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A retrospective study on prescribing pattern and cost analysis of proton-pump inhibitors used among adults of Saudi Arabia

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Abstract

Objective To evaluate the use of proton-pump inhibitors (PPIs) for treatment of different gastric disease in Saudi population and their related administration cost.

Materials and methods It was a cross-sectional retrospective drug utilization study. The utilization rates and cost analysis of each PPIs class of drugs were compared. Study data were obtained from pharmacy database. Data between 1 January 2019 and 31 December 2019 were investigated, including incidence, prevalence and duration of use of proton-pump inhibitors among adults of Saudi Arabia.

Key findings We observed 26 798 (4.27%) prescription of PPIs were dispensed in the in-patient and out-patient pharmacy department of Al-Mana Group of Hospital (AGH) Al khobar. Among all the PPIs user, more than the half ((53.01%, n = 14 208), 95% CI (52.42–53.62)) were male. 30–40 years age patients (24.57%, 95% CI (24.06–25.09) (n = 6585)) were highest number of PPI users. Nearly, equal number of PPI users belongs between 51–60 years ((20.88%, n = 5596), 95% CI (20.40–21.37)) and >60 years ((20.36%, n = 5456), 95% CI (19.8–20.85)). Among all the dispensed PPIs drugs, Pantoprazole is dispensed to the highest number of patients (79.09% (95% CI, 78.61–79.58) (n = 21 197)) while their average duration of therapy was 18.86 days. Among all PPIs, pantoprazole average unit wise cost was highest SR 8.83 (USD 2.35) in comparison to other PPIs.

Conclusion In our study, among all the PPIs Pantoprazole was prescribed to the highest number of patients also it was costliest; hence, their safe and effective use must be warranted. Current study will also help in to develop nation database regarding utilization of proton-pump inhibitors.

Keywords cost analysis; National Institute for Health and Care Excellence; proton-pump inhibitors

Introduction

Proton-pump inhibitors are drugs commonly prescribed to suppress the gastric hyperacidity. Though they are considered generally safe, many study reported with their long term used produces significant adverse effects, such as vitamin B12 deficiency, osteoporotic-related fractures, kidney disease or infections, mainly pulmonary and digestive tract infections.[1,2] These are commonly prescribed for numerous kind of disorders originated from gastric acidity,[3] like gastroesophageal reflux disease (GERD), peptic ulcer disease (PUD) and *Helicobacter pylori* (*H. pylori*) infection.[3–5] These medications are also recommended in management of gastric ulcer disease (GUD) produced by the use of non-steroidal anti-inflammatory drugs (NSAIDs) including low dose aspirin.[6,7] Treatment by the use of PPI, their dose and duration recommended according to disease status.[8,9] According to Clinical guidelines, use of PPI rarely recommended for more than 8–12 weeks. When starting therapy for GERD and PUD, high dose treatment is recommended, whereas low dose treatment is usually given as a maintenance therapy for improving patients.[9]

PPIs ranked as the 6th most commonly dispensed therapeutic category in the United States, whereas 3rd most commonly dispensed therapeutic category in Ireland and Saudi Arabia during 2018.[10–12] However, PPIs cost, acid inhibiting agents and the frequency of prescribing has had a substantial bearing on prescribing budgets globally.[13,14] Costs

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on PPIs was €595 million in England in 2006 and €4.5 billion on one PPI (Nexium®-Esomeprazole) in the United States in 2009.[15,16] In Ireland, total costs on PPIs has augmented from around €7 million in 1995 to €95 million in 2009. PPIs are one of the utmost costliest drug groups reimbursed in Ireland accounting for around 10% of overall drug expenditure.[11]

Many countries develop prescribing guideline for PPI to ensure their appropriate use and cost. For the proper use of PPIs in the management of stomach-ache suggests regular review of patients to evaluate the current need for PPIs and stepping down to a lower maintenance dose or alternative medication to control symptoms based on National Institute of Clinical Excellence (NICE) guidelines. The guidelines also recommend prescribing the lowest cost PPI.[17,18]

Research revealed that guidelines are not being followed with evidence of overprescribing of PPIs in both primary and secondary centred patient care. One study has been conducted in United Kingdom (UK), and result of study showed that 24% of patients admitted to hospital were prescribed a PPI in the community and of these only 54% had an appropriate indication for PPI treatment.[19] In Ireland and Italy, 71% and 66% of PPI prescribing was began in hospital.[20,21]

Economic model has developed for evaluation of different added cost on PPI therapy in comparison to among different acid suppressants is adequate given for higher efficacy in curative and reviving symptoms. A cost-effectiveness analysis of extended term approaches for treatment of GI symptoms in primary care stated early management with a PPI followed by conservative therapy with a H2 blocker towards suppress suggestive reappearance as the optimum approach.[22] Therapy with H2 antagonist was also the optimal plan for the anticipation of NSAIDs induced gastrointestinal (GI) toxicity.[23]

Due to above mentioned alarms, my aim to express real world data on PPIs utilization within one year in private teaching hospital in Saudi Arabia. Precisely my goal was to conclude patterns of PPIs use among adult patient and prescriber feature attributable to gastroprotection and cost analysis.

Material and methods

Study design

It was a cross-sectional, retrospective observational study.

Data source

AGH contains individual information on all dispensed prescription and non-prescription drugs in the inside and outside hospital pharmacy database. We observed 1-year prescriptions dispensed PPIs at AGH Al Khobar, Saudi Arabia. The hospital pharmacy database records provide us as the types of drugs, date and year of dispensing, person, age and gender and drug quantity. All data were archived in hospital with unique identification number of all dispensed prescription. The therapeutic indication for prescribing is not available in the hospital pharmacy database. Dispensed Quantity for every prescription is assumed by the number and strength of the pharmaceutical objects (e.g. capsule or tablet), and the (DDDs), both ways of categorization of drugs are given by World Health Organization (WHO).

Population and study drugs

We included all patients prescription dispensed PPIs between 1 January 2019 and 31 December 2019. Several investigations have been done to identify as an each one was a 'current user' of a PPI at on assumed date. We succeed this by concerning a distinct as a 'current user' if they had dispensed a PPI prescription with sufficient PPI doses to concealment that day. The extent of individually prescription was assessed as the number of tablets or capsules dispensed that is, presumptuous a ingesting of one tablet or capsule each day, however addition 25% to the extent to account for non-compliance and uneven prescription fill-ups. The 5 single PPIs sold in Saudi Arabia, beside thru DDDs definitions, are revealed in Table 1.

Study ethical approval

Prior to conduction of Study, study protocol has been submitted to Scientific Research Unit (SRU) of Mohammed Al-Mana College for Medical Sciences for research protocol review and obtaining Ethical Approval Number. SRU study protocol approval number of mentioned study is SR/RP/33. Study has been conducted in compliance of recent ICH-GCP guideline.

Statistical analysis

Statistical Package of the Social Sciences (SPSS®) IBM Corp Inc, Armonk, NY, USA, version (V. 21) used for the statistical analysis of data. Demographic features were expressed as frequencies and percentages (with Wilson 95% confidence intervals for proportions). Chi-square (χ^2) test is used for the calculation of *P*-value, which helps in estimation of adherence of prescribing pattern as per NICE guideline. *P*-value ≤ 0.05 consider as significant.

Initially, we computed the utilization of PPIs (measured as volume of dispensed DDDs), quantified by PPI type and study duration (1st January 2019 to 31st December 2019).

Table 1 Proton-pump inhibitors approved by SFDA for marketing in Saudi Arabia

Drug	ATC	DDD (mg)	Dose
Esomeprazole	A02BC05	30	10–20 mg o.d/20–40 mg bid
Lansoprazole	A02BC03	30	15–30 mg o.d
Omeprazole	A02BC01	20	10–40 mg o.d/10–20 mg bid
Pantoprazole	A02BC02	40	20–40 mg o.d
Rabeprazole	A02BC04	20	20 mg o.d

ATC, anatomical therapeutic chemical; DDD, defined daily dose; SFDA, Saudi Food and Drug Authority.

Table 2 Baseline demographic characteristics of the studied patient's

Characteristics	Total 26 798% (95% CI) (*n*)
Gender	
Male	53.01% (52.42–53.62) (14 208)
Female	46.98% (46.38–47.58) (12 590)
Age (years)	
18–29	15.26% (14.84–15.70) (4090)
30–40	24.57% (24.06–25.09) (6585)
41–50	17.52% (17.08–17.99) (4697)
51–60	20.88% (20.40–21.37) (5596)
>60	20.36% (19.88–20.85) (5456)
Saudi	61.45% (60.87–62.04) (16 469)
Non-Saudi	38.54% (61.46–62.04) (10 329)

Second, we calculated the gender and age-specific prevalence of PPIs use. Third, to describe duration of treatment, we used the average duration and cost of drug therapy. In short, we monitored all entities from the date of their first PPI prescription, which is, experienced users.

Results

Demographic characteristics of study participants

In AGH Al Khobar from 1 January 2019 to 31 December 2019, total 26 928 items were dispensed to the adult patients in the in-patient and out-patient pharmacy department in which 26 798 (4.27%) items of PPI were dispensed. As described in Table 2, among all the PPI user more than the half ((53.01%, n = 14 208), 95% CI (52.42–53.62)) were male. Among all the PPI users highest number belongs to 30–40 years age patients (24.57%, 95% CI (24.06–25.09) (n = 6585)), nearly equal number of PPI users belongs between 51–60 years ((20.88%, n = 5596), 95% CI (20.40–21.37)) and >60 years ((20.36%, n = 5456), 95% CI (19.88–20.85)). Least number of prescription received from 18–29 years age patients ((15.26%, n = 4090), 95% CI (14.84–15.70)) and 41–50 years patients ((17.52%, n = 4697) 95% CI (17.08–17.99)). Among all the PPI users, 61.45% (n = 16 469) were from community of Saudi Arabia while 38.54% (n = 10 329) from Non-Saudi.

Use of PPIs among different age group adult patients

As illustrated in Table 3, highest number of Esomeprazole prescription received from 30–40 years age group patients (26.70%, 95% CI (25.36–28.09) (n = 1077)) while least number of prescription received from 18–29 years age patients (20.97%, 95% CI (1.37–2.18) (n = 71)). Highest number of Lansoprazole dispensed among the 51–60 years age group (27.26%, 95% CI (33.63–40.67) (n = 208)), while least number of prescription were received from 41–50 years age group patients (16.08%, 95% CI (13.57–18.95) (n = 115)). Among all the Omeprazole users, maximum number of prescription dispensed to the 51–60 years age group (17.97%, 95% CI (32.88–39.60) (n = 208)) while least number of users were from 41–50 years age group (4.26% (8.50–12.85) (n = 80)). Among all the Omeprazole users, maximum number of prescription dispensed to the 30–40 years age group (24.64%, 95% CI (24.04–25.22) (n = 5224)), while least Pantoprazole were used by 18–29 years age group patients (15.92%, 95% CI (1.33–1.65) (n = 3376)). Among all the Rabeprazole users, equal number of prescription dispensed between 30–40 years age patients (14.44%, 95% CI (8.64–23.15) (n = 13)) and >60 years age patients (25.55%, 95% CI (17.68–35.44) (n = 23)).

Prescribing patterns of PPIs

Prescribing pattern of PPI according to National Institute for Health and Care Excellence (NICE) guideline illustrated in Table 4. All the PPI prescribed to the AGH Al Khobar patients adhere to the NICE guideline (P-value <0.05).

Cost analysis of PPI use

The cost analysis was determined by relationship between the profits obtained for the investment. Main determinants for cost analysis are investment of drug therapy and the risk

Table 3 Age wise prevalence of PPIs use among adult patients

Age	Esomeprazole Total 4033, % (95% CI) (*n*)	Lansoprazole Total 715, % (95% CI) (*n*)	Omeprazole Total 763, % (95% CI) (*n*)	Pantoprazole Total 21 197, % (95% CI) (*n*)	Rabeprazole Total 90, % (95% CI) (*n*)
18–29	11.5% (10.97–12.97) (481)	10.20% (18.20–12.65) (73)	19.79% (17.12–22.77) (151)	15.92% (15.44–16.43) (3376)	14.44% (8.64–23.15) (13)
30–40	26.70% (25.36–28.09) (1077)	19.58% (16.84–22.65) (140)	15.98% (13.56–18.56) (122)	24.64% (24.04–25.22) (5224)	25.55% (17.68–35.44) (23)
41–50	17.97% (16.83–19.20) (725)	16.08% (13.57–18.95) (115)	10.48% (8.50–12.85) (80)	17.74% (17.24–18.27) (3762)	16.66% (10.37–25.7) (15)
51–60	22.41% (21.16–23.76) (904)	21.25% (18.42–24.41) (152)	27.26% (24.22–30.53) (208)	22.10% (21.55–22.66) (4685)	17.77% (11.25–26.95) (16)
>60	20.97% (19.76–22.26) (846)	32.86% (29.53–36.40) (235)	26.47% (23.46–29.71) (202)	19.57% (19.05–20.12) (4150)	25.55% (17.68–35.44) (23)

Table 4 Pattern of PPI prescription according to NICE guideline among studied patients

PPIs	≤5 weeks	≥5 weeks	*P*-value (χ^2 test)
Esomeprazole	3065 (75.99%)	968 (24.01%)	<0.05
Lansoprazole	527 (73.70%)	188 (26.29%)	<0.05
Omeprazole	633 (82.96%)	130 (17.03%)	<0.05
Pantoprazole	18 748 (88.44%)	2449 (11.55%)	<0.05
Rabeprazole	69 (76.66%)	21 (23.33%)	<0.05

of gastric disorders to the patients. A total of SR 216 197.185 (USD 57 652.58267) were invested in 1 year on drug acquisition for 26 798 prescription of PPIs. In our study, the least average cost unit wise in SR (USD) drug was Rabeprazole 3.99 (1.06), and high-cost drug was pantoprazole 8.83 (2.35), results of which are thoroughly analyses and reported in Table 5 and Figure 1.

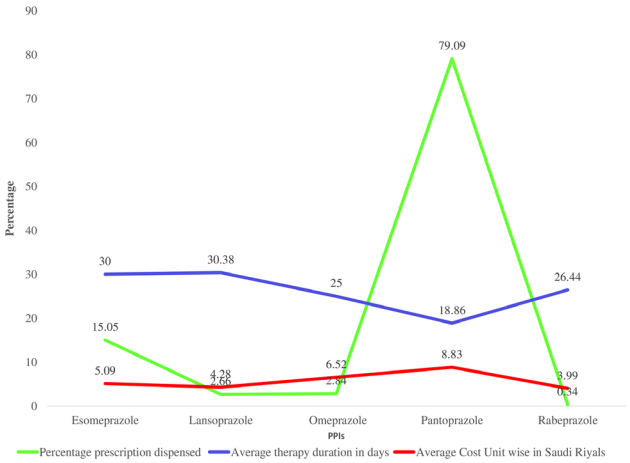

Figure 1 Percentage of all PPIs prescription dispensed. (——) percentage prescription dispensed; (——) average therapy duration in days; (——) average cost unit wise in Saudi Riyals.

Discussion

This study provides clear findings of the recent pattern of use of PPIs among adult patients in Saudi Arabia. In the mentioned study concealed all PPI dispensed in AGH Al Khobar in whole one year. We observed a little rise in the utilization of ulcerogenic drugs among PPI users, and this did not describe the experiential growth in uses of PPIs. We saw common and growing utilization of PPIs, mainly among the intermediate age group (30–40 years) which is comparable to other study.[24] The average age of participants was 41–50 years. This is reliable with the findings of Pendhari *et al*.[25] Among all the PPIs, Pantoprazole (79.09%) was prescribed to highest number of patients. This is consistent with the findings of Ali *et al*.[26]

The magnitude by which patients carry on with long period of PPI therapy is a substantial supplier to increasing prescribing volume and cost and has a substantial influence on prescribing budgets. Different circumstances advice real means of dipping PPI prescribing depend on current guidelines and recognize considerable reserves for national community drugs scheme.[17,18] Randomized controlled trials meta-analysis study of comparing PPIs with H2 blockers demonstrate that earlier pain control and better healing rates at twenty-eight days for PPIs (85% versus 75%).[27] During 1998, Australian community pharmacies dispensed nearly 2 million prescriptions for PPIs, their cost was estimated nearly Australian $180 million, and second most costly pharmaceutical beneficiary entity for that year was omeprazole. Some study suggested total use of PPI prescribing increased between 1990 and 1996; whereas PPI prescription increased rapidly, while utilization of H2 blocker does not goes down greatly. Therefore an extensive difference in PPIs utilization and a possibility for enhancement of general practitioner prescribing patterns.[28] H2 blockers utilization decreased while PPIs prescription increased multifold among western countries.[29] Moreover, our study also demonstrates that there is Average cost unit wise of omeprazole is SR 6.52 (USD 1.74). This is reliable with the findings of Almeman *et al*.[30]

However, among all prescribed drug PPI is most commonly prescribed medication throughout world, they are not totally free from unwanted effects. Nearly 90% patients now a day utilizing these drug without following appropriate guideline.[31] These are the reason for fear of safety and economy, especially these drug delayed in early detection of gastric cancer.[32] Though, regularly prescribed for nonspecific and inappropriate reasons these are evidence, many patients are taking these medicine for long time rather than necessary use.

According to the latest NICE guideline,[9] early short-term PPI treatment for 4–6 weeks (average 5 weeks) is guided for the majority of gastric acid suppressant drugs. In our study, pattern of PPIs prescribed is adhere to NICE guideline.

Table 5 Cost analysis of PPIs used among studied patients

PPIs	Number of prescription dispensed Total 26 798% (95% CI) (*n*)	Average therapy of duration in days	Average cost unit wise in SR (USD)
Esomeprazole (A02BC05)	15.05% (14.63–15.48) (4033)	30	5.09 (1.36)
Lansoprazole (A02BC03)	2.66% (2.48–2.87) (715)	30.38	4.28 (1.14)
Omeprazole (A02BC01)	2.84% (2.66–3.06) (763)	25	6.52 (1.74)
Pantoprazole (A02BC02)	79.09% (78.61–79.58) (21 197)	18.86	8.83 (2.35)
Rabeprazole (A02BC04)	0.34% (0.28–0.42) (90)	26.44	3.99 (1.06)

DDD, defined daily dose; SR, Saudi Riyal; USD, United State Dollar; WHO, World Health Organization.

Conclusions and recommendation

We observed considerable increase in the use of PPIs, especially after 40 years patients. We also observed that PPIs are prescribed in AGH Al Khobar adhere to clinical guidelines. In sight of these results, further initiatives towards suitable prescribing of PPIs, especially in terms of the implementation of de-prescribing policies, are warranted. In our study, among all the PPIs Pantoprazole was prescribed to the more than two-third gastric disorder patients. Among all the prescribed PPIs, pantoprazole average therapy cost is highest still prescribed to the highest number of patients. So, we recommend to keep in mind about severity of adverse drug reaction due to use of Pantoprazole, their safe and effective use must be warranted.

Declarations

Conflict of interest

The Author(s) declare(s) that they have no conflicts of interest to disclose.

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Ethical approval

Prior to conduction of Study, study protocol has been submitted to Scientific Research Unit (SRU) of Mohammed Al-Mana College for Medical Sciences for research protocol review and obtaining Ethical Approval Number. SRU study protocol approval number of mentioned study is SR/RP/33. Study has been conducted in compliance of recent ICH-GCP guideline.

Study place

A retrospective observational study was carried out in Al-Mana Group of Hospital (AGH), Al Khobar, Saudi Arabia. AGH Al Khobar is 250 bedded teaching private hospital with 74 out-patient clinic to provide healthcare facilities to the community of Saudi Arabia.

References

1. Maes ML *et al*. Adverse effects of proton-pump inhibitor use in older adults: a review of the evidence. *Ther Adv Drug Saf* 2017; 8: 273–297.
2. Benmassaoud A *et al*. Potential harms of proton pump inhibitor therapy: rare adverse effects of commonly used drugs. *CMAJ* 2016; 188: 657–662.
3. Dent J *et al*. Epidemiology of gastro-oesophageal reflux disease: a systematic review. *Gut* 2005; 54: 710–717.
4. Malfertheiner P *et al*. Proton-pump inhibitors: understanding the complications and risks. *Nat Rev Gastroenterol Hepatol* 2017; 14: 697–710.
5. Joret-Descout P *et al*. Guidelines for proton pump inhibitor prescriptions in paediatric intensive care unit. *Int J Clin Pharm* 2017; 39: 181–186.
6. Scheiman JM. The use of proton pump inhibitors in treating and preventing NSAID-induced mucosal damage. *Arthritis Res Ther* 2013; 15: S5.
7. Klatte DCF *et al*. Association between proton pump inhibitor use and risk of progression of chronic kidney disease. *Gastroenterology* 2017; 153: 702–710.
8. Katz PO *et al*. Guidelines for the diagnosis and management of gastroesophageal reflux disease. *Am J Gastroenterol* 2013; 108: 308–328.
9. NICE. Gastro-oesophageal reflux disease and dyspepsia in adults: investigation and management, guidance and guidelines. https://www.nice.org.uk/guidance/cg184 (accessed 22 February 2020).
10. IMS Health Report. *IMS National Prescription Audit*. NJ: IMS, 2010. https://www.iqvia.com/-/media/iqvia/pdfs/institute-reports/medicines-use-and-spending-shifts-in-the-us-in-2014.pdf (accessed 22 February 2020).
11. Health Services Executive (HSE). *Primary Care Reimbursement Services: Statistical Analysis of Claims and Payments*. Dublin, Ireland: Health Services Executive (HSE), 2009.
12. AlKhamees OA *et al*. Top 10 most used drugs in the Kingdom of Saudi Arabia 2010–2015. *Saudi Pharm J* 2018; 26: 211–216.
13. van Pinxteren B *et al*. Short-term treatment with proton pump inhibitors, H2-receptor antagonists and prokinetics for gastro-oesophageal reflux disease-like symptoms and endoscopy negative reflux disease. *Cochrane Database Syst Rev* 2010; 10(11): CD002095.
14. Moayyedi P, Delaney B. GORD in adults. *BMJ Clin Evid* 2008; 6: 1–20.
15. *IMS Health Report: Top 15 US Pharmaceutical Products by Sales*. NJ: IMS, 2009. http://www.imshealth.com/portal/site/ims/portal/front/articleC/0,2777,6025_80528184_80530441,00.html (accessed 22 February 2020).
16. National Health Service (NHS). *Drugs for Dyspepsia*. PACT centre pages. London: NHS, 2006. www.ppa.nhs.uk//news/pact-082004.htm (accessed 22 February 2020).
17. NHS National Institute for Excellence (NICE). *Guidance on the Use of Proton Pump Inhibitors in the Treatment of Dyspepsia. Technology Appraisal Guidance*. London: NICE, 2000. http://www.nice.org.uk/nicemedia/pdf/proton.pdf (Accessed 22 February 2020).
18. NHS National Institute for Excellence (NICE). *Management of Dyspepsia in Adults in Primary Care*. London: NICE; 2004. http://guidance.nice.org.uk/CG17 (accessed 22 February 2020).
19. Batuwitage BT *et al*. Inappropriate prescribing of proton pump inhibitors in primary care. *Postgrad Med J* 2007; 83: 66–68.
20. Parente F *et al*. Hospital use of acid-suppressive medications and its fall-out on prescribing in general practice: a 1-month survey. *Aliment Pharmacol Ther* 2003; 17: 1503–1506.
21. Mat Saad AZ *et al*. Proton pump inhibitors: a survey of prescribing in an Irish general hospital. *Int J Clin Pract* 2005; 59: 31–34.
22. Goeree R *et al*. Cost effectiveness and cost-utility of long-term management strategies for heartburn. *Value Health* 2002; 5: 312–328.
23. Brown T *et al*. A comparison of the cost-effectiveness of five strategies for the prevention of non-steroidal anti-inflammatory drug-induced gastrointestinal toxicity: a systematic review with economic modelling. *Health Technol Assess* 2006; 10: 1–420.
24. Madi L *et al*. Prescribing pattern of proton pump inhibitors in Qatar rehabilitation institute: a retrospective study. *J Res Pharm Pract* 2019; 8: 101–104.
25. Pendhari SR *et al*. Use of proton pump inhibitors – a drug utilization study. *Indian J Pharm Pharmacol* 2016; 3: 88–94.
26. Ali T *et al*. Long-term safety concerns with proton pump inhibitors. *Am J Med* 2009; 122: 896–903.
27. Poynard T *et al*. Meta-analysis of randomized clinical trials comparing lansoprazole with ranitidine or famotidine in the treatment of acute duodenal ulcer. *Eur J Gastroenterol Hepatol* 1995; 7: 661–665.
28. Jones MI *et al*. Proton pump inhibitor s: a study of GPs prescribing. *Fam Pract* 2001; 18: 333–338.
29. Boath EH, Blenkinsopp A. The rise and rise of proton pump inhibitor drugs: patients' perspectives. *Soc Sci Med* 1997; 45: 1571–1579.
30. Almeman A *et al*. Prescribing practices and cost of drugs for peptic ulcer in a Primary Health Center in Pulau Penang, Malaysia. *Trop J Pharm Res* 2013; 12: 629.
31. Pham QC *et al*. Acid suppressive therapy use on an inpatient internal medicine service. *Ann Pharmacother* 2006; 40: 1261–1266.
32. Naunton M *et al*. Overuse of proton pump inhibitors. *J Clin Pharm Ther* 2000; 25: 333–340.