ($p<0.05$) (Table II). Prescriber's level of Category 3 (MO & Consultants) was found to be statistically associated with higher generic drugs prescribing rate of <50% compared to other category of prescribers ($p<0.05$) (Table III).

All four patient-related factors (age group, gender, ethnics and occupation) showed no significant mean differences ($p>0.05$) in total drug cost (Table IV). But there were significant mean drug cost differences in five out of six treatment-related factors. They were severity of condition; severity level III incur highest cost ($p<0.001$), length of stay of ≥ 6 days incur higher drug cost ($p<0.001$), number of drugs of ≥7 types ($p<0.001$), type II wards (combination of CCU and CRW) incur higher cost ($p<0.001$) and generic drug prescription rate classification of less than 50% ($p<0.05$) (Table V). Duration of pre existing illness (whether more or less than one year) did not relate to significant higher drug cost prescribed to that patient[18].

Mean differences of drug cost was again compared between types of prescriber and was found to be statistically different

(p<0.001) (Table VI). Category 5 where the combination of MO, specialist and consultants contributed the highest drug cost, followed by category 3 (i.e. MO & Consultants).

Multiple logistics regression ('Enter' method) was conducted to identify factors that contributed to predicted outcome of lower generic drug prescribing rate of <50%. Variables entered were age, types of wards and types of prescriber. From the result shown in Table VII, Type II wards (which consisted of Coronary Care Unit and Cardiac Rehabilitation Wards) was significant factor having generic drug prescription rate of <50% with p=0.031 (p<0.05). It seemed that patients admitted in CCU and CRW has 3.1 (95% CI: 1.11-8.82) odds of being prescribed with more branded drugs.

Similar analysis was conducted to identify the predictors of higher drug cost of ≥RM103. Five factors were found to be significant risk factors to higher drug cost ≥RM103 at p<0.05. They were conditions with severity level 3, length of stay of ≥ 6 days, number of drugs used during hospital stay ≥7 types, ward type II and III and generic drug prescription rate of ≤ 50%. Patients admitted in Ward type II and III (Table VIII) both have 8.7 (95%CI: 2.44 -30.92) and 4.5 (95%CI: 1.23-16.37) times odds of higher drug cost ≥RM103.

Generic prescribing rate of < 50% has 5.2 (95% CI: 1.71-16.04) times' odds of higher drug cost ≥ RM103. Severity level 3 has 4.3 (95% CI: 1.20-15.32) times odds; length of stay of ≥ 6 days has a 4.0 times odds (95% CI: 1.34-12.07) and patients prescribed with ≥7 types have a 3.2 (95% CI: 1.10-9.62) times odd of higher drug cost ≥RM103.

DISCUSSION

Results showed that the average number of drugs prescribed in this study is seven, which is comparable to 6 and 10 from previous studies [3, 4]. This could also result from the higher number of male patients in this study. As mentioned by previous researcher, the frequency of prescriptions for cardiovascular drugs for men was higher than that for women[5,14]. Increased intensity of resource utilization was independently related to speciality of Cardiology and Endocrinology[6]. The number of drugs was observed to be higher in patients aged older than 60 years old, length of stay longer than seven days and the presence of co-morbidities and complications during hospitalization [7, 8].

The overall percentage of generic drugs prescribed is 45.2%. Previous study among teaching hospitals located in Islamabad showed 23.6% drugs were prescribed by their generic names[9]. Low percentage of drugs prescribed by generic name can be due to many reasons. The prescribing doctors may decline generic substitution for medical/ therapeutic reasons and patient acceptance[4]. HUKM

Table I: Profile of Generic Drugs Prescription Rate among Patient-Related Factors

Patient-related factors	N	Mean Rank	p value
Age group (n=135)			
<60 years	62	60.67	0.044*
≥60 years	73	74.23	
Gender (n=135)			
Male	89	66.16	0.446
Female	46	71.55	
Ethnicity (n=135)			
Malay	57	61.01	0.145
Chinese	57	74.48	
Indian	14	61.00	
Others	7	86.14	
Occupation (n=117)			
Government	9	44.06	0.089
Non Government	19	46.18	
Elderly/Pensioner	66	61.59	
Unemployed	23	68.00	

* Significant at p<0.05

Table II: Comparison of Generic Drugs Prescription Rate among Treatment-Related Factors

Treatment-related factors	N	Mean Rank	p value
Severity (n=135)			
Level I	63	69.23	0.861
Level II	38	65.08	
Level III	34	68.99	
Length of stay (n=135)			
<6 days	67	73.36	0.112
≥6 days	68	62.72	
Duration of illness (n=135)			
<1 year	92	67.67	0.885
≥1 year	43	68.71	
Types of ward (n=135)			
Type I (M1/M2)	55	77.17	0.045*
Type II (CCU/CRW)	46	57.83	
Type III (Type I&II)	34	66.93	
Number of drugs received (n=135)			
<7 drugs	82	69.6	0.553
≥7 drugs	53	65.53	

* Significant at p<0.05

Table III: Comparison of Generic Drugs Prescription Rate among Types of Prescriber

Provider-related factor	N	Mean Rank	p value
Types of Prescriber (n=135)			
Category 1 (MO/Specialist)	29	70.84	0.011*
Category 2 (MO & Specialist)	27	70.83	
Category 3 (MO & Consultant)	36	78.82	
Category 4 (Specialist & Consultant)	11	31.68	
Category 5 (MO, Specialist & Consultant)	32	63.34	

* Significant at p<0.05

Table IV: Comparison of Drug Cost Mean Rank among Patient-Related Factors

Patient-related factors	N	Mean Rank	p value
Age group (n=135)			
<60 years	62	68.47	0.898
≥60 years	73	67.60	
Gender (n=135)			
Male	89	68.20	0.933
Female	46	67.61	
Ethnicity (n=135)			
Malay	57	66.25	0.753
Chinese	57	71.46	
Indian	14	66.93	
Others	7	56.29	
Patient's Occupation (n=117)			
Government	9	58.00	0.824
Non Government Sector	19	57.00	
Elderly/Pensioner	66	61.44	
Unemployed	23	54.04	

* Significant at p<0.05

Table V: Comparison of Drug Cost Mean Rank among Treatment-Related Factors

Treatment-related Factors	N	Mean Rank	p value
Severity (n=135)			
Level I	63	56.75	0.00**
Level II	38	67.39	
Level III	34	89.53	
Length of stay (n=135)			
<6 days	67	46.73	0.00**
≥6 days	68	88.96	
Duration of illness (n=135)			
<1 year	92	64.65	0.146
≥1 year	43	75.16	
Number of drugs received (n=135)			
<7 drugs	82	50.95	0.00**
≥7 drugs	53	94.38	
Types of ward (n=135)			
Type I (M1/M2)	55	51.76	0.00**
Type II (CCU/CRW)	46	72.33	
Type III (Type I&II)	34	88.41	
Generic Drug Prescription Rate (GDPR)			
Classification (n=135)	34	72.84	0.036*
GDPR <50%	43	57.65	
GDRR ≥ 50%			

* Significant at p<0.05
** Significant at p<0.001

Table VI: Comparison of Drug Cost Mean Rank among Types of Prescriber

Provider-related Factor	N	Mean Rank	p value
Types of Prescriber (n=135)			
Category 1 (MO/Specialist)	29	40.79	0.00*
Category 2 (MO & Specialist)	27	62.11	
Category 3 (MO & Consultant)	36	74.78	
Category 4 (Specialist & Consultant)	11	61.64	
Category 5 (MO, Specialist & Consultant)	32	92.19	

* Significant at p<0.001

Table VII: Predictors of Generic Drug Prescribing Rate

Predictor Variable	B	S.E	Sig.	Odds Ratio	95% CI
Constant	0.979	0.020			
Age	0.008	0.016	0.626	0.992	0.961-1.024
Ward Type					
Ward Type II	1.139	0.529	0.031*	3.123	1.107-8.815
Ward Type III	0.573	0.545	0.293	1.773	0.609-5.161
Types of Prescriber					
MO & Specialist	0.047	0.583	0.936	1.048	0.334-3.282
MO & Consultant	0.0542	0.596	0.363	0.581	0.181-1.871
Specialist & Consultant	20.176	0.385	0.999	0.800	0.567-3-984
MO, Specialist & Consultant	0.405	0.601	0.500	1.500	0.461-4.875

*Significant at p<0.05

Table VIII: Predictor of Drug Cost

Predictor Variable	B	S.E	Sig.	Odds Ratio	95% CI
Constant	-4.339	0.912			
Severity Level					
Severity Level 2	-0.011	0.548	0.984	0.989	0.338- 2.892
Severity Level 3	1.456	0.650	0.025*	4.289	1.201-15.317
Length of Stay ≥6 days	1.393	0.560	0.013*	4.025	1.343-12.066
Number of drugs ≥7 types	1.177	0.554	0.034*	3.246	1.096- 9.617
Ward Type					
Ward Type II	2.162	0.648	0.001*	8.687	2.441-30.916
Ward Type III	1.502	0.660	0.023*	4.490	1.231-16.374
Generic Drug Prescribing Rate <50%	1.656	0.571	0.004*	5.237	1.709-16.043
Types of Prescriber					
MO & Specialist	0.762	0.789	0.334	2.142	0.456-10.053
MO & Consultant	1.257	0.736	0.088	3.515	0.831-14.869
Specialist & Consultant	-0.272	0.924	0.768	0.761	0.124- 4.661
MO, Specialist & Consultant	0.081	0.870	0.926	1.085	0.197- 5.966

*Significant at p<0.05 and p<0.001

prescriptions mainly come from its own local formulary and dependent on the prescribing patterns of its consultant cardiologists and specialists. As a teaching hospital, the drugs formulary used comes from a very wide range on personal choices and does not depend so much on the Ministry of Health Drug List. HUKM as a teaching hospital, received higher annual operating budget as compared to government hospitals, therefore it can afford to purchase more expensive drugs that are not included in the Ministry of Health Drug List.

The finding of this study proved that there is a significant association between generic prescribing patterns with patient's age. The older the patients, the more generic drugs were being prescribed to them. Older patients are not as demanding or inquisitive as younger patients. They are easily satisfied and rarely question the treatments that were prescribed to them as they lack the knowledge. With these in mind, clinicians also tend to be more laid back with older patients and more careful with younger patients resulting in difference of treatment quality between the two groups [5,15,16].

Lower generic prescribing rates were observed to come from CCU and CRW. This is because critical patients in the CCU and CRW tend to require the use of cardiovascular drugs that do not have generic substitutes. Another plausible reason is that patients in CCU and CRW are normally seen by Specialist and Consultants that tend to use branded drugs. Medical Officers were found to be the biggest user of generic drugs because it was more available to them as compared to branded drugs. However for the Specialist and Consultants, more options are available to them as they are allowed to prescribe from both branded and generic drug lists. But it seemed that their preferences were more inclined towards branded drugs [4,5]. This relates to the fact that patients often have high expectancies when treated by Specialists and Consultants. Patients' non-acceptance towards generic drugs was also said to be higher if the doctor that originally prescribed the medicine was a Specialist[10,11]. According to Laporte, [12] there are four factors which determine quantity of medicines used in a community i.e. drug promotion, the disease pattern, the pharmaceutical supply, and the structure and priorities of the health system.

The findings of this study showed higher severity level and admittance in CCU and CRW were significantly associated with higher drug cost. This outcome is expected, as more severe patients were admitted in CCU/CRW. There, they will be seen by the Specialists and Consultants, who will prescribe them branded drugs that definitely cost more than first line drugs often prescribed to less severe patients from less intense Medical wards.

The longer the length of stay, the more expensive the overall drug costs will be [5,11]. Comparison for similar outcome is difficult as most studies tend to correlate length of stay with total cost, not drug cost alone. These studies do show that total cost is very much corresponded with the length of stay [5,11]. The more drugs were prescribed, the higher is the drug cost.

Median cost by Senior Consultant was found to be the highest of all prescribers. This correlates with the finding that the volumes and costs of prescriptions are determined by the

doctors' training[12]. HUKM policies and research priorities that govern this university may also be the driving force behind their selection of branded drugs that cost more[9]. From this study, there is significant inverse association between drug cost and generic drugs prescription rate.

In multivariate analysis, only Type II Ward (combination of CCU and CRW) was the sole predictor significant to having generic drugs prescription rate <50%. Patients who were admitted in CCU and CRW are 3.1 times more likely to be prescribed with branded drugs. Severity level 3, increase length of stay, higher number of drugs, wards type II and III and lower generic drugs prescription rate were found to have significant relationship with drug cost. Patients in ward type II and III have 8.7 and 4.5 times risk of high drug costs as compared to those admitted in Ward type I. These are the wards that usually use up more resources and were given extra attention by the Specialist and Consultants. Generic drugs prescription rate of less than 50% has 5.2 times possibility of higher drug cost. When generic prescribing rate is low, this means there is more branded drugs being prescribed. Given that branded drugs are somewhat 50-90% costlier than generics, obviously the total cost is higher when they are prescribed more. Severity level 3 has 4.3 times probability of high drug cost. Severity level 1 and 2 usually requires much less number of drugs and cheaper drugs such as first line drugs. Patients with severity level 3 will be admitted in CCU/CRW where they will be seen by Specialists and Consultants who will recommend higher generation of drugs that are branded and more costly. Patients who stayed six days or more have 4.0 times the risk of high drug cost as compared to patients who stayed less than six days. It seemed that the longer they stay the higher is the drug cost. This is not only seen in drug cost but in other costs as well. Patients with longer length of stay were those with worsened condition that required them to be transferred to the high dependency wards[18]. When this occurs they tend to use up more resources. Patients prescribed with seven or more drugs have a 3.2 times chance of high drug cost as compared to patients who received less than seven drugs. The more drugs that were being prescribed, the more costly it became. These patients were usually patients with co-morbidities.

The fact that drugs prescribed by Specialists and Consultants are normally branded and expensive also poses as a bias to the drug prescribing pattern. As for the differences in generic drug prescription and drug costs, it was observed solely among clinicians with different levels of training[19], without taking into account their personal or background characteristics that may influence their pattern of prescribing. Nevertheless, this study did give a picture of drug prescribing practices among cardiovascular patients in HUKM. This information could be used to assist in interventions and improve management processes.

CONCLUSION

This study showed that there were still a high number of branded drugs prescribed for cardiovascular in-patients. Most of these drugs are within the Ministry of Health Drug List while some are from the local drug HUKM formulary. Generic drug prescription rate was still low (45.2%). Training and education of prescribers to prescribe generic drug is needed to contain drug cost as these measures are proven to reduce overall drug cost. This will be a hard process as the leisure of prescribing will be at the hand of their physicians. Incentives or punishment might be included to motivate prescibers to dispense generic rather than branded drugs[7, 9, 11, 16]. Stricter house policies insisting the usage of generic rather than branded drugs has to be set up, to prevent wastage of precious resources at the mercy of recalcitrant doctors. Setting up of bench marking systems, that will readily compare and determine quality control and feedbacks from clients and also providers are a measure that is welcomed. A deviation of higher drug cost in any hospital that has similar outcome might not seem favourable in getting resources for the next year's coming budget. This will especially hold true if budget determination is through zero based budgeting or modified budgeting system and not through the customary global budget. Lastly, attitude and perceptions of prescribing patterns need to be further explored to heed the need to contain cost on drugs.

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