Babson Global Healthcare Entrepreneurship Summit

Lancet Commission on Global Surgery

May 7, 2015

"Successful Expansion of Laparoscopy in Mongolia"

Building New Educational Methods From a Global Surgery Success Story

A "Living Case" Sampler

Synopsis:

Teams of collaborators successfully introduced and expanded laparoscopic surgery in Mongolia using unique educational methods and social engagement processes that recognized several things: surgery is an essential form of public health; the social context surrounding surgery is important for successful outcomes of surgery, and for stimulating social acceptance of surgical innovations; educational processes that combine training in surgical procedures, education of the target population, attention to regional infrastructure, and culturally appropriate deployment can be very effective in spreading advanced surgical care to low-resource areas.

Babson College has been developing video-based, implementation-oriented "living cases", built around on-the-ground executive education methods, that help multi-disciplinary practitioners implement innovations very similar to the ones achieved by surgical teams in Mongolia.

The Lancet Commission on Global Surgery brought together like-minded implementation-oriented collaborators from the Mongolia surgical team, Babson, the Harvard School of Public Health, and Johns Hopkins School of Public Health to explore how to use "living case" educational methods to expand the lessons learned in Mongolia to health care practitioners of all kinds. The group created several successful prototypes and is in the process of expanding this cross-discipline process.

This session will present key elements of this collaboration in an interactive format.

Session Objectives:

- Highlight the success factors in deploying laparoscopic techniques in Mongolia
- Demonstrate elements of the "living case" process interactively with session attendees
- Describe future activities

Background Readings

1. A Successful Model for Laparoscopic Training in Mongolia

Gabriela Vargas1, Raymond R. Price1,2,3, Orgoi Sergelen3, Byadran Lkhagvabayar3, Pandaan Batcholuun3, Tsiiregzen Enkhamagalan

PDF attached.

Also at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3727257/

2. **"Successful Expansion of Laparoscopy in Mongolia"**

Building New Educational Methods From a Global Surgery Success Story

PDF attached

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A Successful Model for Laparoscopic Training in Mongolia

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The benefits of laparoscopic surgery have not been available to the majority of Mongolians. Mongolian surgical leaders requested assistance in expanding laparoscopy. A capacity-building approach for teaching laparoscopic cholecystectomy throughout Mongolia is reviewed. A laparoscopic cholecystectomy training program was developed. The program included a didactic course and an intensive 2-week practical operating experience. Courses were taught in Ulaanbataar and at 3 of the 4 regional diagnostic referral and treatment centers from 2006 to 2010. During this training period, a total of 303 teaching laparoscopic cholecystectomies were performed. There was one common bile duct injury and one duodenal injury. The conversion rate was 2.0%. This program has been successful in creating a self-sustaining practice of training. The traditional surgical approach to gallbladder disease in Mongolia has been challenged and has, in turn, been a stimulus for improvement in the medical community.

Key words: Developing countries – Specialties surgical/education – Cholecystectomy – Laparoscopic – Mongolia – Cholecystectomy laparoscopic/education – Laparoscopy/economics – Laparoscopy/standards

Cholecystectomy is one of the most common operations performed worldwide.[1] Laparoscopic cholecystectomy has revolutionized the care of gallbladder disease, allowing for faster recovery, shorter hospitalizations, decreased wound infections, and decreased use of narcotic medications. In developed countries, laparoscopic cholecystectomy has now become the gold standard in the

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treatment of gallstones. However, open cholecystectomy with its increased morbidity remains the standard of care in developing nations owing to limitations in training, funding, and availability of equipment. The benefits of laparoscopic surgery elude much of the developing world, where people often accept several painful conditions as a fact of life.

In Mongolia, 49% of the 2.7 million people reside in rural areas and live a nomadic lifestyle.[2] Mongolia covers a large geographic area equal to the combined areas of Great Britain, France, Germany, and Italy; it is the most sparsely populated country in the world. The dry deserts and wet mountains coupled with the extremes of weather are significant obstacles to adequate road building and impede transportation for patients in need. The vast rural areas of Mongolia are isolated and present a serious challenge to providing access to adequate medical and surgical care.

In 2006, expenditures for health care reached 4.6% of the gross domestic product of Mongolia; this translated into US $23.2 per capita for health care per year.[2] Weiser *et al*[3] found that surgery is almost absent in countries where less than US $100 is spent on health care per person per year. Laparoscopic cholecystectomy was first introduced into Mongolia in 1994, but by 2005 only 2% of the gallbladders were being removed laparoscopically, and no laparoscopy was performed outside of the capital city, Ulaanbataar.[4,5]

The epidemiology of diseases in Mongolia has dramatically changed over the last 3 decades. Where echinococcal disease was one of the leading surgical diagnoses in the early 1960s, it is now uncommon. Today, the second most common cause of hospital morbidity in Mongolia is gastrointestinal diseases, with liver diseases, appendicitis, and gallbladder disease representing the majority of these illnesses. A cohort study in Mongolia in 2006, comparing the few laparoscopic cholecystectomies to the many open cholecystectomies, found that the laparoscopic approach afforded patients lower infection rates and shorter hospitalizations, and provided hospitals cost savings.[6]

Mongolia is divided into 21 geographic/administrative areas called Aimags. In the early 2000s, the Ministry of Health of Mongolia, in an effort to increase access to improved medical and surgical care to the rural areas throughout Mongolia, designated 4 of the Aimag hospitals as Regional Diagnostic Referral and Treatment Centers (RDRTCs) and targeted them for improved infrastructure and human resource development.

Despite the obvious concerns of inadequate physical and human resources, difficult travel, and relatively limited financial investment in health care, the chief of surgery at the Health Sciences University of Mongolia, recognizing the need for improved treatment for gallbladder disease, requested assistance from the W.C. Swanson Family Foundation (a nonprofit, nondenominational, non-governmental organization [NGO] that had been helping to develop and improve the infrastructure of hospitals in Mongolia since 1999) to help expand laparoscopic cholecystectomy to these 4 RDRTCs. This article reviews the teaching methods and important concepts learned over the last 5 years in expanding laparoscopy in a sustainable manner throughout Mongolia.[5]

Methods

In collaboration with the Health Science University of Mongolia (HSUM), the Ministry of Health (MOH) of Mongolia, and the W.C. Swanson Family Foundation (SFF), a comprehensive multidisciplinary 2-week laparoscopic cholecystectomy–training course was developed. The organizational components included (1) maneuvering the local political and medical system, including importation laws and agreements, and licensing the surgeons on the teaching team; (2) developing and translating an appropriate didactic curriculum; (3) organizing a functional practical component of the course that trains all important team members and provides a continuum of training including pre-, intra-, and postoperative management; and (4) implementing methods for sustainable infrastructure development that supports laparoscopy in a resource-poor environment.

Maneuvering the political and medical regulatory environment in Mongolia

To facilitate the constant changing laws and regulations, a local Mongolian expert was hired as an in-country facilitator and representative for the SFF. Agreements through the MOH and support from local political representatives led to critical long-term alliances that facilitated the import of the necessary laparoscopic and medical supplies. Also, appropriate medical licenses were obtained through the MOH and the National Mongolian Surgical Society for the foreign surgeons. The chief of surgery at HSUM was instrumental in obtaining the licenses as well as organizing the Mongolian doctors, nurses,

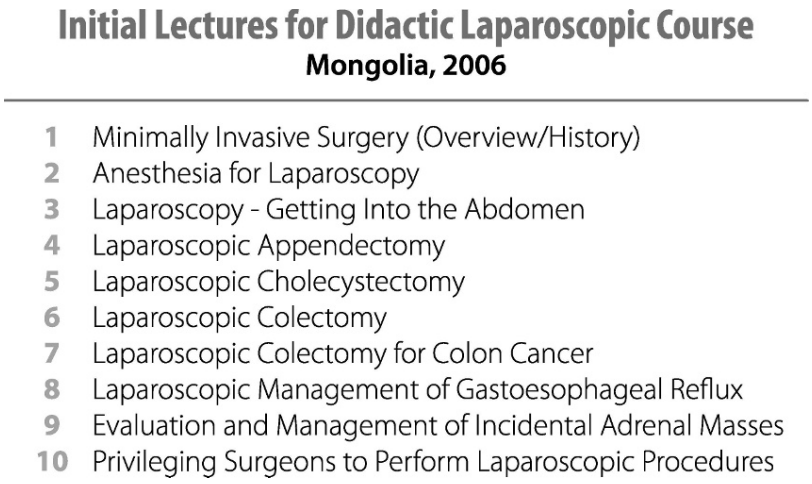

Fig. 1 Initial lectures for didactic laparoscopy course.

and administrators for the courses at the various facilities each year.

Developing the didactic curriculum

The course combined both didactic and practical sessions. The laparoscopic didactic lectures were given either the first day, or over several days in the morning. The initial topics for the laparoscopic didactic course were developed through discussions between the chief of surgery at HSUM and the medical director for the SFF. The topics included basic and advanced laparoscopic training as the first course and was scheduled for Hospital No. 1 where laparoscopy had begun in 1994 (Fig. 1). Later, with permission from the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), the didactic lectures from the Fundamentals of Laparoscopic Surgery course replaced some of the initial lectures. These lectures, combined with those on basic laparoscopy skills, sterile technique, and surgical safety as outlined by the World Health Organization (WHO) surgical safety checklist, provided a total of 8 hours of didactic lectures (Fig. 2). All lectures and presentations were translated into Mongolian. Medical translation for the PowerPoint (Microsoft, Redmond, WA) slides and during the actual course proved to be a significant hurdle solved by collaborating with native surgeons and other physicians from the tertiary care centers in the capital city, who were bilingual in Mongolian and English. Following the direction of the chief of surgery at HSUM, an Emergency Surgery didactic lecture series was also develop and included during the complete 2-week training course at the RDRTCs (Fig. 3). Surgeons and nurses from different surgical specialties (orthopedics, obstetrics and gynecology, and others) attended the didactic portions of the course.

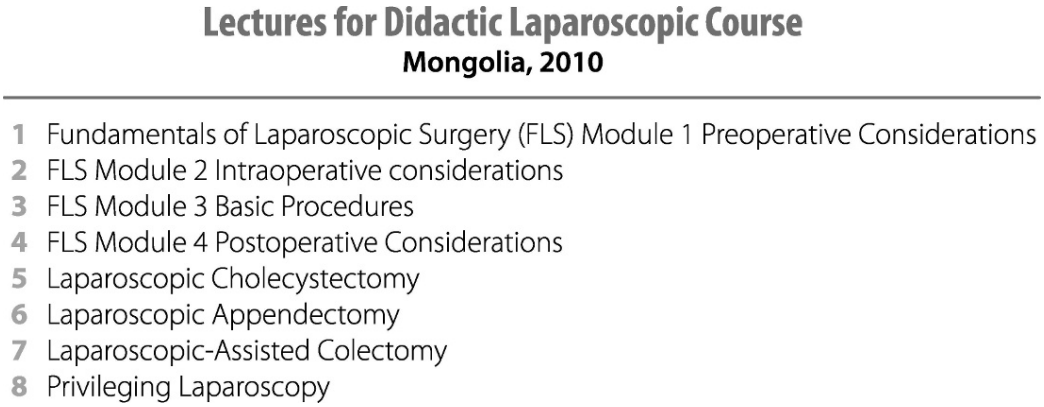

Fig. 2 Revised lectures for didactic laparoscopy course.

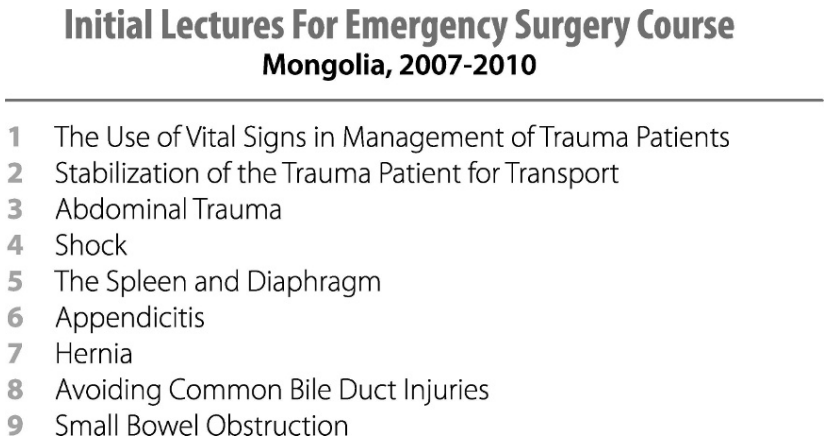

Fig. 3 Emergency surgery didactic lecture series.

Organizing the practical training component

The first laparoscopic course in 2006 included 1 week of laparoscopic cholecystectomy experience and 1 week of advanced laparoscopic surgical procedures (colectomies, an adrenalectomy, a Nissen fundoplication). From 2007 to 2010, all of the practical laparoscopic training components focused on laparoscopic cholecystectomy, with a few appendectomies. The laparoscopic cholecystectomy practical portion of the course provided general surgeons with 5 days of hands-on experience performing laparoscopic cholecystectomies in 2 different operating rooms. The experience was initially designed to provide 2 to 3 Mongolian surgeons per operating room the opportunity to gradually learn the laparoscopic skills—progressing from camera holder, then advancing to first assistant, and finally to lead surgeon. It was politically very difficult to limit the number of surgeons participating in this first practical session. Many Mongolian surgeons assisted, but few gained enough experience to allow them to act as the lead surgeon. Future courses were able to select the few surgeons who would receive the operative practical experience before the teams arrived, allowing for very intensive, focused training with the graduated approach. The numbers of teaching laparoscopic cholecystectomies were also decreased to 3 (or rarely 4) cases, from 6, per day for each operating room; as 6 cases overwhelmed local resources and staff. Relatively few course participants had received prior training in laparoscopy.

Each course included a multidisciplinary education team consisting of 2 surgeons, an anesthesiologist, an operating room nurse, an operating room scrub technician, and a bio-technician. A surgical resident frequently joined the team to facilitate research and patient improvement projects. Each team member was tasked with training his/her Mongolian counterpart about the specifics of laparoscopic surgery from their perspective. This included not only the intra-operative training, but also the pre- and postoperative management of the patients and the care and cleaning of the equipment. Bio-technicians trained their counterparts on maintenance and repair of the equipment and helped identify sustainable ways to replace and upgrade equipment. Inanimate laparoscopic skill simulator boxes were added to the practical component of the course during the last 2 years (2009–2010).

Due to the infrastructure of the health care system in Mongolia, training began first in the capitol city of Ulaanbaatar (UB), where tertiary care is provided. Training was subsequently expanded to the regional centers in 3 of the 4 regional diagnostic referral centers (Erdenet, Khovd, and Choibalsan), and the fourth (Uvukhanghai) was scheduled for training in June 2011. Each education site received an initial training course and a follow-up course the next year. (The initial course in Choibalsan was completed in 2010.) Participants were issued a certificate of completion signed by the President of the National Mongolian Surgical Society and the Medical Director of the SFF at the conclusion of the course. This did not imply any competency but supported the Mongolian national standards for required continuing medical education.

During the 2 weeks of laparoscopic training, any emergency and trauma cases at that facility were managed together with the local Mongolian surgical team and the visiting surgical education team. This included the pre-, intra-, and postoperative

management, with daily combined-team rounds morning and night. Some patients with appendicitis were offered the laparoscopic approach to begin expanding the students' laparoscopic skills. Traditional open surgical procedures were done for all other emergency cases.

Infrastructure development

As laparoscopy requires a totally different set of equipment and instruments, and none of the RDRTCs had any of this equipment, each of the courses included on-site evaluations well in advance of the training sessions. Hospital infrastructure was assessed, including suitability of the power source, status of basic surgical equipment (instruments, cautery, suction, anesthesia machines, operating room lights and beds, autoclaves, and other sterilization methods), and supplies (suture, bandages, medicines). The SFF supplied the necessary infrastructure, initially using equipment obtained from US hospitals that had been refurbished to meet US standards. Working with industry, new equipment and supplies were donated. Containers were shipped months in advance of the education teams, and then installed in the hospitals working with the local Mongolian counterparts. Laparoscopic towers and equipment were installed in each facility (Hospital No. 1, Erdenet; Hospital No. 2, Khovd) prior to the training through the SFF; except in Choibalsan, where a Belgium project had installed some equipment the previous year and had begun laparoscopic training there. Additional laparoscopic equipment was installed in Choibalsan by the SFF. Operating room tables, anesthesia machines, autoclaves, electrocautery machines, open surgical instruments, and open retractors were also donated. Partnerships with industry have begun establishing local vendors in Ulaanbataar to help maintain and provide sources for continued training, supplies, and equipment.

Evaluation

Data were prospectively collected on the numbers of students attending the courses. Patient demographics were collected prospectively on all patients during the training course. Complications were identified prospectively and confirmed with a retrospective follow-up after the courses.

Patient demographics (age and sex), ultrasound findings, procedure type (open versus laparoscopic versus conversion), surgeon (trainee versus trainer), intraoperative complications, and postoperative complications were collected. Hospital records from January 2005 to September 2010 were reviewed in 2 of the 3 regional centers (Khovd and Choibalsan) for all cholecystectomies, and the following data were collected: patient age, sex, preoperative diagnosis, type of procedure, and surgeon. Data collected from Erdenet have recently been published.[5]

Results

All foreign surgeons and anesthesiologists were able to obtain a medical license while in Mongolia. The study was approved by the chief of surgery at the HSUM, the chief of surgery at each hospital, the hospital administration, and the review board of the SFF.

Training courses were organized and taught in Ulaanbataar at Hospitals Nos. 1 and 2, and at 3 of the 4 RDRTCs in Erdenet, Khovd, and Choibalsan from 2006 to 2010. Erdenet, Khovd, and Choibalsan each only had 4 active general surgeons, all of whom completed the practical training. Courses taught at Hospitals Nos. 1 and 2 included students from multiple hospitals throughout Mongolia.

Mongolian surgeons conducted evaluations of patients with symptoms consistent with gallbladder pathology prior to the arrival of the teaching team. All patients underwent laboratory studies consisting of complete blood count (CBC) and comprehensive metabolic panel (CMP). Nearly all patients underwent right upper quadrant ultrasound to verify the presence of cholelithiasis. The patients selected for laparoscopic cholecystectomy had the presence of stones confirmed and symptoms consistent with symptomatic cholelithiasis. The patients were reexamined the day before the planned surgery with a combined training team of Mongolian and international surgeons. Laboratory and radiographic studies were reviewed together during these preoperative teaching rounds. Patients suspected of having choledocholithiasis or acute cholecystitis were treated by traditional open surgery.

A total of 303 laparoscopic cholecystectomies were performed during the practical components of the courses from 2006 to 2010. The female to male ratio was 3.7:1. All patients with gallstones were identified preoperatively with ultrasound. There was one common bile duct injury (0.33%) and one duodenal injury (0.33%). The conversion rate was 2.0% (Table 1). Intra-operative cholangiogram technique was taught during 3 cases in Choibalsan, as it was the first facility that had the capability for intraoperative x-ray during our training courses.

Table 1 Complications and conversion rates in laparoscopic teaching courses (2006–2010)

Laparoscopic Teaching Cases: Conversions and Complications
Mongolia, 2006-2010

	Location	# Lap Chole	# Convert	# Complications
2006	Hospital #1	34	1	0
2007	Hospital #1	40	0	1
	Erdenet	23	1	0
2008	Hospital #2	60	2	1
	Erdenet	16	0	0
2009	Hospital #2	56	1	0
	Khovd	34	1	0
2010	Khovd	15	0	0
	Choibalsan	25	0	0
Total		303	2.0%	0.7%

Operative time, expressed in minutes, was defined as the time of the operation from skin to skin. In Erdenet, the mean operative time for teaching cases was 78 minutes. The average operative times for teaching cases in UB, Khovd, and Choibalsan were 64.3, 82.2, and 92.9 minutes, respectively.

Trainees progressed from camera holders to first assistant once they were able to demonstrate the ability to orient and move the camera appropriately. They did not progress to primary surgeon until they were able to consistently place the instruments safely into the abdomen, handle tissue, retract appropriately, and dissect the gallbladder from the gallbladder fossa. Once these skills were obtained, they were allowed to perform the dissection of the triangle of Calot. Acquisition of all of these skills was the benchmark for successful training.

From 2005 to 2008 in Khovd and Choibalsan, all gallbladders were removed by the open technique. The overall frequency of cholecystectomy as well as the number performed laparoscopically has increased in these facilities since training began in 2009 (Figs. 4 and 5).

Two of the surgeons who received training during the advanced laparoscopic portion of the 2006 course became part of the SFF education team in Erdenet. Two other surgeons from the 2006 laparoscopic cholecystectomy course also joined the SFF teams to teach in Khovd and Choibalsan. These surgeons have facilitated follow-up on-site proctoring and provided short-term fellowships at their facilities to continue the training of the surgeons from these regional hospitals.

In addition, one of these surgeons has become the medical director of Songdo Hospital, a new private Korean hospital in Ulaanbataar, where he performed nearly 100 laparoscopic colectomies in 2010.

Discussion

The introduction of laparoscopy in resource-poor areas has been a topic of some debate. Some have argued that the introduction of laparoscopy in developing countries does not contribute to the improvement of quality and effectiveness of surgical care unless basic and essential surgical and anesthetic services are strengthened in parallel and that perhaps the drive for laparoscopy is driven by industry or academia and not public demand.[7] Others suggest that the benefits of laparoscopy—faster return to work, less pain, and fewer infections—may actually be more important in the developing world, leading to improved productivity in an already fragile economic environment.[8]

Laparoscopy had previously been introduced into Mongolia in 1994, but 10 years later, very few laparoscopic cholecystectomies were being performed. Barriers to the expansion of laparoscopy included the lack of adequate training and significantly limited resources, especially in the rural regions. In Mongolia, the impetus for the expansion of a laparoscopic program resulted from a concerted campaign from the local surgical community to address a critical need for their country. The partnership created between the Health Sciences

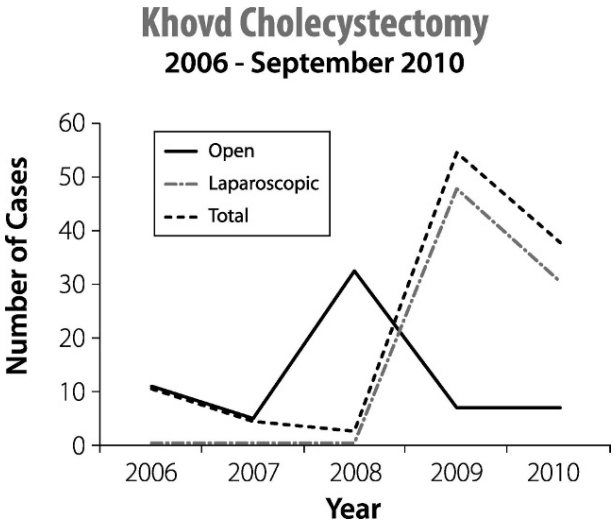

Fig. 4 Incidence of cholecystectomy in Khovd.

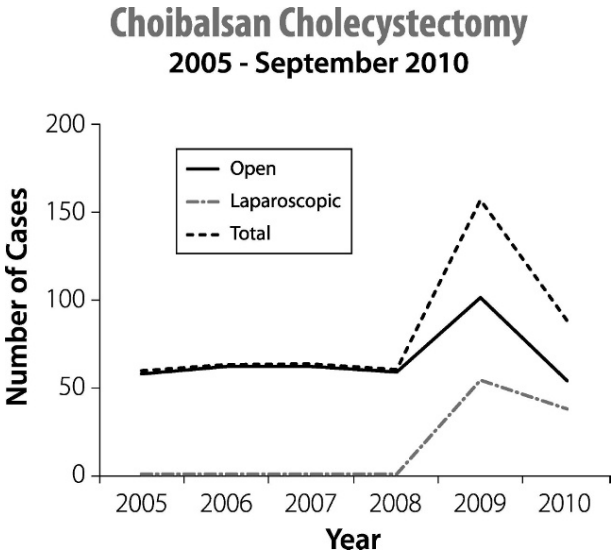

Fig. 5 Incidence of cholecystectomy in Choibalsan.

University of Mongolia and the W.C. Swanson Family Foundation as well as the continued support of the entire surgical community has been an extremely important concept for the successful and sustainable introduction of laparoscopy in Mongolia.

Many lessons were learned from the initial course taught in 2006, as the teams had to carefully navigate the cultural and political nuances. In Mongolia, physicians are trained in a system where they learn by watching and only sometimes assisting. Despite the predesigned curriculum, this led to many surgeons each assisting during the practical component of the laparoscopic cholecystectomy training without providing anyone with enough experience to competently perform a laparoscopic cholecystectomy independently. In order for the training to be effective, local leaders had to be convinced that a different method of teaching was required; training 2 surgeons in one operating room over several days as they progressed through a graduated experience would allow the surgeons to become somewhat proficient in the technique. The chief of surgery, Dr Sergelen, commented in 2009 that one of the most important aspects of the training program had been the introduction of a new way to teach surgery in Mongolia—a ''hands-on'' approach that allows the surgeons to ''do'' rather than just ''watch''—leading to a more rapid acquisition of new surgical skills. It was much easier to consolidate the practical training in Erdenet, Khovd, and Choibalsan, as each facility had only 4 general surgeons and had selected 2 for the majority of the operative experience. One of the most important aspects of this training course is the training of surgeons in their native operative environment. They are able to learn on their own equipment and are involved in troubleshooting and problem solving when issues with the existing infrastructure arise. All trainees continue to practice at the RDRTC where they received their training.

Understanding the limitations imposed by the medical system's infrastructure was another lesson learned during the 2006 course. Sterilization of instruments to allow rapid turnover of the operating room was a limiting factor. Lack of adequate human resources and time, as well as the concern of inadequate sterilization and transmission of infectious diseases if the system was strained, forced us to reevaluate the feasibility of performing a large volume of cases. To overcome this problem, the number of procedures being done per day was decreased by nearly half, and enough scopes and instruments are now taken to each site to allow adequate sterilization to safely facilitate 3 to 4 laparoscopic cases per day.

Combining emergency and essential surgical training in parallel with the laparoscopic training for the RDRTCs indeed has allowed for culturally acceptable methods to improve surgical care in general. Teaching laparoscopic surgery not only led to the expansion of more modern surgical techniques to rural Mongolia, but it also enabled improved reception for basic surgical training. In addition to improved decision making and technical abilities of the surgical team, teaching laparoscopy has facilitated the acceptance of sterile technique courses and the implementation of surgical safety

measures, such as incorporating the surgical safety checklist and implementing a ''time out'' at the beginning of the cases. By providing the surgeons in Mongolia with the training they requested, trust has been gained, allowing for the introduction of training in trauma surgery, emergency surgery, and pediatric surgery and anesthesia, in addition to laparoscopy.

Several studies in developing nations have documented both the feasibility and safety of performing laparoscopic cholecystectomies.[9–11] With careful patient selection, the safety of same-day laparoscopic cholecystectomy has also been established.[1,12,13] The majority of this experience has been carried out in tertiary care centers and has not been well studied in rural centers. As with the experience in developed countries, there is a learning curve for the mastery of laparoscopic skills. Complication and conversion rates in Mongolia are consistent with those seen at the inception of laparoscopy in the 1990s.[5]

One might expect the complication rate to be elevated during the practical portion of the training period where surgeons learning laparoscopy have not had previous experience. However, the common bile duct injury rate and bowel injury rate thus far has been extremely low during the 303 laparoscopic cholecystectomy cases performed. Although converting to an open procedure is taught as good clinical judgment and not a complication, the conversion rate as well has been extremely low during the training courses. An initial report of complication and conversion rates in Ulaanbataar and Erdenet indicated acceptable rates following the trainings.[5]

The multidisciplinary team approach, teaching comprehensive surgical care (pre-, intra-, and postoperative care), and introducing twice daily team rounds with surgery, anesthesia, and nursing was one of the features most appreciated by our hosts. A significant amount of time was spent discussing and reviewing the appropriate work-up and selection of patients for surgery. Teaching appropriate patient selection and criteria for the safe administration of anesthesia provided excellent opportunities to improve perioperative care. The notion that a patient scheduled for surgery should be cancelled if not medically optimized has been an important concept taught during all of the courses. The postoperative management training has been facilitated by improving monitoring capabilities of each facility. An important aspect of this course includes training for each person involved in laparoscopy, including the central processing staff sterilizing the equipment, operating room personnel cleaning the instruments, administrators who provide financial and leadership support to replace and repair the equipment, and the bio-technical support personnel who maintain and troubleshoot the equipment in the operating room.

Laparoscopy has been a gateway to improve the infrastructure of tertiary and regional care centers. In a recent update from Erdenet, the improved infrastructure has allowed the hospital there to increase the volume of surgeries performed and to do a larger variety of cases. Subsequently, they report that wait lists for surgery have dropped dramatically, and infection rates have improved. In Khovd and Choibalsan, the overall number of cholecystectomies has been increasing as well as the number performed laparoscopically. It is hard to imagine that the incidence of gallbladder disease is increasing this dramatically. The increase in cholecystectomy may reflect the improved infrastructure that lends itself to increased capability. It may also represent the increased skills of the surgeons and their willingness to perform the surgery.

Prior to our training courses in 2006, many of the Mongolian people, especially those in the rural areas, were very skeptical about laparoscopic surgery. Just as the support of the medical community is necessary for a program of this type to thrive, the public must also be educated about the new technology and its benefits. A task of this magnitude would not succeed in an environment where the community was distrustful of the technology or apprehensive of its benefits. Therefore, a component of this project included public education utilizing the local media to dispel myths and to clarify the purpose and intent of the mission. The rise in gallbladder surgery may also reflect the general population's increasing acceptance of laparoscopy. The training has led to many patients commenting that their trust in their surgeons has increased dramatically, leading to their willingness to undergo surgery in these facilities. The surgeons in Erdenet expressed that by educating the general population on the benefits of laparoscopy, the public will begin to demand increased access to laparoscopy and initiate lobbying efforts to increase funding from the government to support and sustain this technology.

The ultimate goal of this program has been to provide Mongolian surgeons with the tools and skills necessary to advance the medical and surgical care of their country. Professors from the university were recruited to translate and assist in the training of their rural colleagues. This was a vital component of the

program as it helped foster a mentoring relationship between academic and rural surgeons. The program was designed to accommodate two visits to each training site in consecutive years. Some of the course participants had received laparoscopic training from other visiting foreign medical teams prior to participating in one of our courses. Moreover, many surgeons sought additional training opportunities abroad after participation in this course. Laparoscopic training in Mongolia has been an enabling process that has provided the local surgeons with an improved confidence and self-satisfaction; they can now provide modern surgical care for their people similar to the care available in other parts of the world.

A multidisciplinary team approach, including representatives from industry, is essential in creating a sustainable and practical program. While equipment can be donated, it is critical to supply these nations with technological back-up and training in maintenance of the equipment, so that they may evolve their medical centers at their own pace.[14] In order to avoid the so-called ''brain drain,'' it is important to train surgeons in their own environment, and the training must be adapted to meet the needs of the population.[15] While the medical infrastructure of most developing countries is in need of improvement in several areas, this should not be viewed as a contraindication to the introduction of new techniques. Laparoscopy should be viewed as an extension of general surgery and not a different type of surgery.[16]

With the ubiquitous access to information available on the Internet and other media sources, the global community is beginning to understand possibilities for improving their access to quality surgical care and is demanding the benefits from minimally invasive surgery. Overcoming barriers of limited resources and human capital to develop laparoscopy can be achieved in communities where they feel the benefits are significant and they have the motivation to maintain it. This education model has provided direct training to surgical teams in the capital and the Regional Diagnostic Referral and Treatment Centers in Mongolia as requested by the Mongolian surgical leaders; subsequently, this has provided improved access to modern surgical care in rural Mongolia. The focused training on laparoscopic cholecystectomy in a country that has a high prevalence of the disease has allowed for adequate practical experience during short-term training expeditions. Team training, infrastructure development, integration of laparoscopic training with essential and emergency surgical care, and partnering with local laparoscopic leaders have been key to the successful and sustained laparoscopic development in Mongolia.

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"Successful Expansion of Laparoscopy in Mongolia"

Building New Educational Methods From a Global Surgery Success Story

The development and implementation of advanced, sustainable surgical care in Mongolia over the last decade has had positive, far-reaching healthcare, infrastructure and public health impacts for the country and its people. The innovative processes of social deployment used by collaborative innovators in Mongolia[1] can also provide valuable lessons for healthcare innovators around the world.

> (1) Surgery can improve public health at large by: prioritizing surgically treatable conditions that have a high public health burden; developing surgical systems with high potential for successful outcomes in low resource regions; employing cost-effective, locally-modified procedures; focusing on processes that can be easily documented and communicated to many similar environments around the world.
>
> (2) Providing surgical care with positive outcomes requires understanding and enabling large networks of physical and human resources that extend beyond operating room walls.
>
> (3) Developing such sustainable surgical systems, which can be "pulled"[2] into existence by many stakeholders in a society, has the potential to improve other dimensions of society: economic, political, technological, educational.

In 1994 Mongolia introduced laparoscopic surgery at small scale. Laparoscopic cholecystectomy is a minimally invasive surgical procedure to remove the gallbladder. It is the gold standard in developed countries - associated with faster recovery, shorter hospitalizations, decreased wound infections, and decreased use of narcotic medications. These benefits may be even more important in low resource regions where pre and post operative environments are harder to control, and where days away from work are costly to poor families. But laparoscopy is often unavailable in these settings due to lack of equipment and training.

This 1994 effort was successful but national leaders wanted to scale the benefits to the population at large.

In 2006, recognizing the national public health importance of laparoscopy, the Health Sciences University of Mongolia, the Ministry of Health, and the Swanson Family Foundation, a nonprofit organization helping to build health infrastructure in Mongolia, developed a two-week laparo-

[1] This is called the "innovation team" in the remainder of this case.
[2] As opposed to being "pushed" via regulation or mandates.

This case was prepared by Martin Anderson, Lewis Family Chair in Social Innovation, Babson College and Laurent Benedetti, MD, MPH, Harvard School of Public Health; in collaboration with Raymond R. Price, MD, University of Utah Hospitals and Clinics, Intermountain Healthcare (Utah); Dr. O. Sergelen and Dr. Ganbold Lundeg, both of the Health Sciences University of Mongolia (Ulaanbaatar, Mongolia); with input from Christopher Gudas, MD, MPH.

scopic cholecystectomy training course, incorporating, classroom, simulation, and surgical suite elements. [3]

A cross-functional team of innovators expanded this program nationwide, accompanied by public education campaigns to sensitize Mongolian people to laparoscopic surgery. These innovators not only achieved their public health goals, they experienced first-hand how surgical outcomes were significantly influenced by psycho-social factors, infrastructure, political trends, and even international competition for patients from hospitals outside Mongolia. The material gathered for this case, when accompanied by simple facilitator questions, has proven to be a superb teaching case for many audiences: medical, policy, business, technology.

This extraordinarily successful program is best described in the words of the innovators themselves. See web linkages:

A Successful Model for Laparoscopic Training in Mongolia(4)
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3727257/

Laparoscopic Surgery in Mongolia(5)
https://www.youtube.com/watch?v=6bP_8urrjmw

The article and video also reveal that the program implementers did not adopt a role of visiting experts, but of participants in the social innovation process who learned from patients, students, and many other stakeholders who continue to make this effort successful.

For example, Mongolian surgeons convinced the visiting surgeons to teach them techniques in laparoscopy even though the visitors wondered whether the infrastructure and economy would support the technology and costs of laparoscopic surgery. The visitors were ultimately convinced when Mongolian surgeons took it on themselves to travel to learn laparoscopic skills in facilities around the world. Over the years that ensued, the friendships that formed and the global partnerships that evolved helped inspire collaborators to constantly encourage the best of each other and seek continuous improvement of their efforts in implementing advanced surgical care.

As one might expect, in a program with such high aspirations, many things did not always happen as planned, and a core skill learned by all was how to improvise solutions quickly with the resources at hand.

As a result, Mongolian and US participants adopted, perhaps subconsciously, the mindset and skills of successful business and technology entrepreneurs while implementing “impossible” advanced healthcare in challenging environments.

[3] This is called the “innovation team” in the remainder of this case.

Importantly, the participants in this program informally recorded eight years of their field experiences in video and images. This level of documentation is rare in such social innovations, and it has proven invaluable in follow-up collaborations, such as the one described in this case series.

Surgical Success Was Built On An Educational "Package" That Resembled Other Forms of Entrepreneurship

What was especially unique about this program was that it scaled up based upon a packaged, but ever-evolving, educational process, that in many ways represented a form of "franchising" of a complex social-technological capability. This allowed scale beyond the reach of the original program architects. The elements of the "educational package" would stimulate complex self-generating, and self-regulating behaviors among program participants, even if the founders were not there. Many people talk about "train the trainer" educational models, and this was an exemplary version of that genre.

This educational program was run from 2006 to 2010, and during that time, members of the laparoscopic innovation team in Mongolia captured informal personal videos and images. This provided a glimpse into the human bonding, emotions, and political dimensions rarely captured in formal articles on such programs.

Recorded material contained home visits to patients, camping out on the open plains of Mongolia with members of remote hospital communities, the long roads traveled by patients and medical professionals, the role of animals in a nomadic community, the role of sports that involved considerable bodily risk, local industry practices, and many other dimensions of the social context in which laparoscopy was being deployed.

This informal documentation provided invaluable educational material on how to *perceive and influence the informal human networks* that can enhance or inhibit implementation of even the best-designed programs.

Lancet Commission on Global Surgery Creates Informal Networking

In 2014, as part of the informal networking generated by the Lancet Commission on Global Surgery, researchers from Babson College , Johns Hopkins, and the Harvard School of Public Health visited Dr. Raymond Price, a principal in the Mongolian laparoscopic program, in his Utah office.

During this meeting the visiting researchers remarked on the pronounced entrepreneurial nature of the laparoscopic training program, and saw that the Mongolian innovation team had collected a tremendous amount of teachable material.

At the end of the meeting Dr. Price gave the authors of this case a hard drive with the 8 years of informal video surrounding the Mongolian laparoscopic program. This proved an important stimulus for what followed.

"Entrepreneurship of All Kinds" Meets Laparoscopy in Mongolia - in Living Cases

The recorded material on the Mongolian laparoscopic effort clearly displayed that innovation in pivotal areas like surgery involves multiple levels of society: *rational* (data/science), *emotional* (belief systems, ethics), and *political* (laws and agreements among sectors of society).

Babson's educational philosophy is often called "entrepreneurship of all kinds". This means that "entrepreneurship" is a fundamental social networking behavior of society, it does not just mean "starting a new business".

The management school had been developing video-based "living cases" that help students and executives practice this broader social perspective, and they found like-minded collaborators at many other schools. Collaborators from Babson, Johns Hopkins, and the Harvard School of Public health had been building living cases on complex socially-mediated public health problems like water pollution and human waste, which can only be solved by building political consensus across entire watersheds or sometimes across national boundaries.

In healthcare, Babson and the Cambridge Health Alliance (Massachusetts) worked together on living cases designed to reveal how patients actually *experience* health care systems at home and in their daily lives. This interaction helped CHA with their strategic transition from traditional hospital processes to whole-community health strategies, supported by new community based systems of outreach and care.

Living cases use images and short video clips from all parts of an ecosystem, to convey directly not just technical elements of a surgical procedure or annual physical, but also the emotional and political human factors that may seem "irrational", but are nevertheless pivotal to improving social systems like healthcare.

These video clip libraries can be changed or supplemented quickly as technology, laws, or social behaviors change, thus making the cases more "living" than static text based cases.

Using video in place of text has added advantages in multi-cultural settings. Video allows multilingual, multi-cultural, groups to directly access the dense information contained in video, and to avoid the narrowing of communication imposed by single-language text. This increases all forms of communication and insight, and avoids the cultural bias that can often happen when one language dominates the case material.

Living cases are not designed to teach finite "right answers", but rather to bring *unsolved dilemmas* into the classroom, office, hospital, or to patients and customers themselves, and to ask practitioners and participants to work creatively in crafting shared innovations within these complex social systems.

The point of these "educational solution" processes is to help people develop entrepreneurial senses and reflexes to help them become more effective collaborative innovators in the field.

Living cases also help entrepreneurs understand more deeply how to *enter the complex networks of society and build coalitions* beyond the immediately visible.

This is exactly what the innovators in the Mongolian Laparoscopy program did so well

Mongolian Laparoscopy Implementation Makes An Excellent Living Case

Producing living cases typically involves three steps. Because the point of the cases is not to teach "right answers" but to stimulate new thinking, dialogue, and ideas for action – the case development process emulates rapid prototyping in fluid environments like software creation. These steps are:

- Rapid Prototyping of Case Materials
- Testing and Adapting Prototypes With Actual Users
- Constantly Add New Material From Users to Keep the Cases "Living"

Step One - Rapid Prototyping:

Speed of production and testing with real users are often more important than precision in rapid prototyping. The years of accumulated material from the Mongolian innovators made this part of the process relatively easy for the case team.

The authors of this case quickly produced a prototype living case from the 8 years of Mongolia video, by cutting small "video bricks" and assembling them into sequences that illustrated the major entrepreneurial behaviors exhibited by the participants in the laparoscopy effort.

The pedagogical objective of the prototype was: could this Living Case material be used to help healthcare practitioners create programs similar to the successful entrepreneurial approaches used in Mongolia, and scale them to other low-resource regions? The aim was not to train surgeons to teach local doctors how to perform surgery, but how to help healthcare professionals facilitate user-driven programs that could be supported and "pulled" into existence by the society at large.

The process of extracting one case from the Mongolian material quickly revealed that there was much more that could be drawn from the years of documentation.

In fact, the case team was able to extract 7 prototype mini-courses, from the collection. They moved from building a case, to creating a "demo curriculum" from the seven themes that kept recurring in the work of the innovators. These themes were not instructions on specific methods, but *general principles of social engagement that were more likely to contribute to successful program implementation*.

The themes evident in the Mongolian material, and some of the draft teaching processes outlined by the case team were:

- *Scoping the Ecosystem in Advance Before Travel*

Prepare healthcare professionals to use simple note-taking templates on site, to help them expand their vision, and dig more deeply into what they were seeing once they arrived in a new culture.

Teaching process: have participants watch human networked behavior in the video and ask them to map human networks on three levels: *physical activity*, *information* that flows around the human activity, and the *"mental models" (laws, beliefs, fears, etc.)* that influence the networked behavior of people. This lets people practice visualizing human networks beyond what is immediately obvious.

- *Picking the smallest thing one could do with the largest benefit to the greatest number of stakeholders*

  Ask participants, "what is the smallest thing one can do right now with the largest value for all people in the surrounding network?" Laparoscopy can be seen as a defined surgical technique - but because it requires building an ecosystem of support, it can drive much larger derivative improvements in public health, such as infection control, sterile technique, waste and water management, energy reliability, medical literacy and community outreach.

- *Learning humility from the locals – they know their reality better than you.*

  The videos contained examples of locals using simple and resourceful tools to achieve innovative solutions for healthcare and non-healthcare needs. Use car batteries for surgery, for example. Have participants identify, and then map the networked benefits of simple locally-created innovations.

- *Finding champions in the local culture who will lead at many levels*

  Both patient and country-level champions were integral in driving the development, infrastructure and community trust needed to implement laparoscopic surgery in Mongolia. Ask participants to identify and discuss the attitudes and actions of leaders in the videos. "Leaders" could be anyone in the videos helping to organize activity – not just formally-appointed leaders.

- *Success brings ethical challenges – new social order always creates moral dilemmas*

  US audiences often project US legal standards onto cases in other regions. Use examples of different rules or ethics evident in the videos to let participants discover their own biases and process them before going on site in countries with different contexts.

- *Bring your best game, but still be humble*

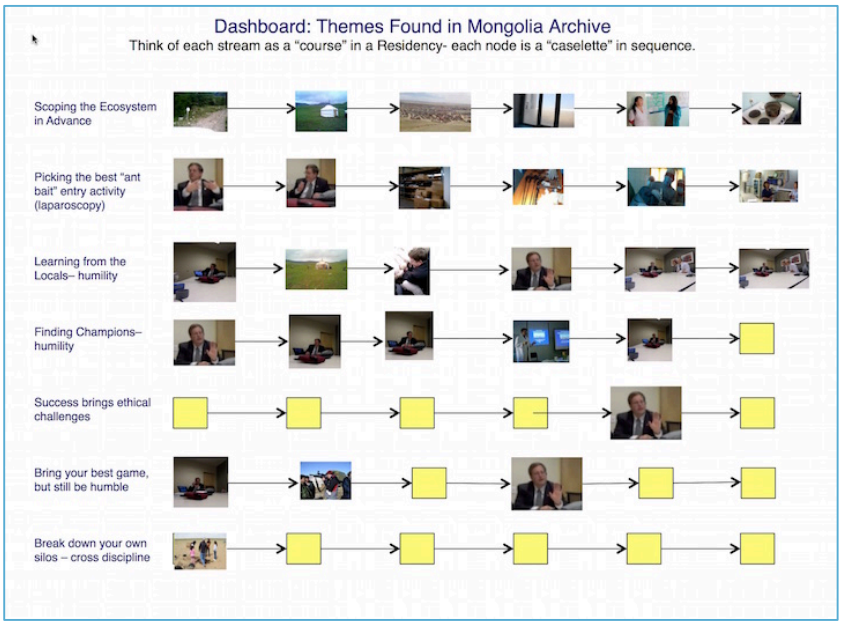
  Learn to be invited to help. Don't just jump in. Combine your advanced surgical talent with effective communication and listening technique. Video revealed surgeons discussing how they learned to find the balance between teaching and standing back.

- *Break down your silos*

  Healthcare roles are tightly defined in many countries. In cultures where roles are not so formally codified, understanding one's dependence on the local social networks is important. We ask participants to list all the contributors for a specific task and then think about how to engage them all. *The person who knows how to obtain gasoline for the generator might become the most important person on the surgical team at some point.*

In a relatively short time, the case team was able to assemble, and reassemble "video bricks" from the Mongolian innovators into demonstration mini-course themes. Below is one of the earliest rapid prototypes.

It is important to note that this kind of prototype can be quickly passed around the world on the internet, so one can get comment and collaboration quickly from many different groups.



This is a screen shot of the prototype living case as it was being built. Each clip illustrates a step in the theme, and the teaching process is to ask discussion questions after each clip, to help the theme emerge in discussion groups.

Step Two – Testing and Adapting: The Mongolian Experience Works Well in Many Environments

The prototype cases were tested in a number of different venues[4], and it became clear quickly the work done by the members of the multiyear Mongolian laparoscopy teams represented excellent teaching materials, even for many non-medical audiences.

This prototype living case, revealed that directly recording and analyzing the peri-surgical social, economic, emotional, environmental, and political factors was an effective process. It could help identify opportunities for innovation, and build collaborative teams to help implement them.

The case team also learned quickly how to adapt titles, the sequence of video clips, and other adjustments that helped make the material more easily understood across cultures.

Step 3 – Build on Successful Pilot Material - Visit to Mongolia November 2014

The authors of this case were invited to attend Mongolia's national celebration of the 20th anniversary of the introduction of laparoscopy in late November 2014. They decided to use this opportunity to construct a more formal implementation of the living case process. In Mongolia they would film in greater detail several elements that proved helpful in the living case prototyping process, and would help illustrate more clearly some of the successes contained in the informal videos of the Mongolian laparoscopic innovators.

For example, significant peer-reviewed studies now reveal that the social and psychological factors in a patient's life, or that of their family, can have important influence on surgical outcomes. Infection control is quite evident, but other factors like "sense of being in control" may have effects on outcomes as well.[6-9]

One living case technique often used to create awareness of psycho-social factors and to stimulate dialog on this peri-surgical environment, without asserting a point of view or advancing a hypothesis, is to shoot video *"walking the patient's pathway"* through their social setting before and after surgery.

This is perhaps the quickest and least expensive, in-the-field educational technique to help health care professionals increase their perception and awareness of the complex social, infrastructure, and cultural ecosystems that contribute to outcomes of health care innovations.

It is also quite useful in almost any cross-cultural classroom environment, to help teams of people bond and learn to listen to each other. Watching your peers see something completely different from you in the same video scene is an eye-opener.

[4] Several sample living cases were prepared. Some were largely people talking. Some were scenes or images of the surgical infrastructure. A characteristic of living cases is that the "video bricks" can be quickly re-assembled for very different audiences, and the team learned that combinations of "people talking" and "situational scenes" worked best.

To avoid patient privacy concerns, "in the life of" video is usually created by walking along the route a *"persona"* patient might walk – not by interviewing real patients.[5] This borrows from social engagement processes companies often use to understand their customers more deeply than by labeling them with abstract demographic labels like *income*, *age*, or *education*. They define a more complex "persona" and try to understand how this persona customer would *experience* the company's service in their home environment. *This technique is widespread and is a key element of "design thinking" which is increasingly used in healthcare environments.*

The authors walked several *personae patient pathways* in Ulaanbaatar, ranging from wealthy to low income "personae" patients. *(See Appendices for image samples from the videos)*

These patient pathway videos were then cut into short clips that are used to help an audience step through the patient experience of traveling to the hospital. An audience is asked read the scientific articles describing the influences of psycho-social factors on surgical outcomes, and then to put themselves in this video by "walking the patient pathway from home, to laparoscopic surgery and back." At several stops along the way, audience participants are asked to pause and reflect, collectively and deeply, about the psycho-social and environmental factors that *might* influence surgical outcomes.

The authors also find it useful to record the *hospital side of the patient pathway* – the walk through the sequence of services and professionals that patients experience as they progress through in-hospital care. The authors videoed two sample hospital pathways in Mongolia: one private and one public.

As previously stated, the point of this is not to teach what the effects of social influence are, but to increase the perceptual and empathic skills of medical professionals *a priori* to help better prepare them for on site collaborative system development.

Appendix 2 contains screen shots from two of the pathways walked and videoed by the authors in Ulaanbaatar. These are presented only to illustrate the concept, and are not as educationally rich as the video streams are in person.

Looking To the Future

As of February 2015, the authors and other collaborators were continuing to build in-depth, higher production quality living cases from the rich examples of the successful Mongolian laparoscopic surgery effort described in "A Successful Model for Laparoscopic Training in Mongolia."

The objective is to test these more structured living cases in global health courses in medical, nursing and public health schools; and to apply them at the executive and policy level to help with issues of funding, regulation, and strategy.

Collaborators from the surgical innovation team, and Mongolian leaders, were also beginning to implement a program of advanced trauma surgery modeled after the successful laparoscopic

[5] In the USA for example, this process can produce significant insight without risk of violating patient privacy or HIPAA regulations.

program. Early meetings on this were videoed in Mongolia in November 2014 and the global planning and collaboration of an integrated trauma surgery program has begun.[10]

Plans were underway to adapt the living case process in this new effort, to highlight public health implications, in addition to the successful model of surgical training.

All Entrepreneurial Ventures Create Surprise Discoveries Revealing Boundless Human Capacity to Innovate – the November 2014 Visit to Mongolia Did the Same

During the November 2014 visit to Mongolia the case authors were introduced by young Mongolian health care practitioners to three themes that may be pivotal to the strategic advancement of healthcare in the developing regions of the world:

- The *increasing cross-border traffic in what used to be called "medical tourism" may be stimulating new solutions to within-country health care barriers*. Like their wealthy counterparts in more than 40 other nations, Mongolian patients are increasingly going for surgical care in neighboring countries. This raises important questions for post-operative care, home-country investment in infrastructure, tele-health, and many other areas.

- *Private hospitals, like Thailand's Bumrungrad and others, who have been thought of as "medical tourism" destinations for Europeans and Americans, are now entering Mongolia, as they are in many other "developing" regions with rising incomes.* Increasingly these are managed by multi-country investors, and some observers suggest that they may supplant, or enhance traditional public hospitals in low-resource areas. This may represent a whole new dimension of "global healthcare".

- Both of the above point toward *emerging innovative forms of global health insurance* that are appearing elsewhere in Asia and Africa, and were being discussed in Mongolia. *Global health insurance, potentially financed by billions of low-income contributors, raises important questions for healthcare leaders and strategists working within the constraints of traditional 20th century nation-based models.*

These themes will represent interesting living cases in the rapidly changing "entrepreneurial business models" of global healthcare.

APPENDIX 1

SAMPLE VIDEO BRICK AND ITS EDUCATIONAL PURPOSE

A simple example of applying a "video-brick" in a Socratic-method classroom can be seen with the image below, where one might ask, "Why do you think people live in those yurt-like *gers,* in the middle of more standard permanent houses?" This stimulates research and discussion around Mongolian nomadic traditions, the increase of urbanization, the subsequent challenges of waste and water management in peri-urban areas such as the one below, electricity, television, social media, wireless communication, transport, work opportunities, environment, pollution and other aspects of Mongolian culture.

The teaching point for this image-based element of the case discussion was not to teach how to perform surgery in a resource limited environment, but to help increase future surgeons' perceptions and sensitivities to upstream events that have the potential to influence the outcome of surgical programs. For example we were told that people living in the *ger's* would often move around the city as work locations changed, which would mean that pre- and post- surgical communications, and therefore surgical outcomes, could be affected by this cultural practice.

Bricks like these are arranged in sequences of 3-10 to create anything from a "class" to a "mini course" on a theme.

APPENDIX 2

PATIENT PATHWAY SAMPLES FROM MONGOLIA VISIT NOVEMBER 2014
These are still images extracted from video clips

Pathway: Low-Income Nomadic Patient

From home to Hospital	Facts	Discussion Questions
	Ger (tent) cluster at edge of city. Temperature -10C. Newborn child at home. Larger image has household items in yard.	Ask questions designed to elicit thinking about home living conditions and customs. Students go online to research.
	Ger village on way to city. Gravel pit nearby recently closed. People living in ger's may move to find work. Patient must walk 3 KM through this area.	Questions on economic factors. How can health care system adapt peri-surgical care for nomads who move unpredictably?
	Reach city in valley. If patient has money, can take the bus. If not must walk 5-8 more KM to hospital. Short daylight in winter.	Influence of environment. Exhaust and coal smoke severe. Can feel residue on one's teeth when breathing. What effects of this? Transport economics? Traffic? Safety?
	Shamanic site. Many patients stop here to seek answers and advice on healthcare, marriage, economics, etc.	Role of religion in surgery? How does surgeon deal with religious advice that affects surgery?
	Public hospital. Very busy and many more people waiting than seats in waiting areas.	How does the hospital environment affect outcomes? Medical records? Economics? Impact on patient trust of medical/surgical staff?

Pathway: Upper-Middle Income Patient

From Home to Hospital	Facts	Discussion Questions
	Lives in new condo complex in city. Salary approximately $400 US per month. Economic growth had been more than 15% per year before 2013. Many partly-finished new buildings.	What communications might they have? How might it impact the care they receive? What do you imagine their day is like? *Go online to research*.
	Drive through downtown traffic. Very large number of Toyota Prius hybrid vehicles. Observe how people cross the streets. See old and new construction.	What does it cost to maintain a private car? How do you think this changes the way people think? What infrastructure effects? What implications for surgery?
	Ample parking at private hospital.	How does this relate to the patient experience? Theft rates are high in the city. Any effects?
	Clean private hospital with near-luxury waiting areas. Investment comes from outside Mongolia. Have students watch YouTube videos of parent hospital in Thailand.	What does this say about patient experience? Impact on patient trust? What does it suggest about future of care in Mongolia? Or of future education of Mongolian doctors?

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