



Utilizing three years of epidemiological data from medical missions in Cambodia to shape the mobile medical clinic formulary

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Abstract

Objective: The purpose of this project was to gather epidemiological data on common diseases and medications dispensed during medical mission trips to Cambodia to shape the mobile medical clinic formulary.

Methods: Data for patients seen during week-long mobile medical clinics was collected in Cambodia during Septembers 2012 to 2014. Each patient's gender, age, weight, blood pressure, glucose, pertinent laboratory values, diagnoses, and medications dispensed were collected. Blood pressure and glucose levels were measured in patients 18 years and above. Data collected onto paper intake forms were transferred onto spreadsheets without patient identifying information and analyzed for aggregate means, common diseases, and most dispensed medications. This project received institutional review board approval.

Results: A total of 1,015 patients were seen over three years. Women made up 61.4%, and the mean age was 41.8 years. The most common diagnosis was gastrointestinal disorders (22.9%) that included gastroesophageal reflux disease and intestinal parasites. Next, 20.1% of patients had hypertension (BP>140/90), 18.0% had presbyopia, 15.4% had back and joint pain, followed by 8.8% with headache, including migraines. Approximately 8.4% of patients had hyperglycemia (RPG >140 mg/dl). The top five medications dispensed were acetaminophen, omeprazole, multivitamin, ibuprofen, and metformin. For hypertension, amlodipine and lisinopril were dispensed.

Conclusion: Cambodia lacks systematic public health collection of epidemiological data for prevalence of diseases. Hence, investigators collected and analyzed information from week-long mobile medical clinics over three years. Proton-pump inhibitors and *H. pylori* lab tests were recommended for gastrointestinal disorders. Acetaminophen and ibuprofen were recommended for pain. Angiotensin-converting-enzyme inhibitors and dihydropyridine calcium channel blockers were recommended over diuretics since patients were already dehydrated. Metformin was recommended for diabetes. Vitamins and supplements were recommended for malnourished patients. Hemoglobin machines and urine test strips were suggested. This information should help future teams decide what medications and laboratory tests would be the most beneficial for use by medical teams in Cambodia.

Introduction

Cambodia is located in Southeast Asia with a population of 14.4 million.¹ Approximately 80.5% reside in rural areas with 1.3 million people living in the capital city of Phnom Penh.¹ The life expectancy at birth averages 61 to 64 years for men and women, respectively.² Agriculture with rice production is the country's primary source of revenue.¹ In addition, small-scale subsistence agriculture serves as another source of revenue; this includes raising fish and livestock.¹

Around the year 2000, following an era of war and civil conflict, Cambodia entered a decade of rapid economic growth, along with demographic and epidemiological shifts.³ Largely from increased tourism and gains in the garment industry, Cambodia's gross domestic product grew at an average annual rate of 7% in the following decade.⁴ Additionally, the under-5 mortality rate per 1,000 live-births declined from 124 in 2000 to 54 in 2010.⁴ Even so, Cambodia remains one of the poorest and most underdeveloped countries in Asia, where many are living on a wage of less than \$1.20 United States Dollar (USD) per day.⁴ About 6,400 deaths occur annually from lack of adequate nutrition.⁵ Malnutrition among the poor leads to stunted growth (reduced height for age) in 40% of

the children and wasting (reduced weight for height) in 11% of the children.¹

Despite the many improvements in the health status in Cambodia, great disparities exist between urban and rural areas, and across socioeconomic groups. Rural areas rely heavily on rain for drinking water during the dry season, and less developed sanitation facilities contribute to increased exposure to communicable diseases.¹ Acute respiratory infection, fever, and diarrhea are common causes of childhood mortality. While many of these conditions are treatable, in a largely fee-based health care system, the cost of healthcare often creates a barrier to those seeking treatment. In addition to communicable diseases, motor-vehicular accidents are a major cause of injury or death in urban areas in the age group 20-39.¹ Non-governmental organizations (NGOs), sponsored by international nonprofit organizations, bridge the access gap in healthcare through supporting and serving NGOs led by nationals within Cambodia.⁶

Objective

Mobile medical clinics provide intermittent care in Cambodia to the underserved population. However, in 2011, the lack of available epidemiological data for prevalent diseases or



medications hampered the preparation of medical teams to provide appropriate treatment for the patients. In order for future medical teams to more accurately secure medications and laboratory tests needed, this project was undertaken. For the purpose of this project, we gathered epidemiological data on the most common diseases and medications dispensed during medical mission teams to Cambodia from 2012 to 2014 in order to shape future mobile medical clinic formularies.

Methods

This study evaluated all patients seen during three years of week-long mobile medical clinics held in Septembers 2012, 2013, and 2014 in Cambodia. Patients were seen and evaluated by a multidisciplinary team of healthcare professionals from the United States, including physicians, pharmacy students, pharmacists, physical therapists, and registered nurses, working alongside long-term medical missionaries and Cambodian trained health care providers.

Medical mission teams visited Phnom Penh, as well as three rural villages in Kampot Province. In 2012, the medical team spent four days in NeaReay and two days in Phnom Penh, and saw a total of 317 patients. In 2013, the team spent two days in AngKjay, two days in NeaReay, and two days in Phnom Penh and saw a total of 408 patients. In 2014, the team spent one day in Prey Thom, a very rural village without electricity, two days in AngKjay, and two days in NeaReay and saw a total of 290 patients.

Each patient's gender, age, weight, blood pressure, blood glucose, pertinent laboratory values, diagnoses, and dispensed medications were collected. Blood pressure and blood glucose levels were measured in patients 18 years and older. Data were collected onto paper intake forms and then organized into a computerized spreadsheet, without patient identifying information, and stored using a secure web interface.

Descriptive statistics were computed for all study variables. Means for adults 18 years and above were reported. The numbers of medications dispensed and common disease states were identified. This study was approved by the Loma Linda University Institutional Review Board.

Results

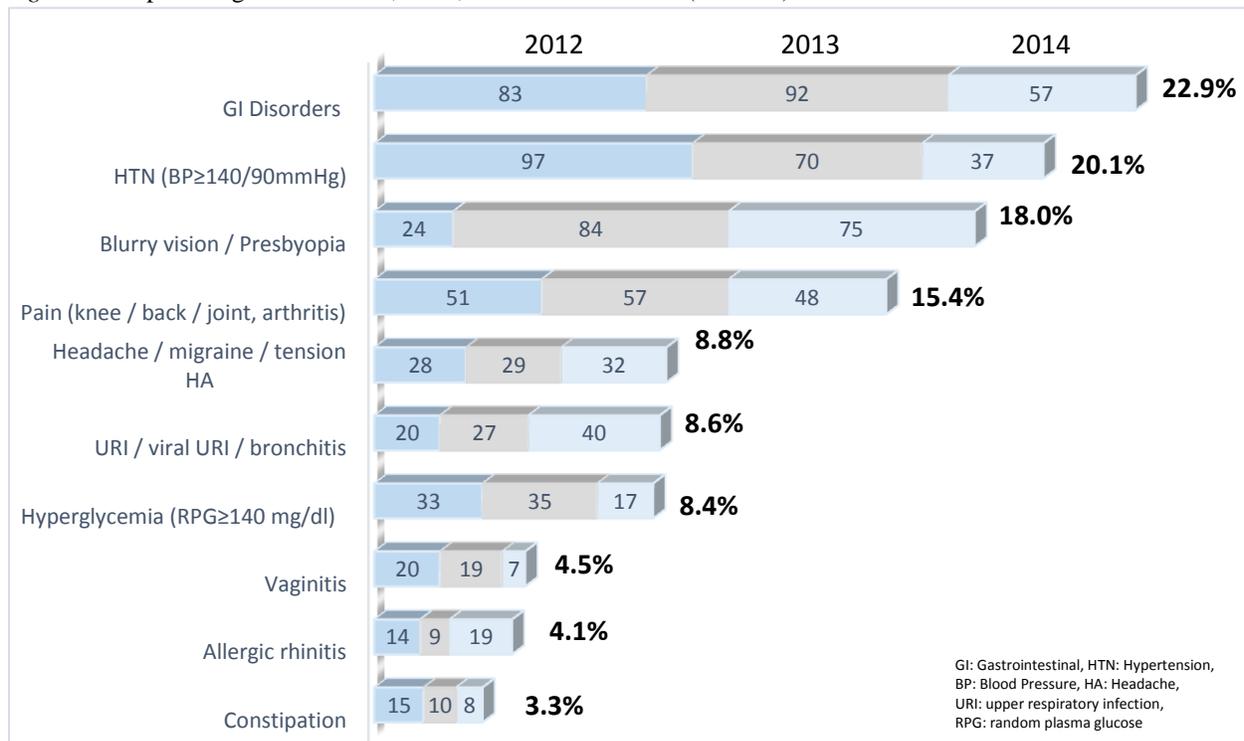
Demographics

A total of 1,015 patients were included in the data analysis over three years. Women made up 61.4% (N=624), and the mean age was 41.8 years with a range of 2 weeks to 87 years. Infants, children, and teenagers, 0-17 years, included 15.5% of the patients. Adults, 18-39 years, made up 25.7%, 40-59 years were 37.0%, and 60 years and over included 21.8% of the sample. In patients 18 years and above (N=858), the mean weight and height was 56.3 kilograms (kg) and 65.7 inches in men, and 44.9 kg and 60.7 inches in women. Average body mass index (BMI) was 21.5 and 21.0 kg/m² for men and women, respectively.

Common Diseases

Overall, gastrointestinal (GI) disorders, including gastritis and gastroesophageal reflux disease (GERD), *Helicobacter pylori* (*H. pylori*) infection, dyspepsia, and intestinal parasites were the most common disorders diagnosed in 22.9% of patients of all ages. *H. pylori* laboratory testing was not available in 2012 and resulted in 27 patients receiving treatment without a laboratory diagnosis. Investigators purchased *H. pylori* testing kits in Cambodia for \$1 USD each. In the subsequent year, only three patients received treatment with a laboratory-confirmed positive test. Seven patients received *H. pylori* eradication treatment in 2014. All patients received albendazole for possible intestinal parasites. Refer to Figure 1 for the top ten most common disorders.

Figure 1. Top 10 diagnoses in 2012, 2013, and 2014 combined (N=1015)



Note: Numbers within figures represent total number of patients with this diagnosis.

Hypertension, defined as a systolic blood pressure of 140 mm Hg or above, or diastolic blood pressure of 90 mm Hg or above, was the second most common diagnosis.⁷ The prevalence of hypertension among Cambodian adults aged 18 and over was 20.1% and was similar among men (21.7%) and women (19.7%). The prevalence of hypertension increased with age, from 9.6% among those aged 18-39, to 21.7% among those 40-59, to 43.9% among those 60 and over.

Blurry vision due to apparent presbyopia was a common complaint from patients over 40 years and made up 18% of the sample. A total of 183 pairs of reading glasses were given over three years. More low-diopter readers (+1.00 to +2.00) were dispensed (N=139) than high-diopter readers (+2.25 to +3.50) (N=44).

Back, knee, and joint pain, including osteoarthritis, was the fourth most common diagnosis at 15.4%. Most of the patients in the rural villages were rice farmers and spent a bulk of their

time planting or harvesting rice. Furthermore, head pain, including migraine and tension-type headache, was fourth with 8.8%. Patients with complaints of back and knee pain were referred to the physical therapist (PT). One PT evaluated a total of 113 patients (71 patients in 2013 and 42 patients in 2014) with complaints of back and knee pain, subsequently instructing them in proper exercises and posture.

The overall prevalence of hyperglycemia, defined as a random plasma glucose (RPG) of greater or equal to 140 mg/dl, was 8.4% and was slightly higher in men (9.6%) than women (7.6%). The prevalence of hyperglycemia increased with age, from 4.2% among those aged 18-39, to 11.0% among those 40-59, and to 14.8% among those 60 and over. Severe hyperglycemia, defined as a RPG of 200 mg/dl or greater, was found in 3.7% of the patients with similar rates between men (3.5%) and women (3.8%). The prevalence of severe hyperglycemia increased with age with 0.8% among 18-

39 year olds, 4.8% among 40-59 year olds, and 5.4% in those 60 years and over. The average glucose value for the 32 patients with severe hyperglycemia was 355.0 mg/dl.

Common Medications

The top five medications dispensed were acetaminophen, omeprazole, multivitamin, ibuprofen, and metformin. This paralleled the top diseases to treat gastrointestinal disorders and pain. Since most patients treated for hyperglycemia required the maximum dose of metformin at 2000 mg/day, four

tablets of metformin 500 mg were required daily for patients. Most patients with diabetes were given 120 tablets each. Hence, it became one of the top five dispensed medications to treat 8.4% of the patients. For hypertension, amlodipine and lisinopril were dispensed the most but diuretics were not used much. Most of the hypertension medications were given once daily, and hence, fewer tablets were dispensed. See Table 1 for a list of the top 20 most dispensed drugs during the three years.

Table 1. Top 20 medications dispensed during 2012-2014

Rank	Medications	2012	2013	2014	Total # tabs
1	Paracetamol 500 mg (Acetaminophen)	3880	4095	4320	12295
2	Omeprazole 20mg	2606	3318	1170	7094
3	Multivitamins	1955	1172	2670	5797
4	Ibuprofen 200 or 400 mg	1721	1711	960	4392
5	Metformin 500 mg or 850 mg	685	1140	600	2425
6	Loratadine 10 mg	310	617	910	1837
7	Children's vitamin	0	600	1200	1800
8	Ferrous fumarate 200 mg or sulfate 325 mg	687	420	540	1647
9	Vitamin B12	510	460	300	1270
10	Amlodipine 5 or 10 mg	400	515	340	1255
11	Lisinopril 10 mg	375	601	210	1186
12	Calcium carbonate 500 mg	810	339	0	1149
13	Docusate sodium 100 mg	434	287	330	1051
14	Amoxicillin 250 or 500 mg	310	329	400	1039
15	Irbesartan 75 mg	0	0	990	990
16	Hydrochlorothiazide 25 mg	900	0	0	900
17	Aspirin 81 mg	490	270	30	790
18	Diphenhydramine 25 mg	267	85	270	622
19	Albendazole 400 mg	256	264	99	619
20	Atenolol 50 mg	540	0	30	570

Discussion

Epidemiological information guides overseas medical mission medication needs. In 2011, no epidemiological data existed in Cambodia on the prevalence of diseases, especially in the rural areas. The investigators collected and analyzed direct data during week-long mobile medical clinics in the Kampot Province of Cambodia from 2012 to 2014. Public health epidemiological data regarding Cambodia was published in September 2015 by the

World Bank and in 2014 by the World Health Organization^{4,8-10} that includes major causes of death and burden of disease but does not indicate prevalence rates by province. Gastrointestinal complaints were the most common health problems. Included in these complaints were intestinal parasitic infections treated with albendazole 400 mg. Testing kits for *H. pylori* minimized antibiotics and saved money. Each Cambodian *H. pylori* antibody test cost \$1 USD. This test detected antibody presence, which enhanced clinical

judgment. For \$5 USD, each *H. pylori* sequential therapy eradication packet contained omeprazole 20 mg twice daily for ten days; amoxicillin 1000 mg twice daily for the first five days; clarithromycin 500 mg twice daily for the next five days; and metronidazole 500 mg twice daily for the next five days. After utilizing *H. pylori* tests, the number of packets given to patients was reduced from 27 in 2012 to 3 in 2013, and 7 in 2014, saving \$75 in two years. All the medications used in the *H. pylori* packet were easily purchased in Cambodia.

A Cambodian survey completed in 2005 showed an unexpectedly high prevalence of hypertension in the relatively poor rural communities. The prevalence of hypertension was 12% in a rural community (Siem Reap) and 25% in a semi-urban community (Kampong Cham).¹¹ The prevalence of hypertension in this study was in the range of that of the 2005 survey at 20.1% in Kampot Province. For reference, the prevalence of HTN in US adults was 29.1% in 2011-2012.¹² U.S. trained physicians initially used the Seventh Report of the Joint National Committee (JNC 7) guidelines which recommended beginning patients with diuretics.¹³ However, after viewing urinalysis results with high specific gravity (above 1.030), the clinicians recommended that diuretics not be used first line in the treatment of hypertension. The clinicians, including the pharmacist, recommended other pharmacologic options, like lisinopril or enalapril, an ACE inhibitor, and amlodipine, a dihydropyridine calcium channel blocker. These medications were readily available in Cambodia for patients to purchase at local pharmacies once they ran out of medications received during the mobile clinic visits and inexpensive at \$0.02 per tablet for lisinopril or enalapril 10 mg and \$0.04 per tablet for amlodipine 5 mg.¹⁴

The 2005 survey also reported rates of diabetes in the two provinces. The total prevalence of diabetes was 5% at Siem Reap and 11% at Kampong Cham, and the prevalence of impaired glucose tolerance was 10% at Siem Reap and 15% at Kampong Cham. Thus, total prevalence of

abnormal glucose tolerance was 15% at Siem Reap and 26% at Kampong Cham.¹¹ However, in 2015, the International Diabetes Federation reported that the prevalence of diabetes in adults in Cambodia aged 20-79 years was only 2.6%.¹⁵ According to this study, the prevalence of hyperglycemia, or possibly impaired glucose tolerance, with glucose values between 140 and 199 mg/dl was 6.2% with higher rates in men (8.7%) than women (4.7%). The prevalence of severe hyperglycemia with glucose values 200 mg/dl and above, which likely indicates diabetes, was 3.7%. Hence, the overall prevalence of hyperglycemia and severe hyperglycemia was 8.4%. In terms of treatment, metformin was the first-line option for diabetes, after establishing baseline renal function through urinalysis tests. Metformin was readily available for purchase in Cambodian pharmacies by the patient once they completed the medications provided during the mobile medical clinic visits. Although inexpensive, sulfonylureas were not recommended due to the risk of hypoglycemia and lack of glucose monitoring by patients. For patients with severe hyperglycemia, insulin treatment was not considered due to limited availability of refrigeration in patients' homes.

Analgesics, such as acetaminophen and ibuprofen, treated back, neck, joint, and headache pain. Based on the needs of the patient population, preparing adequate supplies of these medications is recommended. Interestingly, vaginitis was one of the top ten diagnoses. Limited access to clean water leading to poor hygiene may provide the basis for vaginitis as a common complaint. Antifungal treatments, like fluconazole or antifungal vaginal creams, should be included in the formulary. Loratadine was given for allergic symptoms and mild respiratory complaints with a 10 to 30 day supply. Diphenhydramine was used mostly to treat insomnia with a 14 day supply.

According to the Demographic Health Survey in Cambodia released in 2011, more than 4 in 10 women in Cambodia were anemic, although moderate and severe anemia was relatively rare

(8%). In addition, more than half (55%) of Cambodian children aged 6-59 months were anemic.¹⁶ Thus, adult multivitamins (ranked 3rd) and children's vitamins (ranked 7th), along with other essential nutrients such as ferrous sulfate (8th), vitamin B12 (9th), and calcium carbonate (12th), were given in bulk to patients with poor nutritional status. Prenatal vitamins for pregnant and breastfeeding women were given in bulk for at least three to six months to cover the duration of pregnancy or lactation.

Reading glasses, available in low diopters, helped older patients' complaints of blurry vision. Sunglasses were given to protect against cataracts and pterygium. The investigators recommended the *H. pylori* blood test kit, a hemoglobin machine to test for anemia, and a glucometer. A simple dipstick urinalysis to qualitatively measure urine glucose, protein, leukocytes, and specific gravity helped diagnose infections and understand kidney function.

For chronic diseases such as hypertension and diabetes, it was crucial that the medications selected and started by the short-term mobile medical team be readily available, and not be cost prohibitive for patients to continue treatment once the patients ran out of medications. Hence, mobile teams should consider what medications are available locally when deciding which medications to take with them in the future to treat these diseases.

For sustainability of treatment for patients seen at mobile medical clinics, the short-term medical team was hosted by long-term medical missionaries in partnership with the missionaries located in the rural villages that were visited. After the departure of the short-term team, the long-term medical missionaries went back to these villages bi-monthly to bring additional medications and supplies, and provided follow-up care for those who were identified as having a chronic illness such as hypertension and diabetes. Although these results are specific to the rural areas of Cambodia, some aspects may be generalizable to some neighboring South East Asian countries due to the similarities in

climate and rural living conditions with limited access to clean water and electricity.

Limitations

The study faced several limitations during its course. First, this was an observational study with patient information gathered heavily from rural areas, which may limit the generalizability of the study. Second, this study mostly evaluated prevalence at the time of the clinic visit and did not provide information regarding diseases that may have developed after the visit. Third, there was limited availability of diagnostic testing devices which may have limited the physicians' ability to make a definitive diagnosis. Furthermore, patients typically had one blood pressure measurement, whereas at least two are required for a definitive diagnosis. Similarly, only one random blood glucose measurement was done for most patients, so it was difficult to accurately diagnose based on one measurement. With that said, some strategies to address these issues were to return to the same villages bi-monthly to provide follow-up care for those patients who had elevated blood pressures or blood glucose values for a firm diagnosis.

Conclusion

Delivering cost-effective, high-quality health care services in resource-poor settings remains an enduring challenge. This challenge, however, becomes more formidable for short-term medical mission teams as they are faced not only with limitations in language and culture, diagnostic tools, and treatment options, but also with limitations with respect to local epidemiological data, an indispensable tool for pre-field preparation as well as on-field diagnosis and treatment. The stakes are high given the very poor access to healthcare particularly in rural contexts, the generally high cost of medical mission trips, the limitations of time, and the unavoidable hard decisions the teams must make with respect to what diagnostic tools and medications they will take and which they will

leave behind. We submit this study not only as a resource for those teams traveling to Cambodia but also elsewhere, where attention to epidemiological data promises to lead to a more thoughtful approach to medical mission trips.

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