

**A Systematic Review of Global Implementation of the World Health  
Organization's Trauma Care Guidelines**

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**Abstract**

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**Objective:** Between 2004 and 2010, the World Health Organization (WHO) released three publications intended to provide guidance to policymakers in low- and middle-income countries towards system-wide improvements in trauma care. We sought to understand the degree to which these guidelines have been implemented globally, including understanding location and type of implementation. We thus hoped to identify priorities for future implementation and dissemination strategies.

**Methods:** We conducted a systematic review in which the titles of the WHO trauma care guidelines were used as the search terms: "Guidelines for Essential Trauma Care", "Prehospital Trauma Care Systems", "Guidelines for Trauma Quality Improvement Programmes". Nineteen databases were queried, validation of results was performed through citation analysis and expert consultation. Two reviewers independently scored sources.

**Findings:** The search returned 112 sources describing 140 implementation events in 51 countries. These were divided between those that described needs assessments (45%), endorsement by stakeholders (27%), educational interventions (14%), and incorporation into policy (14%). There was evidence of implementation in 40% of low-income countries, 32% of lower-middle, and 28% of upper-middle income countries.

**Conclusions:** The WHO trauma care guidelines are widely implemented in meaningful ways. However, given the substantial disparities that remain in trauma care, efforts to bring the standards described in the publications to the remaining 143 WHO member states are needed. Particular emphasis should be on: serial needs assessments for ongoing monitoring of capacity for trauma care in health systems, incorporation of guidelines into formal education of healthcare providers, and incorporation of the guidelines into health policy.

## INTRODUCTION

Injury accounts for 11% of the global burden of death and disability. Ninety percent of this burden is in low- and middle-income countries (LMIC). (1) The high injury burden in LMICs is due in part to unsafe conditions, but also due to worse outcomes once someone is injured. The likelihood of death after injury in a LMIC is up to six-times that observed in developed countries. (2) The disparity in outcome after injury is explained in part by the low level of development of trauma care systems, which includes lack of adequate human and physical resources for care of the injured (trauma care), and lack of organization and planning, such as through trauma quality improvement programs. Specifically, dedicated trauma care systems, such as those increasingly common in high-income countries, have been shown to improve outcomes. (3-7) It has been estimated that if victims of injury in LMICs were to receive the quality of trauma care delivered in high-income countries, 1.9 million deaths would be averted each year. (8)

The World Health Organization (WHO) has made a concerted effort to address the above inequalities through the Essential Trauma Care Project and three associated publications: *Guidelines for Essential Trauma Care* (2004), *Prehospital Trauma Care Systems* (2005), *Guidelines for Trauma Quality Improvement Programmes* (2009). (9-12) These are meant to provide resource-level appropriate guidance to policymakers on ways to make system-wide improvements in care for the injured. Development of these guidelines involved dozens of organizations and hundreds of individual experts. These represent the best, and some of the only, available guidance on ways to strengthen trauma care systems in countries at all economic levels. Implementation of these guidelines thus reflects, at least in part, the status of trauma care globally.

It is well established that the publication of guidelines does not always translate into their application or implementation. (13) The WHO publishes dozens of guidelines per year. (14) In the published literature, there is limited evidence reflecting follow-up on dissemination, and even fewer publications addressing implementation of any of the WHO guidelines. (15,16) Only one systematic review of implementation of WHO guidelines has been found in the published literature. (17) The WHO trauma care guidelines have now been available for 5 – 11 years, respectively. As with many WHO publications, each of the trauma guidelines was mailed to 2,000 – 3,000 recipients, including many subscribed public libraries and WHO country offices. In addition, several country offices hosted meetings to facilitate dissemination of the guidelines. However, the actual extent of implementation has not been documented. Thus, we sought to define the current status of implementation of the guidelines, including regional and economic group differences. By so doing, we hoped to identify gaps in implementation that need to be addressed, ultimately promoting improvements in trauma care globally. In the broader context, as one of the first systematic reviews of implementation of any WHO guideline in the literature, we sought to expand the knowledge base regarding dissemination outcomes and implementation strategies of WHO guidelines at large.

## METHODS

The protocol for this systematic review was drafted in accordance with the PRISMA Guidelines and was published prior to initiation at PROSPERO International Prospective Register of Systematic Reviews. (18) The search terms: “Guidelines for Essential Trauma Care”, “Prehospital Trauma Care Systems”, “Guidelines for Trauma Quality Improvement Programmes (Programs)” were used to query each of the included databases. Phrase or “verbatim” searches were conducted where possible, searches were restricted only by date: selecting dates post-publication of the publication of interest, “full text” was searched where possible. A comprehensive search of the scientific and grey literature was conducted for each publication individually using: PubMed, Embase, Scopus, Web of Science, Google Scholar, CINAHL, Cochrane, Global Health Database, Global Health Library – Regional Indexes, WHO LIS, SciELO, Proquest Dissertation and Theses, Grey Literature Report, OAlster, Proquest Conference Papers Index, WHO International Clinical Trials Registry Platform Search Portal,

Google, WorldCat, and OpenGrey. Validation of results was performed through two methods. First, we contacted twenty experts in the field who were identified through review of frequently cited authors. These authors were asked to share any information they may have regarding implementation of the guidelines that would not otherwise be available (i.e. unpublished, not available online). Second, we performed citation analysis using: Scopus, Web of Science, and Google Scholar.

Retrieved sources were included if they referenced the WHO trauma care publications and included evidence of either dissemination or implementation. For the purpose of this systematic review, evidence of dissemination was defined as citation of the guideline, without description of use of the guideline (e.g. citing a statistic found in the guideline). Implementation was defined as application of the guideline. Sources in the six official United Nations languages, in addition to any language into which the guidelines had been translated were included: Arabic, Chinese, English, French, Russian, Spanish, Portuguese and Vietnamese. Sources that referenced the publication of interest, but only in the form of a link to access or purchase the publication without additional evidence of dissemination or implementation were excluded. Sources were included regardless of the quality of evidence, with type of source documented. If two sources described the same implementation event, only one source was included in all results calculations. The search was completed in May, 2015 and results available up to that time were eligible.

Data extraction was conducted by two reviewers (LNL & KR). One reviewer (LNL) performed the initial search and classification of sources for inclusion. A second reviewer (KR) was chosen for his lack of involvement in trauma, quality improvement, the WHO, or professional relationship with any of the other authors or advisors. This second reviewer then reviewed the sources that the first reviewer had classified as defining implementation. He was blinded to the implementation type assigned by the initial reviewer. Discordance between reviewers was resolved through discussion, with each reviewer presenting a case for their classification and resolution achieved with option for referral to a third reviewer (CM) as needed. Data were collected using online reference management software (RefWorks).

Dissemination was further subdivided into sources in which the authors advocated for use of the WHO trauma publications and sources that merely referenced the WHO publications without advocating for their use. Sources included as evidence of implementation were defined in four ways: use of the guidelines for needs assessments (comparing existing practices and resources to those recommended in the guidelines), stakeholder (i.e. national professional societies or other formal bodies) endorsement of guidelines, educational intervention, or, finally, incorporation of components of the guidelines into policy (as evidenced by citation of the guideline in an official regulatory document at an institutional, local or national government level). These four categories were developed through a combination of deductive and inductive coding according to the authors' experience and the themes that arose from the sources retrieved. Sources that met these criteria for "implementation" were further categorized by type of source (e.g. peer reviewed journal, website, newsletter).

The study was conducted with the assistance of an advisory group of six members (Indi Trehan, Frederick Rivara, Manjul Joshipura, Charles Mock, Sarah Safranek, Lacey LaGrone) which included a healthcare librarian and experts in one of each of the following topics: trauma care, trauma quality improvement, WHO guideline formation and dissemination, and systematic review methodology.

## **RESULTS**

A total of 2376 records were reviewed for inclusion in the study. After elimination of duplicates, records without access to full text, texts in excluded languages, and other non-relevant records, 691 records remained (Figure 1). Among these records, 112 sources described 140 unique implementation events and another 578 reports indicated evidence of dissemination, but not implementation (Table 1). Specifically, *Guidelines for Essential Trauma Care* was primarily

referenced in needs assessments (19-59), secondarily in recommendations by stakeholders (28,53,60-78), and was less frequently incorporated into policy (twelve times on the national level, twice on the state or district level)(28,38,79-87) or educational interventions. (41,65,88-96) *Prehospital Trauma Care Systems* was used most frequently for needs assessments (28, 97-106), less so in stakeholder endorsements (67,86,107-112), incorporation into policy (three times on the national level, once on the municipal level) (28,97,113), and educational interventions. (114-117) *Guidelines for Trauma Quality Improvement Programmes* was implemented primarily in stakeholder endorsements (48,67,109,118,119), then educational interventions (119-121), and then needs assessments (48,53,122,123) and incorporation into policy (once at the national level, once at the institutional level). (124,125) Specific examples of each implementation type are presented in Table 2.

Of the 19 descriptions of inclusion of the guidelines in the curriculum of an educational intervention, nine described continuing medical education for professionals, four described courses for lay first-responders, four described education of residents (i.e. post-graduate physicians in training), and one of nursing students. One reference described use of the guidelines to audit existing educational practices. Only one of the educational interventions described inclusion of the WHO publications in degree requirements.

Approximately half of sources were from PubMed cited journals, 5% were from non-PubMed cited journals, and the remainder from a variety of grey literature sources (Table 3). We returned 13 additional reports of implementation through contacting 20 experts in the field. These references were not found through the initial database searches. (47,48,51,53,61,120,126)

The three WHO guidelines were documented in the scientific and grey literature to be implemented in 51 countries, in addition to references which defined location of implementation more broadly - three in LMICs, five in Africa, four in Europe, two in Latin America, and two, even more broadly, in the Americas. The countries where implementation was described represent a broad distribution across five continents. The frequency of implementation reports varied, with an exceptional density in five countries which each had more than ten reports of implementation: Ghana, India, Mexico, South Africa, and Vietnam (Figure 2).

Despite including reports returned in any of the six official United Nations languages and Portuguese, a vast majority (95%) of the implementation events returned were from English language sources. For instance, despite 33 reports of implementation from Latin America, only three reports were in Spanish and only one in Portuguese. Despite 16 reports from Francophone countries, only two were in French.

Implementation of these three guidelines, which were specifically developed for LMICs, was also described in several high-income locations. In France, the Senate adopted a draft bill to include first aid training in driver's license requirements, the bill references *Prehospital Trauma Care Systems*. (113) In the United Kingdom, The Royal College of Anaesthetists referenced *Guidelines for Trauma Quality Improvement Programmes* in their own guidelines, recommending implementation of preventable death panels, governance meetings, and morbidity and mortality meetings. (127) The WHO guidelines were implemented in 40%, 32%, 28%, and 12% of all low, lower-middle, upper-middle and high-income countries, respectively. However, as the countries in which implementation took place tended to be larger countries, the population of these countries accounted for 53%, 84%, 86% and 21% of all of the populations of low, lower-middle, upper-middle, and high-income countries (Table 4).

## DISCUSSION

This paper reflects a systematic review of the scientific and grey literature to answer the question: "To what extent are the WHO guidelines on trauma care being implemented?". There has been a notable degree of implementation, with implementation events of various types documented in 51

countries, representing 40% of all low-income countries and 28-32% of all lower-middle and upper-middle income countries. However, most countries are still not represented. Moreover, only a small portion (14%) of all implementation is the targeted, and arguably most high-impact type, use of the guidelines in formulation of policy.

Records indicate that the guidelines are used most frequently to conduct needs assessments. This is consistent with the relatively recent publication of the guidelines, and the early stage of trauma care systematization throughout much of the globe. Importantly, we identified only four countries (Ghana, India, Mexico, and Vietnam) in which the initial needs assessment was followed-up with documentation of how the issues identified in the assessment had been addressed. (28,38,42,49,80,81,83) Follow-up on completed needs assessments is thus identified as a ready area for future research and advocacy.

A quarter of the sources described professional societies endorsing implementation of the guidelines. This is encouraging as it is in contrast to previous criticisms of WHO guidelines, which found stakeholder engagement to be an area of weakness. (128) The WHO trauma guidelines appear to have adequate stakeholder engagement, with 35 – 85 experts in the field, from a variety of regions, participating in the development of each publication. Stakeholder engagement and endorsement may serve as a foundation for future implementation. Thus, ideally, with time, the distribution of implementation events will shift away from the data-gathering and stakeholder endorsements, towards more actual application of the guidelines as measured by incorporation into both educational curricula and health policy.

Incorporation of the guidelines into educational interventions was documented sparsely, 19 times overall, and only once as a graduation requirement for residents. (120) The global dearth of formal trauma education of physicians was documented in 2009 by Zonies et. al. via a survey of 774 final year medical students in 77 countries. Only 55% of surveyed students reported they were comfortable providing basic trauma care. (129) In our results, the guidelines are primarily used for continuing medical education, often optional, rather than incorporated into degree requirements for medical professionals. This pattern reflects a missed opportunity for ensuring that all providers are able to provide basic trauma care.

The trauma care guidelines were developed specifically for guidance at the ministry of health level. Thus, a thorough investigation into the reasons for the current relative lack of implementation at the national policy level is warranted. The scarce existing literature on implementation of WHO guidelines indicates that an area for optimization is “interaction between researchers and health care policymakers”. (130) Our search revealed excellent examples of this interaction in Ghana, India, and Mexico where national level consensus meetings were held in which WHO trauma experts, trauma care professional societies, and ministry of health representatives collaborated to adapt the WHO trauma care guidelines to their local circumstances. (28) Though these are encouraging examples, they are only three, compared to the 194 WHO member states. The WHO has developed a report in an effort to spring-board off these, and other, successes: “Strengthening care for the injured: Success stories and lessons learned from around the world”. (131) In addition to increased researcher and policymaker interaction, more intentional distribution of guidelines among policymakers is a ready area for improvement. The findings of this systematic review suggest that the guidelines, and references to them, are most readily accessible in clinical journals or other source types that are accessed primarily by clinicians, rather than policymakers.

In considering how to improve implementation of the trauma care guidelines in all of the above ways (needs assessments, stakeholder endorsement, educational interventions, and incorporation into policy), a paper commissioned by the WHO to address dissemination and implementation strategies proves useful. In this paper it was determined that the WHO did not have a general, unified strategy for dissemination and implementation. The authors of this report cited applicability and timing/timeliness as additional areas for optimization. (130) With regard to applicability, several of the retrieved sources in the current search commented specifically on the

appropriateness of the guidelines for LMICs. (8,132-134) However, the vast majority of implementation results were in English-language sources, indicating a need for wider dissemination among non-English-speaking countries, which constitute nearly all of the targeted LMIC's. One or more of the trauma care guidelines had been translated into Arabic, French, Russian, Spanish, Portuguese, and Vietnamese. However, there were no implementation publications in Arabic and limited publications arising in any language from North Africa or the Middle-East. There were a small number of publications from Francophone Africa, indicating this as another priority geographic area.

With regard to timing/timeliness, the dissemination of the guidelines coincided with an increasing global awareness of the significant contribution of non-communicable diseases, and injury in particular, to the global disease burden. (1) Thus, as the guidelines appear to adequately adhere to recommended implementation principles in these facets, it may again be that increased visibility among policymakers is the main area for improvement.

This study has several limitations. First, several of the authors have an interest in reporting successful implementation of the guidelines, which makes the study vulnerable to bias. This has been addressed by including a second, blinded, reviewer who is not in any way professionally involved with the topic at hand, or with the other members of the authorship or advisory group. An additional weakness of the study is the inclusion of only reports electronically available or already known to the experts consulted. This method will likely underestimate the implementation of the guidelines. The authors nonetheless determined a systematic review to be the most appropriate methodology given the anticipated low response rate for remote surveys of ministry of health representatives and other stakeholders. In addition, we can comment only on the endpoint of the dissemination strategies used for the guidelines, but do not have sufficient data to provide critique of specific dissemination strategies and their effectiveness or appropriateness with regard to WHO guidelines. Similarly, though we have data to suggest the guidelines are implemented, we do not have data on whether morbidity, mortality, or economic benefit was realized.

Despite these limitations, this review adds substantially to the literature as one of the first systematic reviews to evaluate implementation of any WHO guideline. The study allows us to draw several conclusions. The WHO trauma care guidelines are being used in their targeted areas: LMICs across the globe. The guidelines are being used in meaningful ways, including needs assessments, stakeholder endorsement, education, and policy. However, the guidelines have been documented to be used in only 51 countries, still a minority of the 194 WHO member states, 139 of which are low- or middle-income. Particular areas for high-yield and appropriate improvement in implementation include increasing awareness of the guidelines among policymakers in order to facilitate incorporation of the guidelines into health policy, incorporation of the guidelines into formal education of healthcare providers, and systematic needs assessments based on the guidelines which are then followed by corrective action and ongoing monitoring.

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Figure 1. PRISMA Flow diagram depicting search results and data extraction. (135)

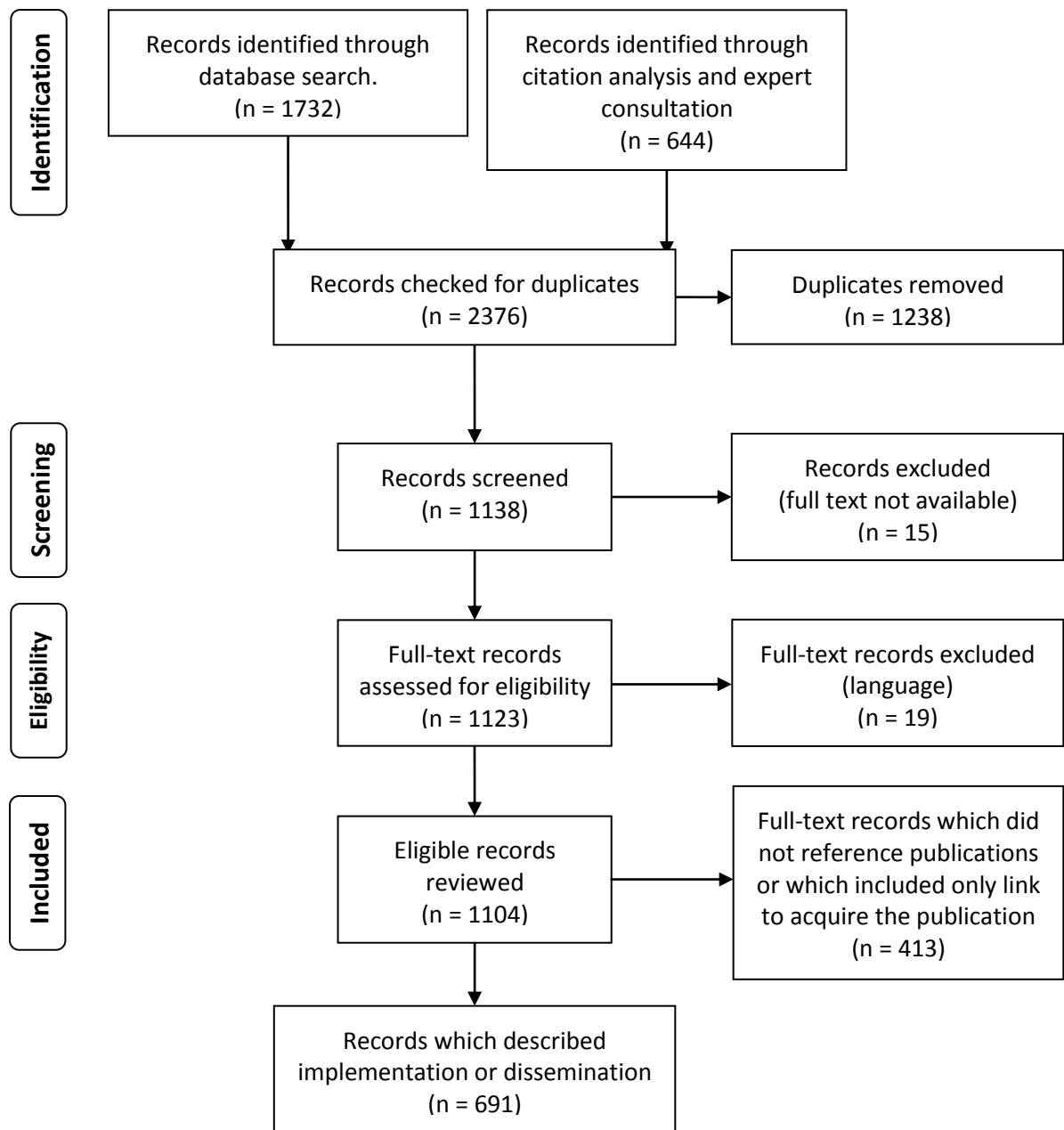
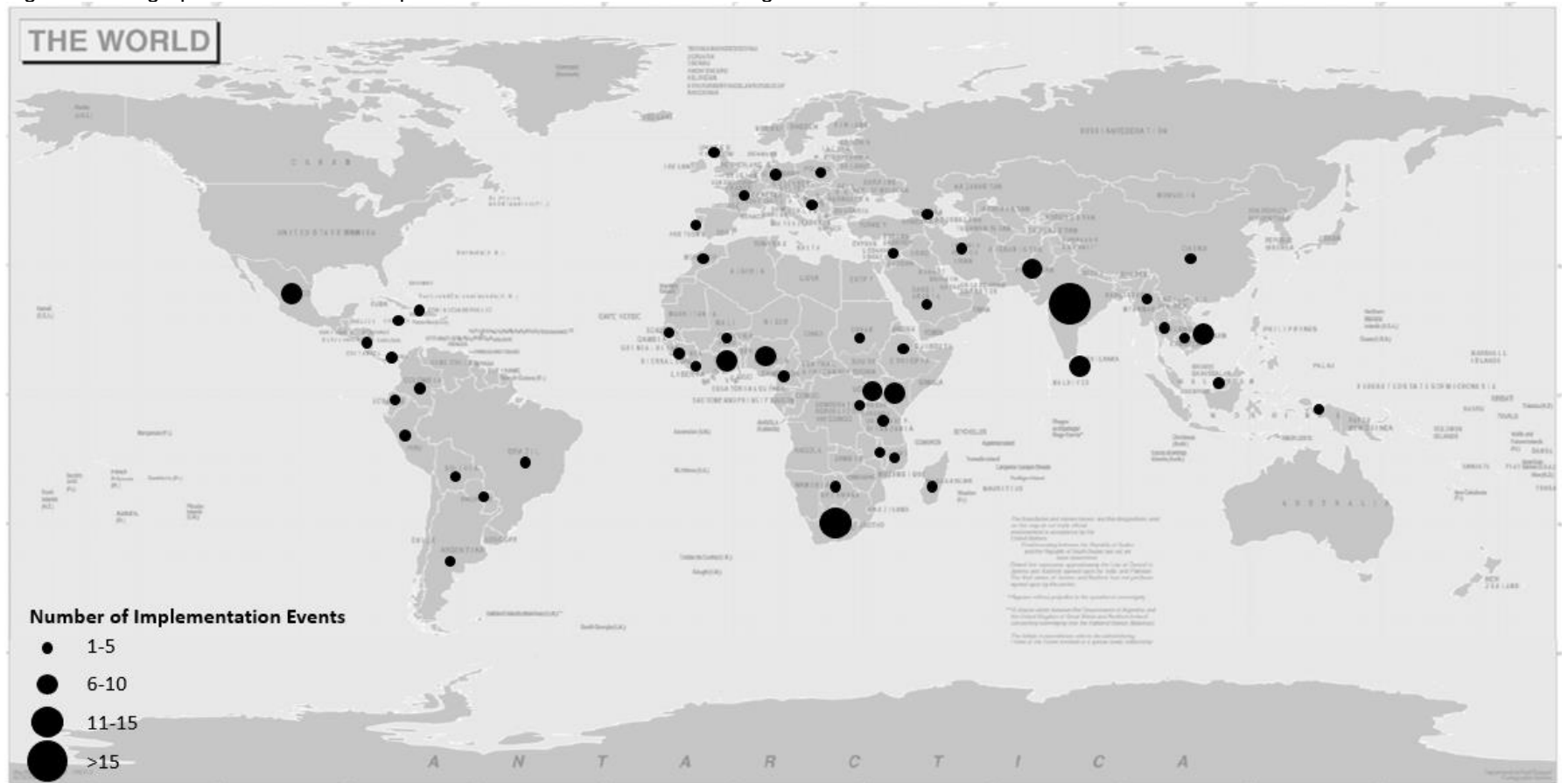


Figure 2. Geographic distribution of implementation of WHO trauma care guidelines.



**Table 1. Implementation and Dissemination of the WHO trauma care guidelines<sup>†</sup>\***

	Essential		Prehospital		QI		Total	
	N	%	N	%	N	%	N	%
<b>Implementation Events</b>	<b>94</b>		<b>29</b>		<b>17</b>		<b>140</b>	
Needs assessment	45	48%	13	45%	5	29%	63	45%
Stakeholder endorsement	24	26%	8	28%	6	35%	38	27%
Educational intervention	11	12%	4	14%	4	24%	19	14%
Policy development	14	15%	4	14%	2	12%	20	14%
<b>Dissemination</b>	<b>346</b>		<b>176</b>		<b>56</b>		<b>578</b>	
Advocacy	58	17%	22	12%	10	18%	90	16%
Referenced only	288	83%	154	88%	46	82%	488	84%

<sup>†</sup> *Guidelines for Essential Trauma Care, Prehospital Trauma Care Systems, Guidelines for Trauma Quality Improvement Programmes*

\*Counts reflect number of events described, a single record may describe multiple events.

**Table 2. Examples of implementation of each WHO trauma care guideline†**

	<b>Needs Assessment</b>	<b>Stakeholder</b>	<b>Education</b>	<b>Policy</b>
<b>Essential</b>	Audit of trauma equipment and facilities at the national and each district referral hospital in East Timor, followed by feedback and recommendations to hospital staff. (52)	Nationwide meeting with the College of Surgeons of Sri Lanka, Sri Lanka Medical Association, Ministry of Health, WHO country office, and non-governmental organizations at which guidelines were adapted to local context. (136)	Guidelines incorporated into curriculum, or listed as required reading, for online courses in Burkina Faso, China, Liberia, and Nigeria, for medical students, residents, and nurses.(91-94,131)	Guidelines referenced, and incorporated into, national standards for trauma care in Mexico. (80)
<b>Prehospital</b>	Questionnaire developed based on guidelines used to assess availability and quality of prehospital care on Pakistani interurban roads. (105)	The African Federation for Emergency Medicine out-of-hospital emergency care workgroup consensus paper “strongly urges” use of guidelines in development of prehospital trauma care systems. (62)	Lay first-responder course on prehospital trauma care conducted in Kampala, Uganda, based in part on recommendations in guidelines. (114)	Guidelines incorporated into Colombian National Legislation: “Decrees and Resolutions” which defines basic qualifications for providers, ambulance equipment, and methods for audit. (28)
<b>QI</b>	Guidelines used to assess trauma care and quality improvement in rural health district in South Africa. (53)	Secretary of Neurotrauma Society of India makes explicit call for implementation of quality improvement programmes in quarterly newsletter, drawn from guidelines. (118)	WHO/IATSI* created a set of instructional materials, freely available online, for two-three day courses. In 2012 alone, collaborators conducted courses in: Brazil, Kenya, Liberia, Malaysia, Paraguay, and Thailand. (8)	Preventable death panel instituted at tertiary-care teaching hospital in Ghana based on recommendations in guidelines. (124)

† *Guidelines for Essential Trauma Care, Prehospital Trauma Care Systems, Guidelines for Trauma Quality Improvement Programmes*

\*International Association for Trauma Surgery and Intensive Care

**Table 3. Distribution of source type for reports on implementation of the WHO trauma care guidelines. †\***

Source Type	Essential		Prehospital		QI		Total	
	N	%	N	%	N	%	N	%
Pubmed referenced journal	54	57%	18	62%	5	29%	77	55%
Other (non-Pubmed referenced) journal	5	5%	2	7%	0	0%	7	5%
Professional society report	2	2%	2	7%	5	29%	9	6%
Web page / Blog	5	5%	2	7%	0	0%	7	5%
Conference proceedings	2	2%	0	0%	1	6%	3	2%
Thesis	1	1%	2	7%	0	0%	3	2%
WHO report	7	8%	1	3%	0	0%	8	6%
Government report	2	2%	1	3%	0	0%	3	2%
Curriculum	3	3%	0	0%	0	0%	3	2%
Grant	2	2%	0	0%	0	0%	2	1%
National policy	2	2%	0	0%	0	0%	2	1%
Report	2	2%	1	3%	0	0%	3	2%
Expert consultation	7	8%	0	0%	6	35%	13	9%
Total	94		29		17		140	

† *Guidelines for Essential Trauma Care, Prehospital Trauma Care Systems, Guidelines for Trauma Quality Improvement Programmes*

\*Counts reflect number of events described, a single record may describe multiple events.

**Table 4. Distribution of implementation of WHO trauma care guidelines, grouped by World Bank income group. ‡**

<b>Income level</b>	<b>Countries in which implementation reported</b>	<b>Total countries</b>	<b>Percent of total</b>	<b>Population of countries in which implementation reported<sup>†*</sup></b>	<b>Total population*</b>	<b>Percent of total</b>
<b>Low</b>	14	35	40%	408	777	53%
<b>Lower-middle</b>	15	47	32%	2,131	2,550	84%
<b>Upper-middle</b>	15	53	28%	2,092	2,432	86%
<b>High</b>	7	59	12%	292	1,367	21%
<b>Total</b>	51	194	26%	4,923	7,126	69%

‡*Guidelines for Essential Trauma Care, Prehospital Trauma Care Systems, Guidelines for Trauma Quality Improvement Programmes*

†Numbers reflect population of countries (<http://apps.who.int/gho/data/node.main.POP107?lang=en>), categorized by 2014 World Bank income group, in which implementation was reported, not necessarily population affected by implementation.

\* Reported in millions.