Non-Doctors as Trauma Surgeons? A Controlled Study of Trauma Training for Non-Graduate Surgeons in Rural Cambodia

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Abbreviations:
ISS = Injury Severity Scale
VAS = Visual Analog Scale

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Abstract

Introduction: Due to the accelerating global epidemic of trauma, efficient and sustainable models of trauma care that fit low-resource settings must be developed. In most low-income countries, the burden of surgical trauma is managed by non-doctors at local district hospitals.

Objective: This study examined whether it is possible to establish primary trauma surgical services of acceptable quality at rural district hospitals by systematically training local, non-graduate, care providers.

Methods: Seven district hospitals in the most landmine-infested provinces of Northwestern Cambodia were selected for the study. The hospitals were referral points in an established prehospital trauma system. During a four-year training period, 21 surgical care providers underwent five courses (150 minutes total) focusing on surgical skills training. In-hospital trauma deaths and post-operative infections were used as quality-of care indicators. Outcome indicators during the training period were compared against pre-intervention data.

Results: Both the control and treatment populations had long prehospital transport times (three hours) and were severely injured (median Injury Severity Scale Score = 9). The in-hospital trauma fatality rate was low in both populations and not significantly affected by the intervention. The level of post-operative infections was reduced from 22.0% to 10.3% during the intervention (95% confidence interval for difference 2.8–20.2%). The trainees' self-rating of skills (Visual Analogue Scale) before and after the training indicated a significantly better coping capacity.

Conclusions: Where the rural hospital is an integral part of a prehospital trauma system, systematic training of non-doctors improves the quality of trauma surgery. Initial efforts to improve trauma management in low-income countries should focus on the district hospital.

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Background

The epidemic of trauma is accelerating. Currently, injury is the fourth leading cause of global deaths, and the World Health Organization (WHO) estimates a 40% increase in global deaths from injury from now to 2030. Approximately 75% of trauma fatalities occur in low-income countries.[1,2] Who will manage this heavy trauma load during disasters and chronic emergencies such as the landmine epidemic?

Studies of Western trauma scenarios consistently report that Level-1 Trauma Centers and reduced prehospital transport times are essential components of a good trauma care system.[3,4] However, high-cost surgical centers are not feasible in countries in which the majority of citizens live in rural areas with poor communication systems and high prehospital transit times. Low-cost, prehospital trauma systems reduce trauma mortality in such settings.[5] However, this leaves the question open: who should provide primary surgery to the prehospital survivors? One option is to establish Western-model surgical centers as part of external relief programs. Such emergency interventions often prove to be "too much, too late".[6] Short-term external interventions are not sustainable; they are not integrated into or within the indigenous medical infrastructure, and they may even weaken the capacity of the host country.[7,8]

The World Association for Disaster and Emergency Medicine (WADEM) launched a call for evidence-based international standards for disaster medicine training and education standards.[9] However, evidence-based standards may not be applicable universally. Despite the efforts of low-income countries to accelerate the production of medical doctors, extensive brain drain increases the gap between needs and in-country resources. As contexts differ, systematic studies of the outcomes of training programs in high- and low-income countries are needed. In a study from Ghana, Mock *et al* recommend that rural trauma programs in low-income countries should focus on local district hospitals.[10] Training non-graduate medical officers for emergency surgery has proven to be successful in Africa. Since 1995, Mozambique has had a national program at the rural district hospitals in which medical assistants with four years of prior formal medical education completed a comprehensive training program in basic trauma and emergency obstetrical surgery. Using mortality and post-operative infection rate as results indicators, Pereira *et al* reported that district hospital care providers did as well as trained obstetricians at the university hospital after completing the training program.[11] Thus, there are good reasons for exploring a strategy of non-formal, non-Western training models to enhance the quality of trauma care in low-income countries.

The aim of the intervention was to examine whether an acceptable standard of local capacity can be built by a moderate upgrading of the existing medical infrastructure. The quality-of-care impact of a systematic training program in primary trauma surgery for non-graduate medical officers at rural hospitals in Cambodia is examined in this study. The intervention is designed as a controlled study using pre-intervention rates of trauma mortality and wound infection as baselines for outcome assessment.

Methods

From 2002 to 2005, the intervention was conducted in Northwestern Cambodia in areas in which landmines and unexploded ordnance contaminate most villages and forest areas.[12] The trauma epidemiology in the study area is changing. Despite extensive mine clearing programs, local farmers still are injured in landmine accidents, especially during logging and clearing jungles for large-scale agriculture. In addition, road traffic is increasing rapidly, and rising numbers of traffic casualties are brought to the local hospitals.

In agreement with the Cambodian Ministry of Health, seven rural district hospitals with established prehospital trauma systems were selected as study hospitals.[5] The catchment area of these hospitals has a population of approximately 1.5 million. The study hospitals are located 100–150 km (62–93 miles) from the nearest urban surgical center. Local roads are in poor condition, and transport to the surgical center takes 2–4 hours during the dry season. During the rainy season, most roads cannot take referrals by car.

Background

Cambodia's medical infrastructure is broken by decades of war and political unrest. The district hospitals in this study did not have operational laboratories, blood banks, or x-ray equipment. There was a shortage of essential drugs and surgical instruments. The responsibility for in-hospital nutrition rests on the families of the patients, as the hospital provides just one low-calorie meal per day. Diseases affecting surgical outcome are endemic, and so is malnutrition.[13] In order to standardize conditions, when the intervention began, all study hospitals were upgraded with basic surgical sets, generators, suction units, electro-cautery units, surgical lamps, autoclaves, and regular supplies of essential drugs.

Trainees

Most surgical care providers at Cambodia's district hospitals are assistant medical officers with just four years of formal medical training, but extensive hands-on experience in primary trauma surgery. From 1967 to 1999, these non-doctors managed the main burden of war trauma with what resources they had at hand. The majority of trainees selected for the actual training program also had studied surgery at makeshift jungle hospitals in the 1970s under the Paris-trained Khmer surgeon Thoun Thieun, at that time Minister of Health of Democratic Kampuchea. Thus, they were quite skillful in hands-on surgical techniques and improvisations, but far from updated in systematic strategies for damage control surgery and post-operative care. To ensure that empowerment gained through the actual training program remained at the local hospitals, there were strict selection criteria for the trainees. They should: (1) be recommended by their local community for good medical skills and moral standing; (2) have at least five years' practical surgical experience; (3) live and work permanently at their respective rural hospitals; and (4) sign contracts to stay after the program was concluded.

Surgical Training

The authors provided training during five consecutive 150-hour courses. The courses were provided at the district hospitals included in the study. The "Village University" teaching model that already had proven its success in establishing prehospital trauma systems in the area was applied in this study.[5,14] This teaching model builds on four pillars:

1. *Confidence*—People learn better and feel more comfortable asking questions when feeling confident and at home. The "Village University" always is located where the students live and work. Trainers and trainees live and work together during the training;
2. *Troubleshooting*—Rigid treatment protocols do not work in a dangerous and dirty social context. The students should learn to identify the main problem of each patient, attempt to solve that problem, then identify the next main problem, and so on;
3. *Learning by Doing*—Lectures constitute no more than 25% of the course. Practice always should follow classes; and
4. *This is a University*—Teaching and treatment methods should be professional, up-to-date, and of a high standard.

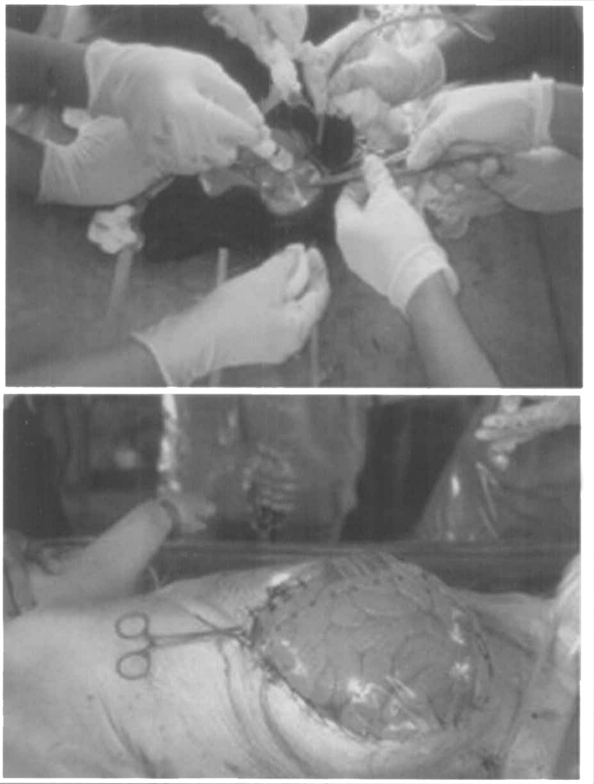

Figure 1—Training surgical techniques on anesthetized animals: debridement and repair of compound skull fractures; temporary ("Bogota Bag") closure after damage control laparotomy.

During the training courses, live, injured animals under ketamine anesthesia were used extensively for the training of surgical techniques and teamwork. Pigs were used for chest and abdominal surgery; dogs and goats were used for skull and limb injury management (Figure 1). The animal model also was used for pre- and per-operative anesthesia training. The training protocol is summarized in Table 1. During each course, the procedures taught during previous courses were rehearsed. Ample time was used for the trainees to present patient cases from their hospitals for group evaluation.

Researcher Training

To enable the local trauma care providers to perform scientific studies of the problems they face in their local setting, and design and test feasible interventions that might be useful, the training program also included formal research training. The trainees attended a three-week course in research methodology and basic medical statistics provided by European scholars. The course fulfilled international requirements for PhD training, and the trainees were certified accordingly. This article is a post-course thesis produced by two of the researcher trainees (HYV, DC).

Data Gathering and Statistical Platform

The main outcome variables in this study are in-hospital trauma mortality and rates of post-operative wound infections. Before the training program was launched, the authors conducted a survey of trauma deaths (trauma-related death within 30 days post-injury) and post-operative infections in trauma patients at the district hospitals under study. *Post-operative wound infection* was defined either as surgical re-debridements performed after the initial operation, or by one of three signs: (1) local inflammation; (2) local pus; or (3) local gas production. All patients consecutively admitted to the study hospitals during 2000 and 2001 were included in a pre-intervention survey under supervision by the authors (YVH and CD). When validating the hospital files, it became evident that there were flaws in the medical documentation at the time (2001); the only severity indicators that could be gathered were prehospital transport times and operating theater diagnosis, which was used for Injury Severity Score (ISS) calculations.[15] During the intervention period, the quality of medical documentation improved, and monthly, the authors collected and validated data on all trauma patients consecutively managed by the 21 trainees at the six district hospitals. The explanatory variables in the treatment group include prehospital transfer times, physiological and anatomical severity indicators, and surgical treatment. All 21 trainees included in the training program practiced as surgeons during the pre-intervention and intervention period.

The trainees' coping capacity when faced with serious trauma cases was used as the secondary outcome variable. To assess this factor, the trainees were asked to assess their own skills before the training program started, and again when the four years of training was concluded. A Visual Analogue Scale (VAS) was used for self-rating.[16]

In rural areas with long prehospital transport times, most fatalities occur during the prehospital phase.[5] Thus, in-hospital mortality rates are rather low and cannot be used for statistical comparison of changes in treatment results unless study samples are large. Therefore, post-operative rates of wound infection were used as an outcome indicator for sample size estimation in the actual setting. Setting the confidence level at 95%, test power at 80%, and defining a 50% reduction in complication rate as clinically significant improvement, the sample size for the actual study should be approximately 190 patients. The pre-intervention (control) group included 169 patients, but due to flaws in medical documentation at that time, 60 patients were excluded from study. During the intervention, it became clear that one of the seven study hospitals received few trauma cases (n = 4), so patients from that hospital were excluded from the study. A total of 262 patients were managed at the remaining six hospitals during the intervention period. Forty-one patients in the treatment group were excluded due to a lack of valid information.

Confidence interval analysis was used to compare proportions and means, and differences were considered significant at 95% level if the 95% confidence interval (95% CI) for the difference did not include zero.[17]

Results

Process Indicators

A group of 21 surgical care providers were trained in five courses (150 minutes total) during 2002–2005. Except for two graduate doctors, all trainees were assistant medical

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Trauma Life Support	Endotracheal intubation. Emergency crico-thyrotomy Chest tube placement Temporary bleeding control: External compression of abdominal aorta Subfascial packing of extremity wounds Ketamine analgesia and anesthesia
General	Wound tracks and projectile ballistics Two-staged surgery in critical cases Primary debridements and delayed primary closure Drainage techniques Hypothermia prevention during surgery
Head/Face Injury	Debridement of superficial traumatic brain injury Repair of dural tear Replacement of skull fracture fragments Skin flaps for wound closure
Chest Injury	Thoracotomy Debridement and suture of lung injuries
Abdominal Injury	Temporary bleeding control Aorta compression Clamping of arteries Gauze packing Temporary closure of intestinal tears Temporary closure techniques Debridement and repair of tears to solid organs
Pelvic Fracture	Bleeding control Extra-peritoneal packing External compression of pelvic girdle
Limb Injury	Fasciotomy External fixation of fractures; muscle flap transfer Plaster craft Amputations Surgical techniques Immediate temporary prosthesis mobilization

Table 1—District hospital trauma training program

	Mean VAS score before training (mean ± SD)	Mean VAS score after training (mean ±SD)	VAS score difference*
Overall confidence	4.7 ±1.62	7.8 ±1.34	2.2–4.0
Surgical skill	4.5 ±1.47	7.6 ±1.06	2.3–3.9
Teamwork	5.2 ±2.07	8.4 ±1.15	2.2–4.2

Table 2—Trainees self-rating of their capacity before and after the training period, Visual Analogue Scale (VAS) scores (n = 21)
*95% confidence interval for the difference

officers with four years of formal medical training. All trainees passed the course examinations and were certified and encouraged to extend their training to their respective hospital teams. The trainees assessed the training impact by self-rating using VAS before and after the training period. The VAS analysis indicated a significant improvement in self-confidence, surgical skill, and teamwork (Table 2).

Patient Characteristics and Risk Factors

The pre-intervention (control) group included 109 patients and the treatment group included 223 trauma patients. The control and treatment group were similar, as both populations mainly had penetrating injuries (80%, 87/109 versus 72%, 161/223 landmine and gunshot injuries; 12%, 13/109 vs. 21%, 47/223 traffic casualties, respectively). In both

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	Hospital 1 n = 90	Hospital 2 n = 31	Hospital 3 n = 38	Hospital 4 n = 21	Hospital 5 n = 10	Hospital 6 n = 33
Prehospital transport time (mean hours)	20 ±1.5	3.0 ±1.5	2.5 ±1.5	4.4 ±2.5	5.2 ±4.1	3.7± 3.2
Injury Severity Score	8.5 ±4.7	8.0 ±2.6	8.3 ±4.4	9.1 ±4.0	4.5 ±2.6	4.7 ±3.1
Physiological severity	7.3 ±0.9	7.8 ±0.1	7.7 ±0.4	6.6 ±0.8	7.7 ±0.2	7.4 ±07
Extremity injuries	66/70 (73%)	28/31 (90%)	36/38 (95%)	19/21 (90%)	6/10 (60%)	21/33 (64%)
Critical area injuries*	24/90 (27%)	3/31 (10%)	2/38 (5%)	2/21 (10%)	3/10 (30%)	8/33 (24%)
In-hospital deaths	1/90	0/31	0/38	1/21	0/10	0/33
Rate of post-operative infection	11/90 (12%)	3/31 (10%)	1/38 (3%)	6/21 (29%)	0/10	2/33 (6%)

Table 3—Patient risk factors and outcome variables by hospital (treatment group) ±standard deviation
*Critical area: Head, face, neck, chest, abdomen, pelvic content, or spine

groups, the median ISS = 9 and 12% of patients were major trauma victims (ISS >15). Prehospital transport times were long (mean = 3.3 ±2.9 vs. 2.8 ±2.2 hours). One-quarter of all patients had prehospital transit times of >4 hours. Upon admission to the hospital, 42 patients in the treatment group had physiological severity scores ≤7.0 indicating serious physiological derangement (equivalent data could not be obtained for the control patients). Risk factor distribution among the hospitals is listed in Table 3.

Comparison of Outcome Indicators

There were four in-hospital deaths in the control group (3.7%) and two fatalities (0.9%) in the treatment group (0.9%, 95%CI for differences = -0.9% to 6.5%). In the control group 24/109 patients (22%) had post-operative wound infections. During the four years of training, 23/223 (10.3%) cases of post-operative infections were registered in the treatment population, which is a statistically significant reduction (95% CI of difference 2.8–20.2%). One of the six study hospitals did not improve performance during the intervention period (hospital 4, Table 3). The rate of infections at this hospital was significantly higher (28.6%, 6/21) compared to the other five hospitals with a mean rate of infections 8.4%, 17/202 (95% CI for difference = 0.5–40%).

Case Report

A 24-year-old male was treated at Hospital 1 in 2004. He fell off his motorcycle and the handlebar struck him in the right upper quadrant of his abdomen. Upon hospital admission two hours after the crash, he was unconscious; respiratory rate was 40/minute; systolic blood pressure was 70 mmHg. An immediate flush infusion of 4,000 ml of warm electrolytes had no impact on his circulatory parameters, and he was taken for laparotomy one hour after admission. During the pre-operative preparations, one member of his family was called, and donated 400 ml of blood for transfusion. Two medical assistants who had attended the training courses performed the surgery under ketamine anesthesia. Two deep lacerations in the right lobe of the liver still were bleeding. The hemorrhage was controlled temporarily by finger clamping the liver vessels and manual compression on large gauze packs for 15 minutes. During this period, the fresh, warm, blood transfusion was given, and other abdominal organs were explored without finding associated injuries. Removing the gauze packs but still finger-clamping the liver vessels, the liver wounds were sutured. The team leader decided there was no need for staged surgery, closed the laparotomy incision, and provided hypotensive fluid resuscitation for 24 hours keeping the systolic blood pressure at 90–100 mmHg. There were no signs of re-bleeding, and the patient was discharged after six days without post-operative complications.

Discussion

This study indicates that rural hospital non-doctors are able to provide primary trauma surgery with lower mortality and morbidity rates when they are well trained and equipped with a minimum of resources. Reduced complication rates, better surgical skills, and understanding of team performance demonstrate the efficacy of this non-formal training program. The results of this study also are relevant for trauma system design: the actual intervention was conducted in an area in which a prehospital trauma system already was well established. Despite long prehospital transport times

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and rough off-road evacuations, the majority of patients could be admitted to the hospital without gross physiological derangement. This is an integral part of a comprehensive rural rescue network to be instrumental for good trauma system performance in rural and remote areas.

Several variables in the study should be discussed. First, in-hospital mortality and post-operative infection are short-term outcome indicators and do not fully reflect the quality of surgical care. Especially in communities with labor-intensive household economies, long-term quality of care indicators such as fracture healing and post-operative rehabilitation also should be examined.

The quality of the medical documentation was poor prior to the intervention. For this reason, as many as 60/169 (36%) of the pre-intervention patients had to be excluded from the study. That left a smaller than estimated control group (109 vs. 190). Thus, the estimate of the pre-intervention outcome indicator (post-operative infection rate) was less precise than expected by the study design. Despite wide confidence intervals for the control group estimate, the confidence interval analysis documented a statistically significant improvement in outcome. When it comes to trauma mortality, the study population is too small to allow for solid statistical comparisons due to small proportions reported (3.7–0.9%) and consequently, wide confidence intervals for the mortality estimates. A tendency toward statistically significant mortality reduction (95% CI for difference -0.9% to 6.5%) still was found. It is probable that a larger sample size would prove significant mortality differences. The study population also is too small to examine subsets and strata among trauma victims. From the data, the particular types of trauma not well managed at the study hospitals cannot be singled out, nor fields of surgical practice not properly addressed in the training curriculum be identified.

Further, there have been trauma patients in the catchment area taken directly to surgical centers, either in Cambodia or across the border to Thailand, bypassing the local district hospital. Such referrals mainly may be a matter of family income, depending on what the patients' family could afford, more than referrals being based on strict medical indications. Therefore, this selection factor should affect the study population at random and not influence the study outcomes.

The individual surgeon's experience and volume of operations clearly is an uncontrolled variable in the study. Reports from Western Level-I Trauma Centers indicate that per-surgeon patient volume does not predict trauma mortality.[18,19] Still, it may be that the caseload impact can be a significant explanatory factor in settings where algorithms and team routines are less standardized and institutionalized—as in the hospitals under study.

Pre-injury illness such as malnutrition and endemic diseases are other uncontrolled variables that affect trauma physiological capacity of patients and trauma care outcome. In a straightforward and small clinical study such as this one, it is unfeasible to measure such variables. Also, such variables are difficult to quantify. However, it is unlikely that major changes have occurred in prevalence rates of nutrition and endemic diseases in the study area over a short time span of five years; Cambodia is a socially stratified country and the study patients come from remote rural areas unaffected by the economic development recently seen in the urban areas.

Interestingly, in one study hospital (Hospital 4), the intervention failed to reduce post-operative morbidity. The two trainees from this hospital did not share their new knowledge learned with their hospital teammates. Thus, the training program did not have any impact on emergency room routines or surgical procedures in that particular hospital. It seems that extension of training programs to include all in-house teams on-duty is one key factor for success. Also, the appreciation given by trainees themselves of better team performance supports such conclusion.

In a study from Malaysia, Sethi *et al* compared trauma care outcome at district hospitals and surgical centers. They found that surgical care at district hospitals contributed to increased trauma mortality.[20] The current study does not dispute this finding; as in other low-income countries, Cambodia needs Level-I Trauma Centers and better referral systems. However, the country currently does not have financial and medical resources to take on the challenge. It is feared that a top-down approach with a focus on Level-1 without operational district hospitals being established primarily will result in unnecessary mortality and morbidity of trauma patients.

Conclusions

Initial efforts to improve trauma management in low-income countries should focus on prehospital care and the local district hospitals. Where the rural hospital is an integral part of a prehospital trauma system, systematic training of non-doctors improves the quality of trauma surgery. In order to be sustainable, careful selection of trainees and practical, on-site education seem to be success factors. To build better disaster management in the rural South, results from this study suggest building a sustainable, local, minimum-acceptable quality service—which, during disasters and hard times, can be supplemented by external emergency relief inputs of Level-I quality.

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Non-Doctors as Trauma Surgeons?

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Some papers send more than just one message. And sometimes, the number of messages is unintentional or at least not explicitly debated in the article. Such papers have been produced before, but perhaps we should elaborate on these imbedded signals.

The primary messages brought forward by this paper include:

1. Non-doctors, if properly trained, but lacking pathophysiological insight, can provide acceptable surgical care and raise the standard of health care;
2. Training in science can be and should be dovetailed into capacity building as an integral part of quality control;
3. Scientific work can be performed outside the laboratory and the established, high-tech hospitals. Science/evidence can be produced where everyday activities occur; and
4. Large Level-1 Trauma Centers probably are cost-ineffective in most low-resource regions as they consume too many resources and most people do not have access to them.

The facilitators of this paper have concentrated their expertise on the betterment of the least developed regions, where resources normally are few and far between, and the standard is at a much lower level compared to the industrialized world. This article describes how two training programs have been combined: (1) how to improve performance; and (2) how to measure and control your performance.

Cambodia and similarly affected regions would have to wait for a long time if they were to focus directly on achieving the standards of western society healthcare systems, bypassing the necessary steps of development. However, they may have sacrificed the good while waiting for the best. Even the best may be inappropriate because the logistical system would not have been able to support it. We have seen this over and over again when western high-tech solutions have been imposed on low-resource areas that do not have the financial, logistical, and technical support systems able to sustain them. Healthcare models of western societies cannot just be copied into developing countries and low-resource regions. The balance between "never let the best be the enemy of the good" and Alexander Pope's statement "A little knowledge is a dangerous thing" is not always easy to achieve. This balance that must be understood and adhered to when engaging in capacity- and competence-building outside the "established" medical society. The ability to produce evidence that makes a difference through education and training in research and quality control, a new standard for international humanitarian assistance is set. Therefore, sustainable development is facilitated, and, at the same time, evidence-based medicine becomes unconfined to high-resource societies. Grassroots science can be and should be done in the greatest laboratory ever created, namely in the daily lives of those working, mostly on their own, far out in the rural area and under far harsher condition than most of us are able to fathom.

Interestingly, one aspect of their conclusions may even be expanded beyond the scope of developing countries. Healthcare concepts, both strategic and

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tactical, that work in densely populated areas, may be counterproductive in less densely populated areas/countries. For example, what works in the Netherlands, Belgium, Germany, or New York, may not necessarily apply to Alaska, Iceland, or Norway.

There is one sentence in the introduction that requires discussion: "evidence-based standards may not be applicable universally." But this is what this paper is all about, to produce evidence for appropriate standards for a specific scope of regions or resource situations. I see this as a paper providing evidence as to when good is better than best or when "the best becomes the enemy of the good". Consequently, the best standard strategy and operational objective in high-resource countries may be counterproductive if applied to low-resource areas. There are ample examples of such humanitarian initiatives.

This program underlines how systematic training programs based on integral resources and competence added well-conceived capacity building programs that resulted in a sustainable improvement. However, a couple of questions are appropriate. As the authors indicate, the endpoints they have chosen do not necessarily tell the full story. What about the rehabilitation—bringing patients back to normal functions—or the opposite, becoming a dysfunctional part of an already burdened society? These seven hospitals all were upgraded to a certain standard, still lower than a hospital in highly industrialized countries, but significantly higher than their rural counterparts. Will the upgrading of these hospitals be sustainable in every sense? Otherwise, programs like this might be just another cause of frustration; you turn enthusiasm into apathy like when you open the gate to give people a short glance at better way of living, only to brutally close the door thereafter.

That said, this paper underlines that there are opportunities for betterment of every region and country. We all should grab these opportunities to broaden our own knowledge base and help strengthening the competence of others. Take notes, collect data. There are many ways and methods to do science. Double blind, randomized trials are but one of them. There is a large unexplored territory for sources of wisdom and insight out there just waiting for your initiative.

Call for Artwork

The cover design of *Prehospital and Disaster Medicine* calls for a photograph of relevant artwork.

If you have access to artwork that you think may be appropriate, please submit a high-resolution print or an electronic file (in TIF or JPG format) to:

Dana Schmidman, Editorial Assistant
3330 University Avenue, Suite 130
Madison, Wisconsin 53705 USA
E-mail: ds5@medicine.wisc.edu

All submissions will be evaluated by a panel of judges.
Items not selected will be returned to the sender.

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