

• CLINICAL RESEARCH •

# Estimating medical costs of gastroenterological diseases

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## Abstract

**AIM:** To estimate the direct medical costs of gastroenterological diseases within the universal health insurance program among the population of local residents in Taiwan.

**METHODS:** The data sources were the first 4 cohort datasets of 200 000 people from the National Health Insurance Research Database in Taipei. The ambulatory, inpatient and pharmacy claims of the cohort in 2001 were analyzed. Besides prevalence and medical costs of diseases, both amount and costs of utilization in procedures and drugs were calculated.

**RESULTS:** Of the cohort with 183 976 eligible people, 44.2% had ever a gastroenterological diagnosis during the year. The age group 20-39 years had the lowest prevalence rate (39.2%) while the elderly had the highest (58.4%). The prevalence rate was higher in women than in men (48.5% vs. 40.0%). Totally, 30.4% of 14 888 inpatients had ever a gastroenterological diagnosis at discharge and 18.8% of 51 359 patients at clinics of traditional Chinese medicine had such a diagnosis there. If only the principal diagnosis on each claim was considered, 16.2% of admissions, 8.0% of outpatient visits, and 10.1% of the total medical costs (8 469 909 US dollars/83 830 239 US dollars) were attributed to gastroenterological diseases. On average, 46.0 US dollars per insured person in a year were spent in treating gastroenterological diseases. Diagnostic procedures related to gastroenterological diseases accounted for 24.2% of the costs for all diagnostic procedures and 2.3% of the total medical costs. Therapeutic procedures related to gastroenterological diseases accounted for 4.5% of the costs for all therapeutic procedures and 1.3% of the total medical costs. Drugs related to gastroenterological diseases accounted for 7.3% of the costs for all drugs and 1.9% of the total medical costs.

**CONCLUSION:** Gastroenterological diseases are prevalent among the population of local residents in Taiwan, accounting for a tenth of the total medical costs. Further investigations are needed to differentiate costs in screening, ruling out, confirming, and treating.

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## INTRODUCTION

The cost analysis of disease management is essential for health policymaking in resource allocation and medical manpower

planning<sup>[1-8]</sup>. Among all medical specialties, gastroenterology has played a major role because of disease prevalence and advanced technology<sup>[9-12]</sup>. While the literature about economic assessments in gastroenterology dealt mainly with cost-effectiveness of single pharmaceuticals, diagnostic measures or therapeutic interventions<sup>[13-23]</sup>, analyses of the entire specialty are relatively scarce. One of the reasons might be that the complete utilization data of the total population or a representative sample are not easily available. The more decisive reason is the lack of a standardized analysis framework and operational measures.

The aim of this study was to estimate the direct medical costs of gastroenterological diseases among the population of local residents in Taiwan. Besides the diagnosis-based approach, the costs would also be sorted by diagnostic procedure, therapeutic procedure, and drug. The strength of this study was to use the complete claim data of a representative cohort of 200 000 people within the universal health insurance program in Taiwan. Not only the nominal costs of gastroenterological diseases but also their relative ratio in total medical costs could be measured.

## MATERIALS AND METHODS

### Data sources

The data of the first 4 cohort datasets (R01-R04) in 2001 from the National Health Insurance Research Database (NHIRD; <http://www.nhri.org.tw/nhird/>) in Taipei were used for the analysis. The NHIRD owned all claims in electronic form from the national health insurance (NHI) program that has started in 1995 and covered nearly all inhabitants in Taiwan (21 653 555 beneficiaries at the end of 2001)<sup>[24]</sup>. The NHIRD has retrieved dozens of datasets publicly available for researchers. For each cohort dataset, the NHIRD at first randomly sampled 50 000 people from 23 753 407 people who had ever been insured from March 1, 1995 to December 31, 2000. Then, all insurance claims belonging to these people were drawn to make up one specific cohort dataset.

A cohort dataset included one registration file of the insured people and 6 files of original claim data: inpatient expenditures by admissions, details of inpatient orders, ambulatory care expenditures by visits, details of ambulatory care orders, expenditures for prescriptions dispensed at contracted pharmacies, and details of prescriptions dispensed at contracted pharmacies. The structure of the insurance claim files had been described in details on the NHIRD web site and in other published literature<sup>[25-28]</sup>.

Among the 4 cohort datasets in 2001, there were totally 183 976 eligible people, 22 746 admissions, 1 241 760 inpatient prescription items, 2 607 646 visits (including 234 598 visits for traditional Chinese medicine), 11 765 537 outpatient prescription items, 127 008 dispensed prescriptions at pharmacies, and 513 231 dispensed prescription items at pharmacies. The ambulatory sector included medical care services at clinics of Western medicine, traditional Chinese medicine, and dentistry, and pharmaceutical services at pharmacies. Because the separation of prescribing and dispensing was not yet thoroughly executed in Taiwan, relatively few outpatient prescriptions had been dispensed at independent pharmacies.

Besides, the fee schedule of 4 837 medical service items and the list of 21 146 approved drug items of Western medicine in Taiwan were downloaded from the web site of the Bureau of National Health Insurance (<http://www.nhi.gov.tw/>, accessed January 12, 2002). Each drug of different brand, strength and form had an official unique identifier for claims. The BNHI also offered a list of ATC codes (the Anatomical Therapeutic Chemical classification system, version 2000)<sup>[29]</sup> for each drug item.

### Study design

The costs of gastroenterological diseases were estimated in 4 dimensions: diagnosis, diagnostic procedure, therapeutic procedure, and drug. The reason for separate approaches was that on the one hand an admission or a visit with a gastroenterological diagnosis might contain service items not related to the gastroenterological diagnosis, and on the other hand a procedure or drug for gastroenterological diseases might not be associated with any gastroenterological diagnosis on the claim because of the coding error or limitation (5 diagnosis fields on an admission claim and 3 on a visit claim).

The age-sex prevalence of patients having any gastroenterological diagnosis during the year was at first calculated. All 5 diagnoses on an admission record and all 3 diagnoses on a visit record were taken into account. Then, medical costs of visits and admissions because of gastroenterological diseases as the principal diagnosis were calculated and stratified by major disease category.

The definition and categorization of gastroenterological diseases were based on the scheme of the Clinical Classifications Software (CCS for ICD-9-CM) developed by the Agency for Healthcare Research and Quality (AHRQ) of the U.S. Department of Health and Human Services<sup>[30]</sup>. The single-level diagnosis CCS aggregated illnesses and conditions of over 12 000 diagnosis codes within the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) into 259 mutually exclusive categories. The single-level CSS categories 6, 12-18, 120, 135, 138-155, 214, 250, and 251 were deemed as gastroenterological diseases. Some codes such as benign neoplasm, injury, and screening that were dispersedly included in other CSS categories were also identified as gastroenterological diseases.

The fee schedule of the NHI included mainly consultation and rehabilitation fees, charges for diagnostic procedures (*e.g.* laboratory tests and radiological examinations), therapeutic procedures (*e.g.* general treatments, radiological interventions and surgeries) and materials, and case payments based on diagnosis-related groups. Among 1 470 items of diagnostic procedures and 2 435 items of therapeutic procedures, 132 and 338 items were related to gastroenterological diseases respectively.

Drugs for treating gastroenterological diseases in the current study included all drug items of the groups A02 (antacids, drugs for treatment of peptic ulcer and flatulence), A03 (antispasmodic and anticholinergic agents and propulsives), A04 (antiemetics and antinauseants), A05 (bile and liver therapy), A06 (laxatives), A07 (antidiarrheals, intestinal antiinflammatory/antiinfective agents), A09 (digestives, including enzymes), C05A (antihemorrhoids for topical use), P01A (agents against amoebiasis and other protozoal diseases), and P02 (anthelmintics) in the ATC classification system. The items in the group J07BC (hepatitis vaccines) were not included because they were not reimbursable within the NHI. A total of 2 269 drug items for treating gastroenterological diseases had been registered in Taiwan since 1995. Some drugs might be no more available on the market or not reimbursable by the insurance during the study period.

In describing utilization and costs of diagnostic procedures, therapeutic procedures, and drugs related to gastroenterological diseases, the number of recipients, the number of orders, and the total costs were calculated and stratified either by individual item of procedures or by group of drugs at the ATC 3rd and 4th levels. The original monetary values in unit of New Taiwan dollars were converted into U.S. currency based on the average exchange rate in 2001 (1 U.S. dollar [USD]=33.8003 New Taiwan dollars) according to the Central Bank of China in Taiwan (<http://www.cbc.gov.tw/>, accessed 6 February 2003).

### Statistical analysis

The database software of Microsoft SQL Server 2000 was used for data linkage and processing. The regular statistics were displayed.

## RESULTS

### General information of the cohort

Among the 200 000-person cohort, only 183 976 people were still insured in 2001. There were more men than women (92 566 vs 91 394), and the status of sex was unknown in 16 persons (Table 1). The mean age of the eligible people was 33.9 (SD 20.3) years.

**Table 1** Age-sex specific prevalence of gastroenterological diseases among cohorts (*n*=183 976) in 2001

Age group in year	No. of patients			Prevalence in percent		
	All	Female	Male	All	Female	Male
Sampling cohort <sup>a</sup>						
<20	51 029	24 644	26 384			
20-39	63 800	32 115	31 670			
40-59	45 432	23 061	22 371			
≥60	23 715	11 574	12 141			
Total	183 976	91 394	92 566			
Patients with any gastroenterological diagnosis at both inpatient and ambulatory sectors <sup>b,c</sup>						
<20	22 006	10 728	11 277	43.1	43.5	42.7
20-39	25 035	14 988	10 044	39.2	46.7	31.7
40-59	20 412	11 497	8 915	44.9	49.9	39.9
≥60	13 845	7 090	6 755	58.4	61.3	55.6
Total	81 298	44 303	36 991	44.2	48.5	40.0
Patients with any gastroenterological diagnosis at inpatient sector						
<20	947	388	559	1.9	1.6	2.1
20-39	792	301	491	1.2	0.9	1.6
40-59	1 056	431	625	2.3	1.9	2.8
≥60	1 738	737	1 001	7.3	6.4	8.2
Total	4 533	1 857	2 676	2.5	2.0	2.9
Patients with any gastroenterological diagnosis at ambulatory sector <sup>d</sup>						
<20	21 931	10 698	11 232	43.0	43.4	42.6
20-39	24 932	14 955	9 974	39.1	46.6	31.5
40-59	20 310	11 459	8 851	44.7	49.7	39.6
≥60	13 643	6 996	6 647	57.5	60.4	54.7
Total	80 816	44 108	3 6704	43.9	48.3	39.7
Patients with any gastroenterological diagnosis at clinics of traditional Chinese medicine						
<20	1 833	1 005	828	3.6	4.1	3.1
20-39	3 608	2 259	1 349	5.7	7.0	4.3
40-59	2 892	1 687	1 205	6.4	7.3	5.4
≥60	1 310	731	579	5.5	6.3	4.8
Total	9 643	5 682	3 961	5.2	6.2	4.3

<sup>a</sup>Those born after January 1, 2001 were not included in the cohort. The status of sex was unknown in 16 persons. <sup>b</sup> Patients with gastroenterological diseases included 4 persons of

unknown sex. <sup>a</sup>All diagnoses of a patient during the year were taken into account, not confined to principal diagnosis at each admission or visit. <sup>d</sup>The ambulatory sector included physician offices, hospital outpatient departments, and emergency departments of Western medicine, dentistry, and traditional Chinese medicine.

The medical care benefits of these people in 2001 totaled 83 830 239 USD, of which 26 443 645 USD (31.5%) was claimed at the inpatient sector and 57 386 595 USD (68.5%) at the ambulatory sector. The clinics of traditional Chinese medicine and independent pharmacies only accounted for 4.2% (3 499 397 USD) and 0.8% (677 908 USD) of the total costs respectively.

The utilization and costs of all kinds of procedures and drugs among the cohort were as following: 1 119 629 orders of diagnostic procedures summing to 7 858 087 USD (9.4% of the total costs), 774 340 orders of therapeutic procedures with 23 582 229 USD (28.1% of the total costs), and 8 683 664 prescribed or dispensed items of drugs with 21 193 285 USD (25.3% of the total costs).

#### *Age-sex specific prevalence of gastroenterological diseases*

Table 1 also displays the number of patients with any gastroenterological diagnosis in 2001 and their prevalence among the eligible cohort, stratified by age group, sex, and setting. Totally, 44.2% of the insured people had at least one gastroenterological diagnosis. The age group 20-39 years had the lowest prevalence rate while the elderly had the highest. The prevalence rate was higher in women than in men (48.5% *vs* 40.0%). But, men had a slightly higher prevalence rate (2.9%) at the inpatient sector than women (2.0%). During the year, 14 888 patients were admitted to hospitals. In other words, 30.4% of inpatients had ever a gastroenterological diagnosis at discharge. Physicians of traditional Chinese medicine made gastroenterological diagnoses in 9 643 patients, i.e. in 5.2% of the entire cohort and in 18.8% of the 51 359 patients having visited the clinics of traditional Chinese medicine during 2001.

#### *Prevalence and costs of gastroenterological diseases by major disease category*

Table 2 shows the aggregate costs of visits and admissions due to gastroenterological diseases. The analysis took account of the principal diagnosis into consideration on each claim only, the results were stratified by major disease category, and the numbers of affected patients were also calculated. Totally, 67 073 patients (36.5% of the cohort) were involved and medical care costs in value of 8 469 909 USD (10.1% of the total medical costs) were consumed. On average, 46.0 USD per insured person in a year was spent in treating gastroenterological diseases.

Besides, 16.2% (*n*=3 676) of all admissions, 8.0% (*n*=209 254) of all visits, and 10.4% (*n*=24 429) of all visits to traditional Chinese medicine during 2001 were primarily attributed to gastroenterological causes. While the largest patient group was noninfectious gastroenteritis (9.6% of the cohort), followed by other gastrointestinal disorders (8.7%), abdominal pain (7.7%), gastritis and duodenitis (7.7%), and other disorders of stomach and duodenum (4.2%), the top 5 diagnosis groups with higher total charges were gastroduodenal ulcer (10.6% of the costs related to gastroenterological diseases/1.1% of the total medical costs), other liver diseases (6.7%/0.7%), other gastrointestinal disorders (6.7%/0.7%), hepatitis (6.5%/0.7%), and biliary tract disease (6.0%/0.6%).

#### *Utilization and costs of diagnostic procedures related to gastroenterological diseases*

Among the cohort during 2001, 36 004 (19.6%) patients utilized 210 156 (18.8%) diagnostic procedures related to gastroenterological diseases with costs of 1 900 752 USD (24.2%

of the costs for all diagnostic procedures and 2.3% of the total medical costs). The computer tomography with 3 fee items took almost a two-fifth share of the costs for GI-related diagnostic procedures. The other two items with higher costs were abdominal sonography (18.4% of the costs for GI-related diagnostic procedures) and upper GI panendoscopy (13.0%). But, the most common procedures belonged to biochemical tests of blood: glutamic-pyruvic transaminase (GPT) with 47 523 orders and glutamic-oxalacetic transaminase (GOT) with 45 653 orders. Nearly a seventh of the cohort received these two tests (Table 3).

**Table 2** Prevalence and costs of gastroenterological diseases among cohorts (*n*=183 976) in 2001 by major disease category, according to principal diagnosis only

CSS <sup>a</sup> code	Single-level CCS diagnosis categories	Patients		Total cost	
		No.	Mean age (SD)	US \$	%
6	Hepatitis	6 356	44.3 (16.1)	547 599	6.5%
12	Cancer of esophagus	67	47.4 (22.3)	193 853	2.3%
13	Cancer of stomach	110	64.0 (15.0)	207 765	2.5%
14	Cancer of colon	230	63.2 (14.3)	308 903	3.6%
15	Cancer of rectum and anus	180	65.9 (12.8)	328 540	3.9%
16	Cancer of liver and intrahepatic bile duct	242	60.5 (14.4)	448 114	5.3%
17	Cancer of pancreas	30	67.9 (13.4)	148 490	1.8%
18	Cancer of other GI organs, peritoneum	40	67.5 (11.5)	70 893	0.8%
120	Hemorrhoids	2 110	45.6 (17.1)	236 477	2.8%
135	Intestinal infection	7 727	25.3 (22.2)	175 479	2.1%
138	Esophageal disorders	967	46.9 (20.9)	145 264	1.7%
139	Gastroduodenal ulcer (except hemorrhage)	6 214	48.1 (18.5)	898 028	10.6%
140	Gastritis and duodenitis	14 112	36.7 (21.9)	348 621	4.1%
141	Other disorders of stomach and duodenum	7 736	38.7 (23.1)	285 697	3.4%
142	Appendicitis and other appendiceal conditions	362	33.1 (18.8)	217 212	2.6%
143	Abdominal hernia	515	35.6 (27.9)	228 586	2.7%
144	Regional enteritis and ulcerative colitis	1 406	31.4 (22.5)	29 259	0.3%
145	Intestinal obstruction without hernia	543	39.4 (29.3)	112 282	1.3%
146	Diverticulosis and diverticulitis	45	58.2 (20.9)	29 713	0.4%
147	Anal and rectal conditions	366	41.8 (21.4)	87 506	1.0%
148	Peritonitis and intestinal abscess	72	49.5 (21.5)	54 941	0.6%
149	Biliary tract disease	1 000	54.2 (17.5)	509 960	6.0%
150	Liver disease, alcohol-related	156	48.5 (12.3)	39 179	0.5%
151	Other liver diseases	2 102	47.7 (16.9)	569 503	6.7%
152	Pancreatic disorders (not diabetes)	157	50.0 (17.0)	116 327	1.4%
153	Gastrointestinal hemorrhage	1 385	52.4 (20.2)	442 493	5.2%
154	Noninfectious gastroenteritis	17 717	28.9 (21.9)	401 586	4.7%
155	Other gastrointestinal disorders	16 080	36.7 (22.6)	563 336	6.7%
214	Digestive congenital anomalies	84	31.2 (22.2)	15 785	0.2%
250	Nausea and vomiting	926	25.5 (24.3)	19 924	0.2%
251	Abdominal pain	14 113	34.4 (20.1)	404 085	4.8%
-	Others	997	37.6 (23.1)	284 509	3.4%
	Total	67 073	34.8 (21.8)	8 469 909	100.0%

<sup>a</sup>CSS: Clinical Classifications Software by the Agency for Healthcare Research and Quality (AHRQ), Rockville, MD, USA.

**Table 3** Utilization and costs of diagnostic procedures related to gastroenterological diseases among cohorts ( $n=183\ 976$ ) in 2001: top 20 by total cost

Item of diagnostic procedures <sup>a</sup>	No. of patients	No. of orders	Total cost		
			US \$	%	Cum.%
Whole body computer tomography (without contrast)	2 541	3 092	374 106	19.7%	19.7%
Abdominal sonography	11 132	15 730	349 690	18.4%	38.1%
Whole body computer tomography (with/without contrast)	1 644	2 106	320 943	16.9%	55.0%
Upper GI panendoscopy	4 693	5 606	247 458	13.0%	68.0%
Serum GPT	25 427	47 523	69 765	3.7%	71.7%
Serum GOT	24 265	45 653	67 676	3.6%	75.2%
Whole body computer tomography (with contrast)	337	437	59 522	3.1%	78.3%
Colon fiberoscopy	730	780	50 698	2.7%	81.0%
Double-contrast study of lower GI series	421	432	29 421	1.5%	82.6%
AFP (RIA)	1 461	2 408	28 361	1.5%	84.1%
AFP (EIA)	2 363	3 570	20 865	1.1%	85.2%
Plain abdomen X-ray	2 338	2 856	18 498	1.0%	86.1%
Serum bilirubin, total	6 345	12 553	18 307	1.0%	87.1%
HbsAg (EIA)	3 678	3 999	17 237	0.9%	88.0%
Serum albumin	6 989	14 638	15 522	0.8%	88.8%
CEA (EIA)	856	1 308	15 293	0.8%	89.6%
Alkaline phosphatase	5 686	10 091	14 159	0.7%	90.4%
Upper GI series	296	315	13 347	0.7%	91.1%
CEA (RIA)	647	1 127	13 344	0.7%	91.8%
Sigmoid fiberoscopy	311	327	11 620	0.6%	92.4%
Others			144 922	7.6%	100.0%
Total <sup>b</sup>	36 004	210 156	1 900 752	100.0%	

<sup>a</sup>Magnet resonance imaging (MRI) was excluded from analysis because the fee schedule of the National Health Insurance did not differentiate MRI for abdomen from MRI for other body parts. <sup>b</sup>Numbers might not add to totals because of rounding.

**Table 4** Utilization and costs of therapeutic procedures (treatment and surgery) related to gastroenterological diseases among cohorts ( $n=183\ 976$ ) in 2001

Item of therapeutic procedure	No. of patients	No. of orders	Total cost		
			US \$	%	Cum.%
Nasal feeding	917	28 352	167 762	15.7%	15.7%
Repair of inguinal hernia (without bowel resection)	322	359	94 046	8.8%	24.5%
Appendectomy	226	226	74 145	7.0%	31.5%
Laparoscopic cholecystectomy	83	84	68 081	6.4%	37.9%
Hemorrhoidectomy, internal & external	198	199	59 994	5.6%	43.5%
Trans-arterial embolization (T.A.E.)	65	96	57 634	5.4%	48.9%
Insertion of nasogastric tube	1 745	5 370	25 609	2.4%	51.3%
Heat probe during endoscopy	162	185	21 893	2.1%	53.4%
Cholecystectomy	58	58	18 485	1.7%	55.1%
Endoscopic papillectomy	31	32	17 893	1.7%	56.8%
Colonoscopic polypectomy	153	157	17 140	1.6%	58.4%
Internal hemorrhoid ligation	216	356	16 795	1.6%	60.0%
Gastric decompression	900	3 712	16 473	1.5%	61.5%
Percutaneous transhepatic cholangiography drainage (PTCD)	38	54	15 735	1.5%	63.0%
Choledocholithotomy with T-tube drainage	28	28	15 282	1.4%	64.4%
Radical gastrectomy	14	14	15 061	1.4%	65.8%
Radical proctectomy	11	11	14 723	1.4%	67.2%
Radical hemicolectomy with ascending colon anastomosis	23	23	13 973	1.3%	68.5%
Restorative proctectomy with colo-anal anastomosis	11	11	13 948	1.3%	69.8%
Vagotomy and pyloroplasty	20	20	13 911	1.3%	71.1%
Others			307 915	28.9%	100.0%
Total <sup>a</sup>	8 349	60 245	1 066 497	100.0%	

<sup>a</sup>Numbers might not add to totals because of rounding.

**Table 5** Utilization and costs of drugs related to gastroenterological diseases among cohorts ( $n=183\ 976$ ) in 2001, by the fourth level of ATC classification system

ATC code	Drug group name	No. of patients	No. of orders	Total cost		
				US \$	%	Cum. %
A02BA	H <sub>2</sub> -receptor antagonists	26 690	85 228	269 851	17.4%	17.4%
A02BC	Proton pump inhibitors	2 223	7 100	219 823	14.2%	31.6%
A02AF	Antacids with antiflatulents	98 197	385 623	156 244	10.1%	41.6%
A05BA	Liver therapy	3 234	12 990	113 482	7.3%	49.0%
A02AD	Combinations and complexes of aluminium, calcium and magnesium compounds	83 569	305 357	108 399	7.0%	55.9%
A03FA	Propulsives	46 418	140 278	108 006	7.0%	62.9%
A02AB	Aluminium compounds	20 845	50 850	71 820	4.6%	67.5%
A06AB	Contact laxatives	8 775	37 266	59 022	3.8%	71.3%
A02AG	Antacids with antispasmodics	53 966	160 086	52 394	3.4%	74.7%
A06AC	Bulk producers	2 327	5 851	47 848	3.1%	77.8%
A09AA	Enzyme preparations	15 041	37 149	35 754	2.3%	80.1%
A03AA	Synthetic anticholinergics, esters with tertiary amino group	19 071	43 779	28 953	1.9%	82.0%
A07EC	Aminosalicylic acid and similar agents	248	1 504	24 494	1.6%	83.6%
A03AX	Other synthetic anticholinergic agents	2 264	4 110	22 682	1.5%	85.0%
A04AA	Serotonin (5HT <sub>3</sub> ) antagonists	108	375	22 612	1.5%	86.5%
A02DA	Antiflatulents	38 126	97 683	16 448	1.1%	87.5%
A03AB	Synthetic anticholinergics, quaternary ammonium compounds	8 413	15 312	16 205	1.0%	88.6%
A03BB	Belladonna alkaloids, semisynthetic, quaternary ammonium compounds	20 940	39 494	15 415	1.0%	89.6%
A06AD	Osmotically acting laxatives	513	1 485	15 401	1.0%	90.6%
A05AA	Bile acid preparations	409	1 580	15 064	1.0%	91.5%
-	Others			131 330	8.5%	100.0%
	Total <sup>a</sup>	149 062	1719 500	1 551 250	100.0%	

<sup>a</sup>Numbers might not add to totals because of rounding.

### Utilization and costs of therapeutic procedures related to gastroenterological diseases

Among the cohort during 2001, 8 349 (4.5%) patients utilized 60 245 (7.8%) therapeutic procedures related to gastroenterological diseases with costs of 1 066 497 USD (4.5% of the costs for all therapeutic procedures and 1.3% of the total medical costs). The most common general treatments were nasal feeding, insertion of nasogastric tube, and gastric decompression. The most common surgeries were hernioplasty, appendectomy, cholecystectomy, hemorrhoidectomy, and trans-arterial embolization. The utilization of surgeries was far less frequent than that of general treatments (Table 4).

### Utilization and costs of drugs related to gastroenterological diseases

Over four-fifths of the cohort received drugs for treating gastroenterological diseases in value of 1 551 250 USD (7.3% of the costs for all drugs and 1.9% of the total medical costs). The most popular drugs were antacids (ATC group A02A) prescribed to 141 185 (76.7%) patients, drugs for treatment of peptic ulcer (A02B) with 29 181 (15.9%) recipients had the largest (33.1%) share of drug costs related to gastroenterological diseases. Table 5 gives a breakdown of the utilization into the fourth level of ATC classification. Despite fewer recipients, proton pump inhibitors (A02BC) were the second in aggregate cost only to H<sub>2</sub>-receptor antagonists (A02BA). Another noteworthy fact was that drugs for liver therapy were prescribed to 7.1% of the cohort.

## DISCUSSION

The current study offered concrete and considerable details about prevalence and costs of gastroenterological diseases among the population of local residents in Taiwan. The major findings were as the following: 44.2% of the insured people had ever a gastroenterological diagnosis during the study year. 16.2% of admissions, 8.0% of outpatient visits, and 10.1% of the total medical costs were attributed to gastroenterological diseases as principal diagnoses. GI-related diagnostic procedures accounted for 24.2% of costs for all diagnostic procedures and 2.3% of the total medical costs. GI-related therapeutic procedures accounted for 4.5% of costs for all therapeutic procedures and 1.3% of the total medical costs. GI-related drugs accounted for 7.3% of costs for all drugs and 1.9% of the total medical costs.

The current study focused only on the direct medical costs within the health insurance system. Those services beyond the insurance coverage were not taken into analysis. Although the NHI in Taiwan reimbursed visits and drugs at clinics of traditional Chinese medicine, the popular utilization of various kinds of folklore medicine by the Chinese people remained yet unknown.

The feature of the current study was to estimate costs of gastroenterological diseases from 4 dimensions. The reason of adopting such an approach was mentioned in the subsection of study design. It was initially difficult to define diagnoses related to gastroenterological diseases. If directly the ninth chapter (diseases of the digestive system) of ICD-9-CM was chosen, not only the scope of dentistry would be included, but also it would miss some GI-related infections, neoplasms, injuries, symptoms and signs coded in other chapters. The analysis did not proceed from the specialties of gastroenterologists and general surgeons either, because it might include breast, thyroid diseases and others then. Besides, other specialists and general practitioners might take care of gastroenterological diseases, too. Consequently, the current study followed a popular and public grouping system (CSS for ICD-9-CM) from the U.S.A.

to facilitate international comparisons in the future.

The other dimensions of the current study had limitations, too. With respect to diagnostic procedures, some tests, *e.g.* serum albumin, were not specific to diagnosing gastroenterological diseases. Besides, some tests, *e.g.* serum GOT, GPT, and bilirubin, almost belonged to screening routines on admission, so their utilization could not reflect the prevalence of diseases. Magnetic resonance imaging (MRI) as a popular and expensive procedure was absent in the analysis because the fee schedule of the NHI did not differentiate MRI for abdomen from MRI for other body parts.

With respect to therapeutic procedures, general treatments such as nasal feeding and insertion of nasogastric tube might not be directly related to gastroenterological diseases. In case payments based on diagnosis-related groups, the reimbursement per admission was fixed no matter whether the actual service items aggregately cost more. Because of the discrepancy between nominal and real values, costs of procedures within case payments, *i.e.* hernioplasty, appendectomy, cholecystectomy, and hemorrhoidectomy, might not be estimated accurately.

Drugs for treating gastroenterological diseases in the current study did not include antineoplastic and immunomodulating agents because these drugs were not specific in indications. Antivirals such as lamivudine or ribavirin were not included in the analysis either because they had been not yet reimbursed by the NHI in Taiwan. Although physicians of traditional Chinese medicine also used ICD-9-CM on claims, the lack of a corresponding classification for traditional Chinese drugs limited the analysis. Furthermore, the widespread use of antacids might be a unique phenomenon that reflected the habit of Chinese physicians in co-prescribing antacids<sup>[25]</sup>.

Finally, it cannot be denied that the diagnoses on insurance claims serve primarily for administrative purposes. They are rather tentative diagnoses than definite ones. Only in combination with conventional epidemiological surveys or data verification, the costs of screening, ruling out, confirming, and treating can be further differentiated.

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