Status of Trauma Quality Improvement Programs in the Andean Region: What Foundation Do We Have to Build on

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Abstract

Introduction—Trauma quality improvement (QI) programs have been shown to improve outcomes and decrease cost. These are high priorities in low- and middle-income countries (LMICs), where 2,000,000 deaths due to survivable injuries occur each year. We sought to define areas for improvement in trauma QI programs in four LMICs.

Methods—We conducted a survey among trauma care providers in four Andean middle-income countries: Bolivia, Colombia, Ecuador, and Peru.

Results—336 physicians, medical students, nurses, administrators and paramedical professionals responded to the cross-sectional survey with a response rate greater than 90% in all included countries except Bolivia, where the response rate was 14%. Eighty-seven percent of respondents reported morbidity and mortality (M&M) conferences occur at their hospital. Conferences were often reported as infrequent – 45% occurred less than every three months and poorly attended – 63% had five or fewer staff physicians present. Only 23% of conferences had standardized selection criteria, most lacked documentation – notes were taken at only 35% of conferences. Importantly, only 13% of participants indicated that discussions were routinely followed-up with any sort of corrective action. Multivariable analysis revealed the presence of standardized case selection criteria (OR 3.48, 95% CI 1.16–10.46), written documentation of the M&M conferences (OR 5.73, 95% CI 1.73–19.06), and a clear plan for follow-up (OR 4.80, 95% CI 1.59–14.50) to

be associated with effective M&M conferences. Twenty-two percent of respondents worked at hospitals with a trauma registry. Fifty-two percent worked at institutions where autopsies were conducted, but only 32% of those reported the autopsy results to ever be used to improve hospital practice.

Conclusions—M&M conferences are frequently practiced in the Andean region of Latin America but often lack methodologic rigor and thus effectiveness. Next steps in the maturation of QI programs include optimizing use of data from autopsies and registries, and systematic follow-up of M&M conferences with corrective action to ensure that these activities result in appreciable changes in clinical care.

Background

Globally, an estimated 973 million persons sustain an injury warranting healthcare each year, one in ten deaths is due to injury, and more human life and health (as measured by disability-adjusted life years) are lost due to injury than HIV, TB, and Malaria combined. [1,2] In low and middle-income countries (LMICs), where 83% of the world's population lives, one out of every three persons who dies as a result of severe trauma would have survived their injuries if they were to receive care similar to that provided in a high-income country. That is almost 2,000,000 deaths due to survivable injuries, and given the disproportionate incidence of injury among young working-age people, a tremendous, avertable, economic and societal burden. [3–5] Trauma care providers in LMICs are thus currently faced with an enormous burden of disease, and are currently operating with training, resources, and infrastructure which contribute to a dramatic, untenable, global disparity in outcomes. [1]

Implementation of quality improvement (QI) programs such as morbidity and mortality (M&M) conferences, trauma registries, and audit filters, can decrease cost, increase efficiency, and improve outcomes. [6,7] The World Health Organization (WHO) has recognized the key role of QI programs in trauma care. This is evidenced by inclusion of dedicated guidelines for QI as one of three seminal WHO guidelines directed at improving global trauma care. [6,8,9] The Panamerican Trauma Society was an early adopter of these QI guidelines, and has spearheaded their translation and dissemination, along with an associated two-day training course, in Latin America since 2009. [10] However, it is unclear to what extent QI practices are actually being implemented in the Andean region, and in LMICs in general. A recent review of implementation of the WHO trauma QI guidelines found only seven reports of implementation of the QI guidelines in Latin America, none of them in the Andean region. [11] A 2013 systematic review of global trauma registry implementation returned only three examples from Latin America, a similar review published the year before returned zero. [12,13] Documentation of M&M conference practices in LMICs is also scarce, and is largely limited to comments regarding the presence or absence of these conferences. [14–17] Few assessments of M&M components (case referral, selection, presentation, discussion) were identified in the literature, and these only at United States academic centers. [18,19]

We sought to evaluate the on-the-ground practices of QI in the Andean region of Latin America. Detailed investigation of the current level and mode of implementation will

provide an informed position from which to draft next steps in the dissemination and maturation of QI programs in Latin America, and LMICs at large.

Methods

This cross-sectional, descriptive study was conducted in four middle-income countries in the Andean region of Latin America. The gross national income per capita for the included countries; Bolivia ($2,870), Colombia ($7,970), Ecuador ($6,090), and Peru ($6,360), is significantly lower for each country than the Latin American average ($8,990).[20] These four countries of the Andean region are characterized by a common ancestral language (Quechua and Aymara), Spanish colonial history and official language, topography, and more recently, a political and economic pact: the Andean Community of Nations.[21,22]

The University of Washington and the Universidad Peruana Cayetano Heredia ethical committees approved this study. We administered an anonymous, single-page questionnaire (Supplemental Figures 1 and 2) regarding trauma QI practices to healthcare providers of all levels of clinical training in Bolivia, Colombia, Ecuador and Peru. Potential subjects were approached between July 2015 and January 2016. Subjects in Bolivia were contacted while attending an international academic trauma conference. In Colombia, data were collected at four urban hospitals where local investigators had professional contacts. In Ecuador, data were collected at six hospitals in two cities, and one national surgical training course, similarly, where local investigators had professional contacts. In Peru, data were collected at 10 hospitals reported by local contacts to have high trauma volume in the capital city, and at one rural surgical training course. We are unable to estimate the number of hospitals represented as many respondents were from national conferences and were not asked the name of their home hospital to preserve anonymity.

The Spanish language questionnaire was based on the current literature, and underwent several modifications, including after initiation of data collection in Colombia and Peru. Thus, sample size for certain questions, in particular those pertaining to details of the M&M conferences, varies. The questionnaire included respondent demographics, hospital descriptors such as size and location, objective QI practices such as frequency of M&M conference and presence of a trauma registry, and subjective factors such as adequacy of case presentations at M&M conferences and relative validity of sources of medical information. Of the 22 questions on the survey, six included a free text, qualitative, component. An explanation of terms was provided at the beginning of the survey, defining M&M as referring to "any meeting where complicated cases ("morbidity and mortality") are routinely reviewed".

STATA (StataCorp. 2015, College Station, TX) was used for data analysis including descriptive statistics on all items. Qualitative data were inductively coded, and the frequency of coded responses presented.

Multivariable logistic regression was used to estimate contribution of study variables on the likelihood of the participant responding positively to the question: "Have you ever witnessed a change in your institution as a result of a discussion had at an M&M conference?". Fifteen

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variables hypothesized to be the most likely to predict response to this question were entered into a saturated model. Country of origin was entered as a dummy variable, and due to inadequate number of responses Colombia was excluded. Peru was used as a reference category. For all variables, "I don't know" was treated as "no". Blank responses were excluded and the number of valid values, or included responses, is listed for each variable in Table 6. For the variable "Presence of plan for follow-up to the M&M conference" the following responses were considered to represent presence of a plan: "the chief decides", "it is discussed again at another conference" and free text responses "a report is made", "applied to patient management", or "develop a protocol". "It is collected / stored", "other" without explanation, "I don't know", and "nothing" were considered to represent absence of a follow-up plan.

Results

336 responses were collected, with a response rate of 100% in Ecuador, 100% in Colombia, 90% in Peru, and 14% in Bolivia. (The sole method of data collection in Bolivia was passive collection of surveys at an international academic trauma and acute care congress.) Respondents most commonly worked at hospitals with fewer than 500 beds, in urban locations, about half of which were considered "public", and the respondents were primarily either physicians or in training to be physicians. (Table 1.)

M&M conference frequency, attendance, and other forums for discussion of errors

A vast majority of respondents (87%) worked at institutions where M&M conferences are practiced. A majority (97%) of respondents reported the presence of some place to discuss errors in their hospital, whether it was only the M&M conferences (28%), or also other formal or informal institutional forums (40%). Respondents from hospitals with M&M conferences reported these conferences to occur at least monthly in only 53% of cases. Fifty percent of respondents at hospitals with M&M conferences reported five or more attending physicians present at these conferences. (Table 2.)

M&M conferences - case referral and selection

A majority (62%) of M&M conferences included discussion of only one or two cases. The primary perceived objective of the meeting was most frequently to prevent errors and improve the healthcare system. The objective was less frequently perceived to be to acquire the opinions of colleagues for the further management of complex cases (22%), and education was cited as the primary objective of the meeting in only 11% of surveys. The somewhat common perception of the M&M conference as an opportunity to form an opinion regarding next steps in management of a patient was further reflected by the fact that 40% of respondents reported the most common type of case presented at the conference to be a patient with ongoing problems who required further treatment. This practice is locally referred to as a "Junta Medica" or medical board, a multi-disciplinary meeting where difficult cases are discussed – a process distinct from a traditional morbidity and mortality conference.

One third of respondents did not perceive there to be anything preventing them from referring cases to the M&M conference. A small minority (6%) cited fear of repercussion as a barrier to referring cases, and the remainder cited organizational factors such as disorganization, scheduling, absence of time, and absence of perceived responsibility ("It's not my job.") as reasons for not referring cases to the M&M conference. Approximately half of respondents reported that cases are selected for the conference based on subjective criteria applied by either a designated staff member or the chief. Only 20% of respondents were aware of the use of a standardized criterion to select cases. (Table 3.)

M&M conference – case presentation, discussion, and follow-up

A substantial number (33%) of respondents felt that 25% or more of case presentations lacked essential information. Notes were taken during only 35% of M&M conferences. When notes were taken, a standardized form was used only one quarter of the time. Only 14% of respondents could identify a clear follow-up plan for conclusions drawn from M&M conferences. (Table 4.)

Registries, audit filters, and autopsies

Approximately 60% of represented institutions had a trauma and/or acute care surgery registry, half of which were at least partially electronic, and just under half of which could be used to answer specific questions. Forty-four percent of hospitals employed audit filters. Most respondents worked at an institution that practiced autopsies. Of those who reported presence of autopsies at their institution, only 19% reported the autopsy results were ever used by clinicians or resulted in improvements in clinical practice. (Table 5.)

Perceived barriers to quality improvement

The three most commonly cited reasons for limited use of M&M meetings and registries were lack of staff interest (28%), lack of staff time (27%), and lack of staff experience or education (17%). In the purely qualitative portion of the survey, the most commonly recommended next steps to improve use of QI elements in the respondents' hospitals were to motivate staff, train staff, and to improve attendance at M&M conferences.

Country-specific results

Basic hospital characteristics (size, urban v. rural, etc.) varied between countries. For example, Bolivia had the largest, proportion of subjects from the private sector, while Peru had the smallest. There were also differences in reported QI practices. M&M conferences were most frequent in the Peruvian sample, and least frequent in Ecuadorian sample. Respondents from all countries were equally likely to have witnessed a change in their institution as a result of an M&M conference discussion. However, given the variation in sampling methods and the different baseline characteristics of participants sampled in each country, firm conclusions about differences in QI practices among the countries are not possible, except as described in the multivariable model below.

Characteristics predictive of effective M&M conferences

Approximately half of all respondents stated that they had witnessed a change at their institution as a result of a discussion had at an M&M conference (defined herein as an "effective" M&M conference). After adjusting, standardized case selection criteria (OR 3.23, 95% CI 1.29–8.10), presence of a note-taker (OR 4.73, 95% CI 1.75–12.8), and report of a known mechanism to follow-up the conference (OR 3.69, 95% CI 1.41–9.70), were positively associated with effective M&M conferences. (Hosmer-Lemeshow chi2 =3.58, p=0.73, indicating an acceptably well-fitted model with minimal concern for over-fitting.) Though high correlation may be anticipated between note taking and plan for follow-up, multicollinearity diagnostics were consistent with a lack of collinearity of independent variables (variance inflation factors and tolerances: 0.97–1.03). (Table 6.)

Discussion

This survey of health care providers reveals there to be a solid foundation of trauma QI practices in the Andean region on which to build. Most respondents work at an institution with a M&M conference, and half of them work at hospitals with some form of trauma registry. These rates of implementation are higher than what is reported in the Asia-Pacific region, and lower than what is targeted in the United States. [17,23]

It is the quality rather than the quantity of M&M conferences that is the concern in this sample from the Andean region. M&M conference frequency, attendance, standardization of case referral and selection, case documentation, and establishment of a clear plan for system-oriented corrective actions were identified as areas for improvement. Recent literature has shown that most healthcare errors are due to system-wide factors, and that individually focused analysis and correction leads to missed opportunities for sustained improvement.[24,25] Nonetheless, the perceived objectives and types of cases selected in the Andean region indicate that M&M conferences are frequently perceived as an opportunity to decide on next steps in an individual patient's care. While this may be an important function, only a small portion of conferences included elements that were shown to be associated with an effective M&M conference: standardized case selection criteria, documentation of the discussion, and planned follow-up.

This study is a large-scale, detailed assessment of M&M processes. There are few reports in the literature to which it can be compared. One such 2007 report from Johns Hopkins Hospital identified standardization of case documentation and follow-up as areas for improvement. [19] When registries in the Andean region are compared to those in a 2016 systematic review, the Andean registries were almost as detailed as the least detailed registries from high-income regions.[26] This pattern of the presence of the QI practice, without optimization of the practice, is found in the use of autopsies in the region as well.

The next steps for improvement identified in this study are consistent with the wider body of literature in suggesting that motivation, education, and staff time are limiting factors in implementation of QI programs in general.[24,24,27] It is worth noting that physical, financial, and human resources were not identified as primary limitations. Business management experts agree that in efforts to implement large-scale culture-changing maneuvers,

participants need to experience early "wins".[28] In our study, fewer than half of respondents stated they had ever witnessed a change occur in their institution as a result of an M&M conference. Thus, the current lack of motivation for QI programs in Latin America may be most effectively addressed by increasing the real and perceived efficacy of M&M conferences as an instrument for change. Specifically, through establishment of standardized case selection criteria, routine case documentation during conferences, and development of written plans for follow-up. In response to this data, an M&M standardization toolkit has been developed by the Peruvian General Surgery Society, which, in conjunction with the Panamerican Trauma Society / WHO two-day course on trauma QI, provides both a foundational education in QI and practical tools for implementation of rigorous programs.[10]

The identification of lack of staff education and staff time as barriers to QI program implementation highlights the need for high-level prioritization of QI, with ministries of health, and hospital administrators, requiring participation in QI activities, and providing protected time for this participation.[19] A report from Namibia describes a national project in which 1094 healthcare providers attended QI capacity-building workshops and then integrated QI into their local context, with associated improvement in 10 of 11 indicators of HIV care.[29] Similarly, the WHO has pushed for mandatory discussion of all maternal deaths in M&M meetings, with evidence of positive impact. [15–17,30,31]

Before drawing conclusions, the limitations of this study should be addressed. Particularly in institutions, which report M&M conferences "rarely" or "annually" it is expected that the reported details of that conference may be skewed by recall bias. Respondents may be inclined to exaggerate actual QI practices in an effort to portray their institution in a favorable light. A convenience sampling method was used, and specific methods varied between sites. In one country, Bolivia, the survey was distributed at an international academic conference, with passive collection of surveys and a relatively low response rate. The sample also reflects variable sample sizes from any given hospital, with multiple respondents reporting on practices from one institution in many cases. Thus, conclusions regarding trends in the Andean region at large may be conservatively drawn, but meaningful comparisons between countries are limited.

Data were collected primarily at urban hospitals, and in academic environments. This is likely to over-estimate the proliferation of QI programs in the region. Furthermore, the survey instrument evolved during the study, and certain metrics, particularly detailed questions regarding M&M conference processes, were not gathered from a majority of Colombian participants and a large number of Peruvian participants. Though trends were generally consistent across the three countries where these details were collected, it may be that there are unique processes in Colombia, which were not captured in this study. Finally, apart from one question regarding participant's perspective regarding the impact of M&M conferences, we cannot comment on the impact of QI programs, only on their perceived presence and characteristics. However, the aim of this study was to assess the current level and form of implementation, rather than to establish the evidence-base for QI programs, as this has been previously reported.[7]

In conclusion, this extensive study of regional QI practices provides useful information for the development of QI programs globally. A good portion of the relatively abundant QI programs in the Andean region are QI programs only by name, as they do not have essential elements that ensure corrective action, or "closure of the loop", which is essential for effective QI. Next steps include increased rigor of M&M conferences: standardization of case selection processes, documentation of cases, and routine development of clear plans for follow-up, and, increased use of data from registries and autopsies to effect clinical care. Additionally, further research on the status of QI programs in rural and non-academic settings is warranted, and is anticipated to reveal a large opportunity for increased implementation of QI programs in these settings. In addition, evaluation of barriers and facilitators to trauma QI programs, including cultural norms surrounding disclosure of medical errors is essential to definition and implementation of locally acceptable QI initiatives. Limited reports from Latin America suggest that both "mutual empathy" in making mistakes and a fear of litigation may result in a lack of reporting, and criticism of, errors. This has been described as a so-called "conspiracy of tolerance". [32–34] Whether and how these tendencies manifest in the Andean region, or how they compare to other regions of any economic level, merits evaluation. Locally, QI program maturation may be facilitated by collaboration between neighbors, with institutions with weak QI programs learning from institutions with action-oriented QI programs. These types of collaborations may be most readily facilitated by local surgery societies. In addition, increased publication of successful examples of QI from LMICs should be prioritized in order to motivate providers, and provide models for future programs.[7,35,36] Nationally, the authors propose that a preventable death in a young victim of trauma should be just as "anathema" as a maternal death, with mandatory reporting to the ministry of health, and thus with a similar health system prioritization of excellence in care provided to victims of trauma. On a global scale, there is a need for increased dissemination of QI programs as a means of empowering local providers to participate in their health systems as planners, system-thinkers, and as agents for change.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Characteristics of respondents classified by country.

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	61	18%	69	21%	105	31%	101	30%	336	100%
Size of hospital where you work. (Number of beds.)										
<100	41	67%	16	23%	40	38%	30	30%	127	38%
100–499	17	28%	20	29%	37	35%	40	40%	114	34%
>=500	0	0%	10	14%	0	0%	17	17%	27	8%
Blank	3	5%	23	33%	28	27%	14	14%	68	20%
Total	61	18%	69	21%	105	31%	101	30%	336	100%
Location of hospital where you work. *										
Urban	44	72%	3	60%	92	88%	89	88%	228	84%
Rural	5	8%	1	20%	7	7%	8	8%	21	8%
Blank	12	20%	1	20%	6	6%	4	4%	23	8%
Total	61	100%	5	100%	105	100%	101	100%	272	100%
Type of hospital where you work. *										
Public	30	49%	3	60%	62	59%	65	69%	160	60%
Private	24	39%	1	20%	37	35%	10	11%	72	27%
Other / Blank	7	11%	1	20%	6	6%	19	20%	33	12%
Total	61	100%	5	100%	105	100%	94	100%	265	100%
Your specialty *										
General practice / Internal Medicine	28	46%	13	42%	43	41%	14	18%	98	36%
Emergency medicine	2	3%	7	23%	6	6%	0	0%	15	5%
General surgery	20	33%	3	10%	27	26%	44	57%	94	34%
Other surgery	0	0%	2	6%	8	8%	1	1%	11	4%
Anesthesia	0	0%	0	0%	3	3%	0	0%	3	1%
Intensive Care	4	7%	6	19%	13	12%	3	4%	26	9%
Administration	2	3%	0	0%	1	1%	0	0%	3	1%

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	61	**18%**	**69**	**21%**	**105**	**31%**	**101**	**30%**	**336**	**100%**
Other / Blank	5	8%	0	0%	4	4%	15	19%	24	9%
Total	61	100%	31	100%	105	100%	77	100%	274	100%
Your clinical training [*]										
Technician	0	0%	8	26%	6	6%	0	0%	14	5%
RN	8	13%	3	10%	7	7%	0	0%	18	7%
Medical student	0	0%	6	19%	1	1%	4	5%	11	4%
Resident	1	2%	1	3%	10	10%	2	3%	14	5%
Attending	46	75%	13	42%	77	73%	56	73%	192	70%
None / Other / Blank	6	10%	0	0%	4	4%	15	19%	43	16%
Total	61	100%	31	100%	105	100%	77	100%	274	100%

[*] These questions were added to later versions of the survey after partial distribution in Colombia and/or Peru, hence, the denominators for these questions vary compared to the total sample.

Table 2

Basic characteristics of M&M conferences

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	n	%	n	%	n	%	n	%	n	%
M&M conferences occur										
Yes	56	92%	58	84%	80	76%	98	97%	292	86%
No	2	3%	10	14%	18	17%	2	2%	32	9%
I don't know / Blank	3	5%	1	1%	7	7%	1	1%	14	4%
Total	61	100%	69	100%	105	100%	101	100%	338	100%
Where else are errors discussed. *‡										
Institutional office: statistics, quality, administration.	25	40%	0	0%	20	19%	10	13%	55	22%
Within service: rounds, informal, other mixed meeting	7	11%	0	0%	10	10%	9	12%	26	10%
Preventible death panel	2	3%	1	20%	5	5%	4	5%	12	5%
Audit	0	0%	0	0%	2	2%	3	4%	5	2%
Pathology	0	0%	1	20%	0	0%	1	1%	2	1%
Nowhere	12	19%	1	20%	24	23%	31	40%	68	27%
I don't know / Other / Blank	16	26%	2	40%	44	42%	20	26%	82	33%
Total	62	100%	5	100%	105	100%	78	100%	250	100%
Frequency •										
Weekly	8	14%	25	43%	27	34%	38	39%	98	34%
Monthly	16	29%	5	9%	8	10%	30	31%	59	20%
Quarterly	8	14%	5	9%	5	6%	2	2%	20	7%
Annually	3	5%	4	7%	2	3%	4	4%	13	4%
Rarely	20	36%	19	33%	32	40%	21	21%	92	32%
I don't know / Other / Blank	1	2%	0	0%	6	8%	3	3%	10	3%
Total	56	100%	58	100%	80	100%	98	100%	292	100%
Average number of attending physicians in attendance *•										
1–2	8	16%	0	0%	6	8%	0	0%	14	7%

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
3–5	17	**34%**	0	**0%**	15	**19%**	30	**42%**	62	**30%**
5–10	14	**28%**	3	**60%**	30	**38%**	27	**38%**	74	**36%**
>10	11	**22%**	2	**40%**	20	**25%**	14	**20%**	47	**23%**
I don't know / Blank	6	**12%**	0	**0%**	9	**11%**	4	**6%**	9	**4%**
Total	50	**100%**	5	**100%**	80	**100%**	71	**100%**	206	**100%**

*
These questions were added to later versions of the survey after partial distribution in Colombia and/or Peru, hence, the denominators for these questions vary compared to the total sample.

†
Respondents selected one or more of the following.

•
Only responses from participants who reported M&M conferences were practiced at their institution are included.

Table 3

Details of case referral and selection for M&M conferences.

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	N	%	n	%	n	%	n	%	n	%
Average number of cases discussed *										
1–2	41	73%	0	0%	55	69%	51	68%	147	68%
3–5	4	7%	4	80%	9	11%	15	20%	32	15%
>5	6	11%	1	20%	5	6%	7	9%	19	9%
I don't know / Blank	5	9%	0	0%	11	14%	2	3%	18	8%
Total	56	100%	5	100%	80	100%	75	100%	216	100%
Perceived objective of M&M conferences *‡										
Improve the system	48	66%	3	43%	61	50%	52	60%	164	57%
Decide on next steps in a patient's treatment	14	19%	1	14%	33	27%	20	23%	68	24%
Education	7	10%	3	43%	15	12%	10	12%	35	12%
Assign blame / Other / Blank	4	5%	0	0%	13	11%	4	5%	21	7%
Total	73	100%	7	100%	122	100%	86	100%	288	100%
Types of cases discussed at your M&M conference+										
Patients with ongoing problems who require treatment	24	43%	1	20%	28	35%	43	57%	96	44%
Discharged patients	6	11%	1	20%	7	9%	3	4%	17	8%
Both	20	36%	2	40%	33	41%	27	36%	82	38%
I don't know / Blank	6	11%	1	20%	12	15%	2	3%	21	10%
Total	56	100%	5	100%	80	100%	75	100%	216	100%
What has prevented you from referring more cases to your M&M. *‡										
Nothing	25	44%	3	75%	31	32%	36	36%	95	37%
Lack of time /interest	3	5%	0	0%	4	4%	3	3%	10	4%
Not my job / fear of repercussion	18	32%	1	25%	24	25%	14	14%	57	22%
Disorganization	6	11%	0	0%	11	11%	12	12%	29	11%
Other / Blank	4	7%	0	0%	11	11%	5	5%	20	8%

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	N	%	n	%	n	%	n	%	n	%
Total	57	100%	4	100%	97	100%	99	100%	257	100%
Case selection *†										
Standardized criteria	19	34%	4	80%	17	21%	11	14%	51	23%
Designated personnel / chief decides	24	43%	1	20%	48	59%	57	75%	130	60%
Other / I don't know / Blank	13	23%	0	0%	16	20%	8	11%	37	17%
Total	56	100%	5	100%	81	100%	76	100%	218	100%

*
These questions were added to later versions of the survey after partial distribution in Colombia and/or Peru, hence, the denominators for these questions vary compared to the total sample.

†
Respondents selected one or more of the following, count reflects total number of responses, not total number of participants.

Table 4

Details of case discussion, documentation, and follow-up for M&M conferences.

Country	Bolivia n	Bolivia %	Colombia n	Colombia %	Ecuador n	Ecuador %	Peru n	Peru %	Total n	Total %
What percentage of case presentations have missing information.*										
<25%	16	29%	4	80%	32	40%	34	35%	86	36%
25–75%	18	32%	0	0%	27	34%	22	22%	67	28%
>75%	6	11%	0	0%	4	5%	2	2%	12	5%
I don't know / Blank	16	29%	1	20%	17	21%	7	7%	41	17%
Total	56	100%	5	100%	80	100%	98	100%	239	100%
Does someone take notes?*										
Yes	23	41%	4	80%	25	31%	24	32%	76	35%
No	20	36%	1	20%	35	44%	38	51%	94	44%
I don't know / Blank	13	23%	0	0%	20	25%	13	17%	46	21%
Total	56	100%	5	100%	80	100%	75	100%	216	100%
If someone takes notes, do they use a standardized form?*										
Yes	6	26%	3	60%	5	20%	3	38%	17	28%
No	12	52%	1	20%	11	44%	4	50%	28	46%
I don't know / Blank	5	22%	1	20%	9	36%	1	13%	16	26%
Total	23	100%	5	100%	25	100%	8	100%	61	100%
During M&M discussion, what is the most valid source of medical knowledge? *ϕ										
The literature	22	41%	4	100%	52	54%	43	58%	121	53%
Clinical experience	30	56%	0	0%	30	31%	27	36%	87	38%
Blank	2	4%	0	0%	15	15%	4	5%	21	9%
Total	54	100%	4	100%	97	100%	74	100%	229	100%
How is the discussion of the meeting followed-up. *‡										
Nothing / Stored	27	44%	0	0%	42	40%	38	49%	107	43%

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	n	%	n	%	n	%	n	%	n	%
The chief decides	11	18%	0	0%	14	13%	21	27%	46	19%
Discussed in other conference / report is made	12	20%	2	100%	9	8%	9	12%	32	13%
Applied to patient management / protocols	0	0%	0	0%	1	1%	2	3%	4	2%
I don't know / Other / Blank	11	18%	0	0%	40	38%	7	9%	58	24%
Total	61	100%	2	100%	106	100%	77	100%	246	100%
Change as a result of M&M. *										
Yes	33	54%	5	100%	47	45%	39	51%	124	50%
No	19	31%	0	0%	28	27%	28	36%	75	30%
I don't know / Blank	9	15%	0	0%	30	29%	10	13%	49	20%
Total	61	100%	5	100%	105	100%	77	100%	248	100%

*
These questions were added to later versions of the survey after partial distribution in Colombia and/or Peru, hence, the denominators for these questions vary compared to the total sample.

‡
Respondents selected one or more of the following, count reflects total number of responses, not total number of participants.

φ19 responses were dropped from this question because respondents inappropriately selected more than one answer.

Table 5

Trauma registries, audit filters and autopsies.

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	n	%	n	%	n	%	n	%	n	%
Does your hospital have a trauma registry?										
Yes	34	56%	45	65%	67	64%	51	50%	197	59%
No	18	30%	22	32%	15	14%	40	40%	95	28%
I don't know / Blank	9	15%	2	3%	23	22%	10	10%	44	13%
Total	61	100%	69	100%	105	100%	101	100%	336	100%
If yes, is it electronic or paper? *										
Electronic	10	29%	1	20%	42	63%	17	40%	70	47%
Paper	19	56%	3	60%	19	28%	18	42%	59	40%
Combination	2	6%	0	0%	1	1%	3	7%	6	4%
I don't know / Blank	3	9%	1	20%	5	7%	5	12%	14	9%
Total	34	100%	5	100%	67	100%	43	100%	149	100%
Is it possible to query this registry with specific questions (i.e. how many patients died last year after splenectomy?) *										
Yes	18	53%	2	50%	36	54%	17	53%	73	53%
No	9	26%	0	0%	15	22%	8	25%	32	23%
I don't know / Blank	7	21%	2	50%	16	24%	7	22%	32	23%
Total	34	100%	4	100%	67	100%	32	100%	137	100%
Does your hospital use an audit filter?										
Yes	13	38%	39	87%	16	24%	19	37%	87	44%
No	14	41%	4	9%	29	43%	25	49%	72	37%
I don't know / Blank	7	21%	2	4%	22	33%	7	14%	38	19%
Total	34	100%	45	100%	67	100%	51	100%	197	100%
What percent of trauma / emergency surgery patients who die undergo autopsy?										
0%	19	31%	4	6%	2	2%	10	10%	35	10%

Country	Bolivia		Colombia		Ecuador		Peru		Total	
	n	%	n	%	n	%	n	%	n	%
1–25%	18	30%	4	6%	32	30%	27	27%	81	24%
25–75%	0	0%	4	6%	4	4%	9	9%	17	5%
>75%	4	7%	39	57%	19	18%	16	16%	78	23%
I don't know / Blank	20	33%	18	26%	48	46%	39	39%	125	37%
Total	61	100%	69	100%	105	100%	101	100%	336	100%
What percent of autopsy results are used by clinical staff or to improve the practice in your hospital? •										
0%	12	29%	23	35%	36	35%	29	32%	100	33%
1–25%	9	21%	4	6%	18	17%	15	16%	46	15%
25–75%	0	0%	0	0%	3	3%	1	1%	4	1%
>75%	0	0%	7	11%	1	1%	3	3%	11	4%
I don't know / Blank	21	50%	31	48%	45	44%	43	47%	140	47%
Total	42	100%	65	100%	103	100%	91	100%	301	100%

*
These questions were added to later versions of the survey after partial distribution in Colombia and/or Peru, hence, the denominators for these questions vary compared to the total sample.

•
Count excludes responses from participants who answered "0%" to percent of deceased trauma patients who undergo autopsy.

Table 6

Univariable and multivariable analysis to identify factors predictive of an effective M&M conference

Variable[†]	Number of valid values	Univariable analysis		Multivariable analysis	
		OR (95% CI)	p-value	OR (95% CI)	p-value
Number of M&M conferences per year	180	1.01 (1.00 – 1.03)	0.05	1.01(0.99 – 1.04)	0.32
Error prevention as the primary objective of the M&M conference	196	1.06 (0.73 – 1.55)	0.76	0.80 (0.38 – 1.71)	0.56
Scientific literature identified as the most valid source of information in an M&M discussion	189	1.96 (1.05 – 3.65)	0.03 [*]	2.13 (0.79 – 5.76)	0.14
Presence of a standardized case selection criteria	**196**	**2.56 (1.28 – 5.13)**	**<0.01** [*]	**3.48 (1.16 – 10.46)**	**0.03** [*]
Absence of barriers to referring cases	184	1.06 (0.58 – 1.94)	0.86	1.59 (0.32 – 8.04)	0.57
Note-taking during M&M conference	**197**	**2.60 (1.32 – 5.13)**	**<0.01** [*]	**5.73 (1.73 – 19.06)**	**<0.01** [*]
>25% of case presentations missing essential information	148	0.79 (0.40 – 1.58)	0.51	1.34 (0.45 – 3.98)	0.60
Three or more attendings present at M&M conferences	174	3.25 (0.91 – 11.59)	0.07	2.82 (0.42 – 19.10)	0.29
Presence of plan for follow-up to the M&M conference	**195**	**1.44 (0.77 – 2.70)**	**0.26**	**4.80 (1.59 – 14.50)**	**<0.01** [*]
Opportunity to discuss errors outside of M&M conferences	195	0.53 (0.27 – 1.01)	0.06	0.60 (0.22 – 1.62)	0.31
Presence of trauma registry	175	2.54 (1.28 – 5.06)	<0.01 [*]	1.89 (0.65 – 5.55)	0.25
Lack of staff motivation as primary obstacle to QI	188	1.60 (0.86 – 2.99)	0.14	1.38 (0.48 – 3.98)	0.55
Lack of staff education as primary obstacle to QI	188	0.86 (0.40 – 1.84)	0.70	1.61 (0.36 – 7.13)	0.53
Country of origin: Bolivia	199	1.07 (0.56 – 1.06)	0.84	0.89 (0.17 – 4.76)	0.89
Country of orgin: Ecuador	199	1.02 (0.57 – 1.85)	0.94	1.49 (0.32 – 6.94)	0.61

[*]
p-value of <0.05 significant

[†]
All variables were coded 0 = No, 1 = Yes, with the exception of "number of M&M conferences per year" which was a number 1 – 52.

O
Adjusted model constant = 0.04 (0.00 – 0.62)