Endoscopic capacity in West Africa.

Daniel Perl[1], Desmond Leddin[2], Damon Bizos[3], Andrew Veitch[4], James N'Dow[5], Stephanie Bush-Goddard[6], Ramou Njie[8], Maud Lemoine[8], Suzanne T Anderson[7], John Igoe[2], Sharmila Anandasabapathy[1], Brijen Shah[1]

1. Gastroenterology, Icahn School of Medicine at Mount Sinai, New York, NY, USA.
2. Gastroenterology, Dalhousie University, Halifax, Nova Scotia, Canada.
3. Department of Surgery, University of the Witwatersrand, Johannesburg, South Africa.
4. Gastroenterology, New Cross Hospital, Wolverhampton, England.
5. Urological Surgery, University of Aberdeen, Aberdeen, Scotland.
6. Horizon's Clinic and Foundation, The Gambia.
7. Clinical Services Department, Medical Research Council Unit, The Gambia.
8. Hepatology, Medical Research Council Unit, The Gambia.

Abstract:

Background: Levels of endoscopic demand and capacity in West Africa are unclear.

Objectives: This paper aims to: 1. describe the current labor and endoscopic capacity, 2. quantify the impact of a mixed-methods endoscopy course on healthcare professionals in West Africa, and 3. quantify the types of diagnoses encountered.

Methods: In a three-day course, healthcare professionals were surveyed on endoscopic resources and capacity and were taught through active observation of live cases, case discussion, simulator experience and didactics. Before and after didactics, multiple-choice exams as well as questionnaires were administered to assess for course efficacy. Also, a case series of 23 patients needing upper GI endoscopy was done.

Results: In surveying physicians, less than half had resources to perform an EGD and none could perform an ERCP, while waiting time for emergency endoscopy in urban populations was at least one day. In assessing improvement in medical knowledge among participants after didactics, objective data paired with subjective responses was more useful than either alone. Of 23 patients who received endoscopy, 7 required endoscopic intervention with 6 having gastric or esophageal varices.

Currently the endoscopic capacity in West Africa is not sufficient. A formal GI course with simulation and didactics improves gastrointestinal knowledge amongst participants.

Keywords: Endoscopic capacity, endoscopic demand, West Africa, training course.

DOI: http://dx.doi.org/10.4314/ahs.v16i1.44

Cite as: *Perl D, Leddin D, Bizos D, Veitch A, N'Dow J, Bush-Goddard S, Njie R, Lemoine M, Anderson ST, Igoe J, Anandasabapathy S, Shah B. Endoscopic capacity in West Africa. Afri Health Sci. 2016;16(1): 329- 338. http://dx.doi.org/10.4314/ahs.v16i1.44*

Introduction

Though the burden of common gastrointestinal (GI) conditions such as diarrhea continues in Africa[1], the landscape of GI illness in the region is changing to one of morbidity and mortality from chronic illness[2] as people are living longer[3]. Chronic GI illnesses, such as non-infectious gastric ulcer disease, cancer, dyspepsia and cirrhosis, are on the rise and have created an increased demand for endoscopic services[4]. To quantify this rise is currently difficult as data is limited, yet even now the burden of GI malignancy in Africa is at the very least on par with that of Western nations; for example, the cumulative death rates attributed to liver disease, esophageal cancer, and stomach cancer in the Gambia [27.42 per 100,000] and Nigeria [41.35 per 100,000] are both greater than that of the United States [15.15 per 100,000] and France [17.45 per 100,000][5].

Corresponding author:
Daniel Perl,
Annenberg Building, Box 1069
1468 Madison Avenue
New York, NY 10029
Phone: 315-663-6461
Fax: 212-241-5142
Email: perld@med.umich.edu

Each of the aforementioned chronic conditions requires endoscopy for the diagnosis, emergency treatment or chronic monitoring of disease progression. Consequently, the demand for endoscopy in West Africa is likely to be similar to that of the United States, however, the endoscopic capacity lags far behind. That is, the United States has 3.9 gastroenterologists per 100,000 people, nearly all of whom have regular access to endoscopy suites[6], whereas the Gambia has 3.8 medical doctors per 100,000 people, few of whom are trained in formal gastroenterology, including basic upper endoscopy[7]; and in Nigeria there are just 60 registered gastroenterologists for a nation of 140 million people[8]. In addition to sheer manpower, there are perhaps greater obstacles in infrastructure including developing and sustaining new endoscopic units, having a reliable power supply, and the poor availability of consumables[8-10]. Consequently, little is known about how great the endoscopic shortage truly is, except that it exists[8].

In light of this shortage, various attempts have been made to train the current healthcare professionals[11,12]. One of the most widely recognized is the World Gastroenterology Organization (WGO), which sets up training centers across the world in hopes of forming a lasting foundation that will train endoscopists for generations[13]. The WGO has also developed resource-cognizant cascades, available on the internet, that outline management of GI diseases based on resource-level, which can be equally if not more effective than training centers as they can be applied universally[14]. In fact, a study in Zambia, which discussed similar resource-dependent GI medicine and its incorporation into endoscopy training, assessed the utility of didactic sessions for training. In general, the study found resounding support for more structured symposiums, with all participants (n=19) affirming they would attend and recommend attending future courses[15].

This descriptive paper aims (1) to describe the current labor and endoscopic capacity in West Africa via a survey from regional GI healthcare professionals, (2) to quantify the impact of a mixed methods endoscopy course on the knowledge, skill, and attitudes of healthcare professionals in West Africa via pre and post didactic examinations and surveys, and (3) to quantify the types of diagnoses in a case series of patients presenting during a three-day live endoscopy course.

Material and methods:

Course description

We developed a three-day course for healthcare professionals (physicians and nurses) from West Africa that focused on the diagnosis and treatment of GI disease in this population. The course was held at the Medical Research Council (MRC) Unit in Fajara, Gambia. The course was designed and taught by a core of six endoscopists from four countries (SA, BS, JI, DL, AV, DB) brought together through the World Gastroenterology Organization (WGO) and was supported by an unrestricted industry grant (Karl Storz Endoscopy-America Inc). Faculty included general gastroenterologists, advanced endoscopists, and a general surgeon.

The course format included mini-lectures with content derived from current medical literature. For clinical topics, speakers incorporated the WGO Cascades, a set of guidelines developed to tailor evaluation and management to intensity of resources, specifically for the resource-limited health care setting. Endoscopy teaching was through lecture, active observation of live cases, case discussion and simulator experience.

Participants

At the start of the course, demographic information regarding the endoscopy skill level of physicians and their needs, in terms of infrastructure and manpower, as well as population-wide endoscopic demand was estimated via questionnaires. Participants had self-reported fluency in English. The participants were invited via known professional and medical societies as well as personal contacts of our hosts in the Gambia. Physicians were invited to bring a nurse if they wished. Lodging, food, and course material were provided by the host site.

Surveys

Participants completed a general questionnaire detailing their training type and duration, endoscopic experience and skill level as well as other population demographics, including how long patients wait for emergency endoscopies, and size of their patient population and what technologies (i.e. chest X-ray, ERCP) were currently available at their practices.

Data regarding symptoms, diagnosis, anesthesia, and treatment were gathered during the course from clinical cases. No patient identifiers, except for age and sex were kept on file. Consent was obtained and patients were treated according to standard procedure. That is, patients underwent conscious sedation with an opiate and benzodiazepine. Heart rate, blood pressure, respirations, and oxygen saturation were monitored by the endoscopist and nurse during the procedure. We monitored vital signs at the start and end of procedure and at 5 minute intervals in the PACU until the patient recovered. When an additional dose of medications was administered, vital signs were rechecked within 3 minutes. Endoscopes were disinfected using Cydex protocol. We used infection control and sedation monitoring similar to our home institution. Patient selection was in part self-referral, physician referral, and those being cared for at the facility for other reasons who needed evaluation. There was no exclusion criteria.

Participants were surveyed on two clinical didactic sessions to quantify the efficacy of each session. The two sessions were management of upper GI bleeding and management of acute diarrhea. Before each lecture, participants completed a short multiple choice exam (5-10 questions) that assessed their knowledge on that topic. In addition, participants approximated their comfort level in terms of medical knowledge in the area on a scale from (1) very uncomfortable to (5) very comfortable. Then, immediately after the lecture, a different multiple choice exam (4-5 questions) was given as well as one question regarding comfort level. Because the exams were given immediately before and after each didactic, pre and post exam questions were different to avoid memory recall bias.

At the end of the course, participants evaluated the utility of each component (i.e. didactics, case discussions, etc) on a 5-point scale. This evaluation also included open-ended comments regarding what they learned and will bring back to their practice, what they enjoyed most about the course, and what they would change about the course. Not all participants attended each lecture and session, so the total number of learners varied.

Lectures and faculty

The teaching faculty consisted of four board certified gastroenterologists, a gastroenterology fellow and a board certified general surgeon. The faculty came from Canada, Gambia, South Africa, United Kingdom, and USA were all well versed in the GI cascades outlined by the World Gastroenterology Organization. Lectures incorporated and reviewed WGO cascades, using them as teaching tools for the participants who came from a variety of resource settings. Of note, the clinical effectiveness of the cascades was not evaluated either objectively or subjectively.

Statistical analysis

Participants were grouped based on their training and also evaluated as an entire unit. Physicians, who ranged from current residents to practicing physicians, composed one group and nurses along with one-day participants, whose medical training was unknown, composed the second. As a result of participant fluctuation from day to day, data were evaluated using a per protocol analysis. Microsoft Excel 2007 (Microsoft, Redmond, WA, USA) was used to perform matched pairs t-test and chi-square analysis. Tests of significance were two-sided with a p-value of less than 0.05 regarded to be statistically significant.

Results

Tables 1a and 1b display the demographics of the participants made up of seventeen physicians and ten nurses. Most attendees came from Gambia (n=10), Nigeria (n=8) and Senegal (n=7). Of the physicians, eight were gastroenterologists who trained on average 5 years more than the non-GI physicians, including 32 months of endoscopic training. Notably for the non-GI physicians, of the four that performed endoscopy, only one had training, a 12-month course. Additionally, the nurses had training in assisting physicians in endoscopy, but not performing it themselves; they had an average of 3 years of general nurse training.

The majority of participants practice in the hospital setting, with populations greater than 25,000 (Table 1b). In estimating endoscopy capacity (Table 1b), nine of thirteen physicians were located within 10 kilometers of an endoscopic unit. Waiting time for emergency endoscopy also varied with nine (56%) physicians estimating it would take a day to a week for a patient to receive endoscopy, and four (25%) estimating it to be even longer.

Table 1a: Participant Demographics (n = 27)

	Years of Training	Performed Endoscopy(n)	Endoscopic Training (Months)	Lifetime Endoscopies	
				1 – 100	More than 100
Physicians (17)	15.0	12	21.9	4	8
GI (8)	17.6	8	32.7	1	7
Non-GI (9)	12.6	4	3.0*	3	1
Nurses (10)	3.0	10**	0	2	3

Endoscopic training represents the average amount of training only for those physicians that had performed endoscopy. *Only one internist had 12 months of training, while the other 3 non-GI physicians who scoped received no training. **Number of nurses who assisted physicians in endoscopy.

Table 1b. Endoscopy Capacity (n = number of respondents).

		Physicians		
		GI	Non-GI	Total
Nearest Endoscopy Unit (n = 13)	< 1 km	2	3	5
	1 – 10 km	2	2	4
	10 – 100 km	2	0	2
	> 100 km	0	2	2
Size of Community (n = 17)	> 1 million	5	3	8
	25,000 – 1million	3	6	9
Wait time for Emergency Endoscopy (n = 16)	< 1 day	1	2	3
	1 day – 1 week	6	3	9
	1 wk – 1 month	1	0	1
	> 1 month	0	3	3

Table 2a shows that as the distance from an endoscopic unit increased, the time to endoscopy increased as well ($p = 0.0044$). Table 2b shows that not one physician in an urbanized setting reported the waiting time for emergency endoscopy to be within one day.

Table 2a. Wait time in relation to Nearest Endoscopy Unit.

	Wait time for Emergency Endoscopy				
Distance from Endoscopy Unit		< 1 day	1 – 7 days	7 – 30 days	> 30 days
	< 1km	2	3		
	1 – 10 km	1	3		
	10 – 100 km		1	1	
	> 100 km				2
Each number represents how long emergency endoscopies take in relation to how far the nearest endoscopy suite is, as reported by physicians. P-value for Mantel-Haenszel Chi-square is 0.0044.					

Table 2b. Wait time in relation to size of population.

	Wait time for Emergency Endoscopy				
Population Size		< 1 day	1 – 7 days	7 – 30 days	> 30 days
	> 1 million		6	1	1
	25,000 – 1 million	3	3		2

Table 3 lists diagnostic modalities available to participants in their home sites. While all had the capacity for chest x-ray, less than half could perform an esophagogastroduodenoscopy (EGD), less than a third a barium enema, and none an endoscopic retrograde cholangiopancreatography (ERCP).

Table 3. Facility equipment. N =28

X-ray	100%
Barium Swallow	61%
Ultrasound Doppler	43%
EGD	43%
Barium Enema	32%
General MRI	7.0%
MRCP	3.6%
ERCP	0.0%
Capsule	0.0%
The right column is the percent of participants (n=28) who reported having the test available at their practice.	

Table 4 shows the clinical indication, findings and results of EGD performed. Overall, twenty-three patients were scoped with eleven requiring some form of treatment outlined in Table 4.

Table 4. Upper Endoscopic Findings (n = 23)

Endoscopic findings	Treatment				Total
	Bands	Biopsies	Triple Therapy	None Required	
Varices	4	0	0	2	6
Erythema	0	3	3	1	7
Normal	0	0	1	10	11
Total	4	3	4	13	24*

Three of the patients were positive for H. pylori and received triple therapywith omeprazole, amoxicillin and clarithromycin.
*One patient had varices and erythema.
**Erythema is an endoscopic term referring to increased gastric erythema suggestive of gastritis. Note no histology was taken.

Table 5 reports the performance and perceived comfort level before and after didactic sessions on diarrhea and upper GI bleed. For the didactic on diarrhea, there was a significant improvement on the multiple-choice exam after the lecture for the entire group ($p < 0.0001$), while subjective comfort level did not change. In contrast, after the didactic on upper GI bleed physicians performed significantly worse on the multiple-choice exam ($p = 0.001$). But as a group, physicians and nurses felt that their comfort level with upper GI bleed actually increased ($p = 0.02$) after the didactic.

Table 5. Performance and comfort level Pre versus Post Didactic

		Multiple Choice Exam			Comfort Level (scale 1 – 5)		
		n	Pre (%)	Post (%)	n	Pre	Post
Diarrhea	Physicians	10	39*	71*	9	4.11	4.11
	Nurses	15	37**	63**	14	3.14	3.21
	All	25	38**	66**	23	3.46	3.5
GI Bleed	Physicians	12	81**	50**	12	3.4	3.8
	Nurses	12	53	42	12	2.27	2.83
	All	24	67**	46**	24	2.82*	3.33*
All	Physicians	8	66	61	8	3.7	4.0
	Nurses	6	52	38	8	2.62	2.75
	All	14	56	51	16	3.19	3.42

An asterisk within a box denotes a statistically significant difference compared to the adjacent box, which together represent pre and post didactic values. One asterisk (*) represents a p-value less than 0.05. Two asterisk (**) represents a p-value less than 0.005. Each participant rated if they were very uncomfortable (1) to very comfortable (5) for each topic.

Finally, Table 6 presents how useful attendees found different components of the course. Of the sessions, physicians tended to find the live endoscopy ($p = 0.044$) and colonoscopy ($p = 0.064$) seminars as well as case discussions ($p = 0.067$) to be more useful than the nurses. In an open-ended questionnaire of how to improve the course, of thirteen physicians, eight (61%) wanted more hands on experience and six (46%) felt the course should be expanded in terms of length and size.

The nurses tended to find the endoscopic cleaning session to be more useful than both the live upper endoscopy ($p = 0.052$) and colonoscopy ($p = 0.052$) seminars. And lastly, six (66%) nurses would have liked to see more nurse specific training.

Table 6. Evaluation of Sessions (n = 26)

	Physicians (n=15)	Nurses (n=11)	All Participants
Didactics	4.53	4.36	4.48
Live Upper Endoscopy**	4.73	4.09	4.48
Live Colonoscopy*	4.6	4.09	4.41
Case Discussions*	4.73	4.18	4.51
Simulator	4.47	4.4	4.46
Endoscopy Cleaning	4.4	4.64	4.5
Overall*	4.56	5	4.73

Participants were asked to rate components of the course on a scale from 1 (poor quality/not useful) to 5 (highest quality/very useful). A star (*) next to a course component indicates a slight difference in how nurses and physicians ($p < 0.10$) viewed that component of the course and two stars (**) represents a significant difference ($p < 0.05$) between the two groups.

Discussion

The current level of endoscopic training and capacity in West Africa needs assessment so that healthcare systems can be prepared to treat the increase in chronic GI diseases[5]. The significant burden of GI disease is supported by the cohort of patients seen during this study in which over a quarter of the patients had esophageal or gastric varices, both of which are markers of chronic GI disease and necessitate endoscopic monitoring. Additionally, nearly a third of the patients required some form of endoscopic diagnosis or therapy (Table 4). While the data was limited in number and patients were self-referred or brought to the center through personal referral, it is difficult to determine whether these biases would cause us to over or underestimate the types of disease in the region. Certainly, analyzing more patients is necessary before broader estimations can be made; that said, anecdotally, the cases presented were common types of disease the participants reported seeing. Overall, measuring the endoscopic pathology present in local populations is not only invaluable to understanding regional endoscopic demand, but can also be utilized in developing region-specific training curricula.

Clearly the prevalence of upper GI disease is high, but a majority of the healthcare professionals in the study work in settings that are not equipped to treat, let alone diagnose, these upper GI illnesses (Table 3). This lack of equipment, especially the availability of EGD in less than half of practices, partially explains the lengthy waiting time for emergency endoscopy, which in urbanized populations is at least one day but can be several days and even weeks (Table 2b), delays that are associated with significantly worse outcomes[16,17]. Granted the small sample size of providers and the subjective nature of the report limit the ability to extrapolate to nation-wide capacity. However, seeing as though the course was specifically for upper GI endoscopy, one could presume that participants were fairly knowledgeable on the subject matter. And if the levels of resources (Table 3) are even slightly accurate, it is a major concern in and of itself and will need to be addressed, likely with cheaper diagnostic modalities that currently are unavailable.

Because resources vary region to region, formal courses in West Africa should be effective at teaching resource-cognizant therapy as opposed to gold-standard therapy. To this end, this study also evaluated the impact of a resource-cognizant, mixed-methods endoscopic course on West African physicians. Generally, the participants appreciated the varied teaching formats. More specifically, our data suggests that the effectiveness of a curriculum should be evaluated subjectively and objectively, which is a novel strength of this study. Prior studies, which either did not evaluate or used subjective measures alone[15], may have been misled by their results. That is, in our study, subjectively, the diarrhea lecture was not as valuable to participants as the upper GI bleeding lecture; yet, the objective assessment highlights an improvement in knowledge in diarrheal illnesses but not for upper GI bleeding.

This disagreement could be due to physicians in West Africa having significant exposure to diarrhea and its treatment so the lecture sat near their comfort level and, as a result, they were able to absorb the details thus enhancing their knowledge base, however unknowingly. In contrast, physicians in West Africa have less experience treating upper GI bleeding and thus there is a wider knowledge gap compared to management of diarrheal illness. The worsening exam scores after the upper GI bleeding didactic even though the comfort level of participants increased ($p < 0.05$) signifies two important findings. First, the exam scores on their own suggest revision in the instructional approach is in order. Secondly, and more concerning, subjective measures alone can be misleading and, in this case, lead to delivery of sub-standard care. That is, subjectively, we would have concluded the upper GI didactic effective, yet when taken together, the data indicates the participants did not fully grasp the intricacies of the didactic. In short, by having both learner self assessment and knowledge assessment, faculty are able to enhance future course offerings, and better assess the true effectiveness of their course. Granted the multiple choice exams themselves were too short and the difficulty of exams taken before and after each lecture was not controlled, biases that can be remedied in the future. Finally, although simulation and active observation were employed during the course, there was no objective measure of the hands-on endoscopic skills of participants.

The lack of endoscopic capacity in West Africa needs to be addressed not only in light of the growing chronic GI disease but also, as shown in this study, by the long waiting time for emergency endoscopy (Table 2b) and the lack of endoscopic resources (Table 3). Developing a state-of-the-art training center, like those of the WGO, besides being fiscally difficult, overlooks the predominantly rural populations in West Africa, where resource-rich medicine training would translate poorly. That is, focusing on training that considers the equipment and personnel limitations of the region is vital. Thus, formal courses that identify their participant's resources and can adapt their sessions may be beneficial. Along these lines, the WGO cascades, which we incorporated throughout our curriculum, can be effective for training, yet still, innovation and development of low-cost, reusable endoscopic equipment[18] is needed as is further understanding of the current endoscopic supply and demand.

Separate from this, it was clear that endoscopists have a firm understanding of diarrheal disease and treatment, yet are challenged by the management of upper GI bleeding, which as shown in Table 4 is a rather common clinical complaint. Therefore, by documenting upper GI pathology (Table 4) and current equipment levels (Table 3), this study allows future courses to better frame their didactic and simulator sessions to focus on the therapies that are actually available to endoscopists in West Africa and the diseases they see on a weekly basis, which in the end should improve the quality of endoscopic care. Additionally subjective feedback throughout the course demonstrated the effectiveness of the didactic sessions, but also emphasized that future courses should tailor their curricula to include more live and simulator based sessions. Overall, by obtaining subjective feedback and objective metrics on the course, upper GI pathology, and endoscopic capacity, future courses will more appropriately intertwine their curricula with the practical constraints of the region, while at the same time informing health directors on the current state of endoscopy in West Africa.

Conflicts of interest and ethical adherence:
There are none to declare.

Declaration of funding source:
Karl Storz Endoscopy-America Inc funded some equipment and technical support as well as some travel expenses.

Acknowledgements:
The authors would like to thank Dr. John Doucette for helping with data analysis.

References

1. World Health Statistics [database on the Internet]. World Health Organization. 2013 [cited February 10 2014.]. Available from:http://www.who.int/gho/publications/world_health_statistics/2013/en/.
2. NugentR. Chronic Diseases in Developing Countries: Health and Economic Burdens. Annals of the New York Academia of Sciences. 2008;1136:70-9.
3. World Health Organization: Global Health Observatory. [cited February 10 2014]. Available from: http://www.who.int/gho/mortality_burden_disease/life_tables/situation_trends_text/en/.
4. Nwokediuko SC, Ijoma U, Obienu O, et al. Time trends of upper gastrointestinal diseases in Nigeria. Annals of gastroenterology: quarterly publication of the Hellenic Society of Gastroenterology. 2012;25(1):52-6.
5. World Health Rankings. 2011 [cited March 3 2014]. Available from: http://www.worldlifeexpectancy.com/world-health-rankings.
6. Moayyedi P, Tepper J, Hilsden R, et al. International comparisons of manpower in gastroenterology. *The American journal of gastroenterology*. 2007;102(3):478-81.
7. Physicians by Countries. 2014; Available from: http://www.quandl.com/health/physicians-all-countries.
8. Chuks, Nwokediuko Sylvester (2011). Challenges of Gastrointestinal Endoscopy in Resource-Poor Countries, Gastrointestinal Endoscopy, Prof. Oliviu Pascu (Ed.), ISBN: 978-953-307-385-9, InTech, DOI: 10.5772/22471. Available from: http://www.intechopen.com/books/gastrointestinal-endoscopy/challenges-of-gastrointestinal-endoscopy-in-resource-poor-countries.
9. A.B. Olokoba LBO, A.A.G. Jimoh , F.K. Salawu, et al. Challenges of Establishing an Upper Gastro-Intestinal Tract Endoscopy Unit in a Resource-Poor Setting. *Research Journal of Medical Sciences*. 2008;2:212-6.
10. MandevilleKL, Krabshuis J, Ladep NG, et al. Gastroenterology in developing countries: issues and advances. W*orld journal of gastroenterology: WJG*. 2009;15(23):2839-54.
11. Africa Partners Medical: Olmsted Outreach. 2009 [March 1 2014]; Available from: http://africapartners-medical.org/index.php?page=gastrointestinal-endoscopy-workshop.
12. Wilhelm TJ, Mothes H, Chiwewe D, et al. Gastrointestinal endoscopy in a low budget context: delegating EGD to non-physician clinicians in Malawi can be feasible and safe. *Endoscopy*. 2012;44(2):174-6.
13. WGO Training Centers. World Gastroenterology Organisation. [March 3 2014]; Available from: http://www.worldgastroenterology.org/training-centers.html.
14. Fried M, Krabshuis J. Can 'Cascades' make guidelines global? *Journal of evaluation in clinical practice*. 2008;14(5):874-9.
15. Asombang AW, Turner-Moss E, Seetharam A, et al. Gastroenterology training in a resource-limited setting: Zambia, Southern Africa. *World journal of gastroenterology*: *WJG*. 2013;19(25):3996-4000.
16. Chen PH, Chen WC, Hou MC, et al. Delayed endoscopy increases re-bleeding and mortality in patients with hematemesis and active esophageal variceal bleeding: a cohort study. *Journal of hepatology*. 2012;57(6):1207-13.
17. Hsu YC, Chung CS, Tseng CH, et al. Delayed endoscopy as a risk factor for in-hospital mortality in cirrhotic patients with acute variceal hemorrhage. *Journal of gastroenterology and hepatology*. 2009;24(7):1294-9.
18. Howitt P, Darzi A, Yang GZ, et al. Technologies for global health. *Lancet*. 2012;380(9840):507-35.