Contributions to the American Society of Hematology Meeting From Low- and Middle-Income Countries: An In-Depth Analysis and Call to Action

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PURPOSE: Establishing research capacity in low- and middle-income countries (LMICs) is key for improving the outcomes of patients with hematologic diseases globally. Few studies have analyzed the contributions of LMICs to global hematology. The American Society of Hematology Meeting (ASH) is the largest international academic event where peer-reviewed contributions in our field are presented.

METHODS: In this cross-sectional analysis, all abstracts accepted to ASH 2018 selected for a poster or oral presentation were reviewed. Those that had a contributing author from an LMIC were identified. The proportion of LMIC abstracts across categories was analyzed. Country of origin, high-income country participation, the presence of a conflict of interest (COI), and sponsorship were determined.

RESULTS: From 4,871 abstracts reviewed, 506 had a contributing author from an LMIC (10.4%), with 277 (54.7%) contributions in partnership with a high-income country. LMIC-independent contributions corresponded to 19 of 1,026 oral abstracts (1.9%) and 209 of 3,845 posters (5.4%). Most abstracts from LMICs were clinical (n = 311; 61.5%) and multicentric in nature (n = 353; 69.8%). COI statements with the pharmaceutical industry were common (n = 214; 42.3%). Collaboration between LMICs was infrequent (n = 33; 6.5%). Upper-middle–income countries had 466 participations (81.5%), in comparison with 96 (16.8%) in low-middle–income and 10 (1.7%) in low-income countries.

CONCLUSION: LMICs were responsible for a small fraction of abstracts at ASH18; low-income countries were practically absent. Almost half of accepted works represented a form of international collaboration, with clinical, multicenter studies predominating and COI disclosures a frequent and unexpected feature, reflecting the instrumental nature of LMIC participation and a lack of independent, robust, locally developed hematology research.

INTRODUCTION

It is difficult to quantify and assess the research activity performed across the world. The current gold standard for dissemination of scientific knowledge are the peer-reviewed articles published in academic journals, without a single database or outlet encompassing them all.[1,2] Although they are considered of lesser value in terms of depth and academic prestige than peer-reviewed articles, abstract contributions presented at international scientific meetings also represent an interesting focus of study where the work of researchers worldwide is presented in a single moment in time. In the field of hematology, the American Society of Hematology (ASH) Annual Meeting and Exposition in the United States is the largest international hematology-focused research meeting. ASH abstract submissions range from basic and translational research to clinical trials and health services research. They are submitted for blinded peer review and are selected for presentation according to their scientific quality and merit as determined by an international selection committee, regardless of their country or region of origin.[3] Although the bulk of research in academic medicine and other sciences is conducted in high-income countries (HICs), more than 80% of the population in the world live in low- and middle-income countries (LMICs).[4] The reasons behind this pattern are many and are closely related to the historical, geopolitical, and economic background of these countries.[5,6] Although investigators in LMICs are faced with important challenges that limit their capacity for performing research, reports available to account for their contributions to the field of hematology are scarce.[7-9] As hematologic diseases are a significant cause of worldwide morbidity and mortality, knowledge of the research contributions made by

CONTEXT

Key Objective

To determine the role of low-middle–income countries in a large international hematology meeting as a measure of global research equity.

Knowledge Generated

We show that low- and middle-income countries were responsible for only a small fraction of abstracts accepted at an American Society of Hematology Meeting. Most studies were performed in collaboration with a high-income country and came from an upper-middle–income economy.

Relevance

This study highlights the need for improving research capacity in hematology across the world and addresses current limitations in equity of representation in the global stage.

LMICs to the field would offer a useful insight. Therefore, we sought to evaluate contributions made by researchers from LMICs to ASH in 2018 as a reflection of the current research capacity in the field of hematology throughout the developing world. Consequently, our primary aim was to describe the proportion of contributions accepted for oral or poster presentation that included an LMIC and the distribution across ASH abstract categories. Secondary aims were to determine the characteristics of the research conducted in LMICs that was accepted for presentation in the meeting including country of origin, single or multicentric in nature, high-income country participation, presence of a conflict of interest (COI), and pharmaceutical industry sponsorship.

METHODS

We performed a cross-sectional study analyzing abstracts presented at ASH18 that included an LMIC and evaluated their characteristics. The ASH18 abstract website was open for submissions from May to August 2018. Instructions to submit ASH abstracts included research or studies written in English that were not publicly available or accepted for publication or presented to a meeting of 1,000 or more participants before the submission closing date and the requirement that the authors had to be an ASH member or to be sponsored by one, as well as the payment of an $85 in US dollars submission fee. The system allowed authors to state a preferred method of presentation either oral or poster, with the possibility for withdrawal if the preferred presentation format was not selected by the reviewers. During the blinded peer-review process, abstracts were categorized as follows: (1) accepted for oral presentation, (2) accepted for poster presentation, and (3) accepted as an online-only format and not presented in the meeting. Abstracts accepted for presentation were posted online in November 2018 and are currently available as a supplemental issue of *Blood* journal.[10]

Eligibility Criteria and Process

This study was performed by reviewing all abstracts that were accepted for presentation as an oral communication or a poster presentation. We excluded abstracts accepted as an online-only format to include only higher-quality contributions as determined by the blinded peer-review process. To determine the frequency of LMIC participation, we analyzed all contributing authors' affiliation and abstracted those that included an author from an institution in an LMIC according to the World Bank classification in 2018, which included those countries or territories with a gross national income (GNI) of < $12,056 in US dollars per capita,[11] regardless of HIC collaboration. The authors (P.R.C.-P., E.B.-E., L.T.-A., A.G.-D.L., and O.C.-M.) manually reviewed abstracts in duplicate during 2019 and retrieved their relevant characteristics. Discrepancies were resolved by a third reviewer.

Outcomes

Our primary outcome was the proportion of contributions accepted for presentation that included an LMIC and the distribution across ASH abstract categories. As secondary outcomes, we analyzed several characteristics across LMIC abstracts including their single or multicenter origin, their study type (clinical *v* basic or translational research), the presence of any declared COI, or an identified pharmaceutical industry sponsor. We compared these characteristics in studies that had a contributing author from an HIC (LMIC + HIC studies) versus those that did not (LMIC-independent) and according to its presentation format (oral *v* poster presentations). We did not analyze HIC-only abstracts because of resource restrictions. To determine the contributions made by each LMIC and compare them with each other, we sorted abstracts into participations by country, allowing for duplicates in studies that included more than one LMIC. Each country's participations were compared and grouped according to the geographic region (Latin America, Europe and Central Asia, Middle East and North Africa, Southern Asia, and sub-Saharan Africa) and World Bank GNI per capita tier (upper-middle–income, low-middle–income, and low-income).[11] Lastly, abstract participations were correlated with country-specific population and global development indexes, including the

Human Development Index (HDI), GNI, and life expectancy in an exploratory fashion.[4]

Statistical Analysis

Descriptive statistics with medians and ranges, frequencies, and percentages for quantitative and qualitative variables were used accordingly. Hypothesis testing between LMIC + HIC and LMIC-independent and oral and poster presentation groups was performed using the chi-squared test or Fisher's exact test for categorical data and Student's *t* test and the Mann-Whitney *U* test for parametric and nonparametric continuous variables, respectively. Pearson's or Spearman's correlation was performed according to normality. Statistical analysis was performed using SPSS software version 20 for Mac (IBM, Armonk, NY).

RESULTS

A total of 4,871 abstracts were presented at ASH 2018; 1,026 were selected as oral presentations and 3,845 as posters. Among them, 506 abstracts had a contributing author from an institution in an LMIC (10.4%) and 91 were presented orally (18%), corresponding to 8.9% of all oral presentations, and 415 were presented as posters, corresponding to 10.8% of all poster presentations; 277 (54.7%) abstracts were developed in association with an institution in an HIC (LMIC + HIC). Abstracts in LMICs without HIC collaboration (LMIC-independent) were 229, corresponding to 19 oral presentations (1.9% of oral contributions) and 210 posters (5.4% of posters). LMICs contributed a varying proportion across abstract categories, being highest in red cells (21.7%) and lowest in health services and outcomes (5.9%). LMIC-independent contributions were more prominent in red cells (8.5%) and lower in gene therapy (3%) (Table 1). In the malignant disease category, LMIC abstracts had a higher proportion in genetics and pharmacology (10.2%) and acute leukemia (10%) categories and lowest in chronic lymphocytic leukemia (3%), whereas LMIC-independent were highest in acute leukemia (6.3%) and lowest in chronic lymphocytic leukemia (1.8%) (Table 1).

Abstract Characteristics

Most abstracts were clinical (61.5%) and multicentric (69.8%) in nature. Clinical trials reflected 19% of all LMIC abstracts. A COI statement was reported in 42.3% of contributions with 21.3% having a pharmaceutical industry sponsor identified in the text. Mixed LMIC + HIC contributions had significantly more COIs and industry sponsors than the LMIC-independent contributions (Table 2). When comparing oral versus poster LMIC abstracts, works selected for an oral presentation were significantly more clinical and multicentric in nature, with a higher proportion of clinical trials and a higher number of COIs and industry sponsors reported (Table 3). First authors were affiliated to an LMIC institution in 68.2% of all cases (n = 345). Collaborations with HIC represented 54.7% (n = 277) of LMIC contributions, most frequently including the United States (n = 196, 38.7%). LMIC collaborations with each other

TABLE 1. Contributions From LMICs to ASH18 According to Abstract Category and Format of Presentation

| | All Accepted | LMIC + HIC | | | | | | LMIC-Independent | | | | | |
| | | Total | | Oral | | Poster | | Total | | Oral | | Poster | |
ASH abstract category	No.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Red cells	295	64	21.7	10	15.2	54	23.5	25	8.5	0	0	25	10.9
Leukocytes	126	16	12.7	2	6.7	14	14.6	5	3.9	1	3.3	4	4.2
Hemostasis	433	63	14.5	14	14.6	49	14.5	29	6.7	5	5.2	24	7.1
Blood transfusion	46	4	8.7	0	0	4	11.8	2	4.4	0	0	2	5.9
Hematopoiesis	207	18	8.7	3	4.5	15	10.6	7	3.4	0	0	7	5
Malignancies	2,584	226	8.7	40	7.8	186	9	100	3.9	8	1.6	92	4.5
Genetics and pharmacology	265	27	10.2	4	7.4	23	10.9	8	3	0	0	8	3.8
Acute leukemia	632	63	10	8	5.8	55	11.1	40	6.3	3	2.2	37	7.5
Lymphoma	588	57	9.7	11	9.6	46	9.7	22	3.7	2	1.8	20	4.2
Chronic myeloid neoplasms	457	43	9.4	9	10.7	34	9.1	14	3.1	0	0	14	3.8
CLL	165	5	3	1	2.8	4	3.1	3	1.8	0	0	3	2.3
Plasma cell disorders	477	31	6.5	7	7.8	24	6.2	13	2.7	3	3.3	10	2.6
Transplantation	626	78	12.4	15	10.9	63	12.9	46	7.3	4	2.9	42	8.6
Gene therapy	95	10	10.5	4	16.7	6	8.5	3	3.2	0	0	3	4.2
Health services and outcomes	459	27	5.9	3	3.8	24	6.3	11	2.4	1	1.3	10	2.6

Abbreviations: ASH, American Society of Hematology Meeting; CLL, chronic lymphocytic leukemia; HIC, high-income country; LMIC, low- and middle-income country.

TABLE 2. ASH18 Abstracts' Characteristics From LMICs According to the Presence or Absence of High-Income Country Collaboration

Variable	LMIC-Independent (n = 229)		LMIC + HIC (n = 277)		P^a
	No.	%	No.	%	
LMIC first author	229	100	116	41.9	< .001
Format					
Oral	19	8.3	72	26	< .001
Poster	210	91.7	205	82	
Study type					
Clinical	149	65.1	162	58.5	.077
Basic or translational	80	34.9	115	41.5	
Multicentric	76	33.2	277	100	< .001
Clinical trials	39	17	57	20.6	.18
COI statement	42	18.3	172	62.1	< .001
Industry sponsor	19	8.3	89	32.1	< .001

Abbreviations: ASH, American Society of Hematology Meeting; COI, conflict of interest; HIC, high-income country; LMIC, low- and middle-income country.

^{a}P values determined by Fisher's exact test.

were infrequent and documented in 33 cases (6.5% of all contributions), most within the context of an international collaboration that included an HIC (n = 32).

Participations per Country and Correlation With Global Development Indexes

A total of 572 participations per country in the 506 abstracts analyzed were documented. Overall, LMICs participated in a median of three contributions per country (interquartile range, 1-6). China was by far the most prolific LMIC with 249 participations (43.5%). Countries with more than 10 participations included Brazil (n = 76), Russia (n = 51), India (n = 41), Mexico (n = 22), and Thailand (n = 16) (Fig 1, Appendix Table A1). The East Asia and Pacific region

had 267 participations (46.7%). Following in descending order were Latin America (n = 122; 21.3%), Europe and Central Asia (n = 64; 11.2%), Middle East and North Africa (n = 51; 8.9%), Southern Asia (n = 42; 7.3%), and sub-Saharan Africa (n = 26; 4.6%). Upper-middle–income countries had the highest number of participations (n = 466; 81.5%) and low-middle–income countries were responsible for 96 (16.8%), whereas low-income countries for 10 (1.7%). The number of participations was moderately correlated with the corresponding country's population (r, 0.57; $P < .001$), which persisted regardless of the collaboration of an HIC. Similarly, a moderate correlation was found between number of participations and GNI per capita (r, 0.45; $P < .001$) (Table 4). Other significant, albeit weak, correlations were found with the HDI, HDI adjusted for inequality, and country-specific life expectancy (Table 4). No significant difference was observed in the number of participations according to HDI or GNI per capita category ($P = .15$ and $P = .48$, respectively).

DISCUSSION

Establishing research capacity in LMICs is key for improving health systems and implementing actionable programs through evidence-based assessments.[12,13] In this study, we found that LMIC contributions to global hematology as defined by the ASH18 meeting abstracts were relatively few. One in 10 abstracts presented at ASH18 had a participating author from an LMIC. Half of those contributions included an author from an HIC, usually in a leading capacity. Thus, approximately one in 20 abstracts was a truly independent research initiative that originated in the developing world, with only a handful corresponding to oral presentations. An overall similar proportion of LMIC contributions was observed across categories ranging from 6% to 22% (Table 1). The variations in the proportion of contributions from LMICs may occur because of several factors, including differences in disease incidence, the aging of the population, access to novel diagnostic or prognostic technologies and therapies, pharmaceutical

TABLE 3. ASH18 Abstracts' Characteristics From LMICs According to the Presentation Format

Variable	Oral Presentations		Poster Presentations		P^a
	n = 91	%	n = 415	%	
LMIC first author	40	44	305	73.5	< .001
Study type					
Clinical	64	70.3	247	59.5	.035
Basic or translational	27	29.7	168	40.5	
Multicentric	83	91.2	270	65.1	< .001
Clinical trials	38	41.8	58	14	< .001
COI statement	60	65.9	154	37.1	< .001
Industry sponsor	35	38.5	73	17.6	< .001

Abbreviations: ASH, American Society of Hematology Meeting; COI, conflict of interest; HIC, high-income country; LMIC, low- and middle-income country.

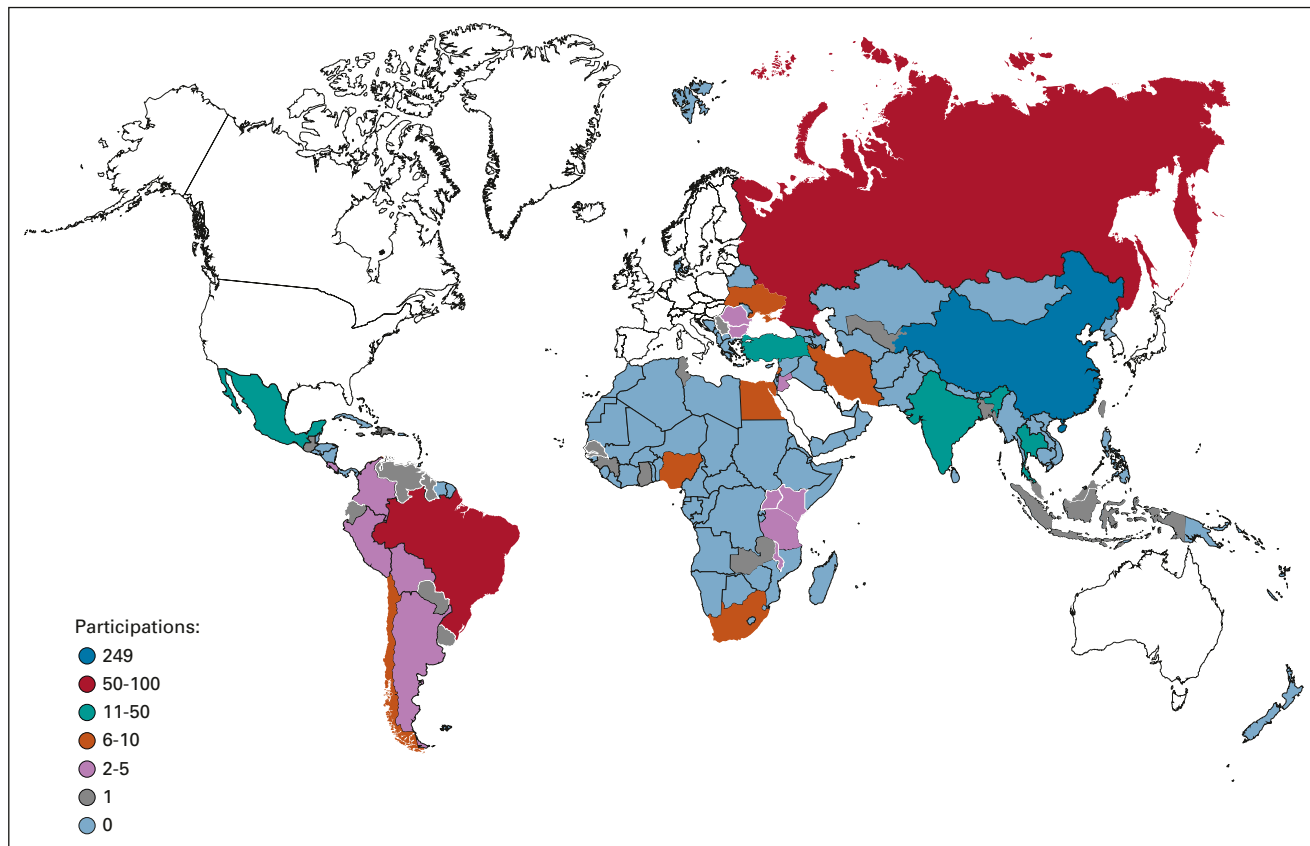^{a}P values determined by Fisher's exact test.

FIG 1. Map displaying participations in ASH18 abstracts from LMICs around the world. ASH, American Society of Hematology Meeting; LMIC, low- and middle-income country.

industry interest, and the scientific competitiveness within each research space.[14] Differences in research capacity have been associated with a lack of education, training, access to protected time, and funding interest in LMICs, which may explain the significant difference in the frequency of clinical versus basic and translational contributions, as has been noted in other specialties.[15,16] Unexpectedly, a positive COI statement was documented in 42.3% of LMIC contributions, a reflection of the pharmaceutical industry's worldwide-reaching marketing arm and its interest in developing local key opinion leaders, despite the fact that the largest market share for pharmaceuticals is ultimately derived from HICs.[17,18] Conversely, only 8.3% of LMIC-independent contributions had an identified industry sponsor. The majority of contributions from LMICs came from upper-middle–income countries, finding only a moderate to weak correlation with global development indices, even after controlling for HIC-LMIC partnerships suggesting that other factors not captured by these indices may also play a role in research contributions in hematology (Table 4).

Few studies have analyzed hematology research capacity in LMICs. A previous bibliometric study by Acevedo et al [7] analyzed Latin American contributions to ASH and the ASCO Meeting from 2000 to 2010 and found that 31.3% of

2,871 contributions did not represent true Latin American works, 61.5% were presented as printed-only abstracts, and 1.9% were as oral presentations, finding a similar frequency of contribution across countries in this region. Another study analyzing the presence of Chinese contributions in several hematology journals from 2004 to 2013 reported that this country was responsible for 2.4% of all articles, with less citations and publications in high impact factor journals in comparison with articles from HICs, albeit this study did not include other LMICs for comparison.[8] Lastly, a scientometric study assessed 23,295 publications on hematopoietic stem-cell transplantation reporting 5% of contributions originated in China and 1.39% from Latin America, with the two largest contributors in the region also being Brazil and Mexico.[9] An underlying theme among these publications is that research topics of interest to LMICs may not always appeal to editors or reviewers in HICs and can be perceived to be of lower value when they are performed with less robust experimental designs and analytic methods or do not include novel diagnostic technologies or therapeutic agents.[19] ASH abstracts may be affected by this form of editorial bias although author blinding and an international abstract reviewer roster may partially limit this effect. Consequently, presumption of editorial bias by LMIC investigators against their nationality

TABLE 4. Correlation of LMIC Contributions to ASH18 With Global Development Indexes

	Population		HDI		HDI-Inequality		Life Expectancy		GNI per Capita	
Variable	r^a	**P**	r^a	**P**	r^a	**P**	r^a	**P**	r^a	**P**
Contributions										
All	0.57[a]	< .001	0.39[a]	.01	0.38	.02	0.3	.05	0.45	
Per million			0.35[a]	.02[a]	0.39[a]	.01	0.35[a]	.03	0.33[a]	< .01
First author[b]										
All	0.57[a]	< .001	0.25	.11	0.18	.28	0.23	.15	0.31[a]	.03
Per million			0.32[a]	.04[a]	0.25	.18	0.29	.06	0.35[a]	.04
LMIC-only										
All	0.65[a]	< .001	0.31[a]	.04[a]	0.26	.11	0.27	.09	0.37[a]	.03
Per million			0.35[a]	.02[a]	0.29	.07	0.28	.07	0.41[a]	.02
LMIC + HIC										
All	0.43[a]	< .001	0.37[a]	.02[a]	0.36[a]	.02	0.3	.06	0.45[a]	< .01
Per million			0.27	.08	0.32[a]	.04	0.3	.06	0.25	.11

Abbreviations: ASH, American Society of Hematology Meeting; GNI, global national income; HDI, Human Development Index; HIC, high-income country; LMIC, low- and middle-income country.

[a]Pearson or Spearman correlations were performed according to the Kolmogorov-Smirnov test; contributions adjusted according to the inhabitants in each country in 2018.

[b]Number of contributions with a first author affiliated to an institution in an LMIC per country.

coupled with fear of rejection and lack of mentorship may discourage authors from submitting their works. Other major socioeconomic factors potentially associated with a lower participation of LMICs include the cost of travel and lack of institutional support, with bureaucratic difficulties including taking pay cuts for missing workdays, submission fees and lack of sponsorship, language barriers, as well as competing international or national meetings.

Our findings should be interpreted with caution as contributions to scientific meetings are simple but also unvalidated surrogate outcomes to measure the true impact of research in improving health.[20] The number of LMIC contributions to ASH is considered in competition with HIC-originated research and therefore does not necessarily encompasses the true quantity or quality of all hematologic research performed in the developing world. Analyzing contributions to other international meetings across different regions could help clarify this issue. Furthermore, a large proportion of these contributions may never be ultimately published in a peer-reviewed journal.[7,21] This study is also limited by the analysis of a single ASH meeting and excluded publication-only contributions. Although undertaken as such in an effort to analyze the most current works considered of a higher quality after peer review in sufficient detail, a larger longitudinal analysis including rate of publication would be of interest and more easily achievable through data mining, which was out of the scope of this report. Biomedical research in LMICs should be recognized and fostered. Developments in diagnostic or therapeutic

tools applicable to this setting through pragmatic studies that cannot otherwise be performed in HICs may lead to increased survival or quality of life with the potential for global relevance, positively affecting large populations.[22] Successful examples of this are the development of all-trans retinoic acid and arsenic trioxide for the treatment of acute promyelocytic leukemia in China, which have become worldwide standards of care.[23] Research capacity building is crucial to assess the unknown status quo in many LMICs, identifying limitations and barriers to better access to health care, achievable through increased guidance and collaboration from HICs. In this respect, ASH has recently recognized this need by developing the Global Capacity Building Showcase, a forum in the annual meeting where the works of investigators from LMICs are highlighted, as well as other educational and funding resources for investigators in these regions of the world.[24] Similar opportunities are available through the sponsorship of other international societies.

In conclusion, LMICs, where more than 80% of the world's population resides, were responsible for only a small fraction of abstracts selected for presentation at ASH18, mostly by upper-middle–income countries with the three largest contributors being China, Brazil, and Russia and a low number of contributions by low-income countries. Almost half of accepted works represented a form of international collaboration, with clinical, multicentric studies predominating and COI disclosures a frequent and unexpected feature.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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Open Payments is a public database containing information reported by companies about payments made to US-licensed physicians (Open Payments).

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APPENDIX

TABLE A1. Contributions From LMICs to the 2018 ASH

Country and Region	Participation			First Author Abstracts			HIC Collaborations		Income[a]	HDI
	No.	%	Per Million Population	No.	%	Per Million Population	No.	%	Stratum	Stratum
Latin America	122	21.3	0.22	65	18.8	0.12	84	68.9	—	—
Argentina	3	0.5	0.07	1	0.3	0.02	2	66.7	Upper-M	Very high
Bolivia	3	0.5	0.26	—	—	—	3	100	Low-M	High
Brazil	76	13.3	0.36	49	14.2	0.23	50	65.8	Upper-M	High
Colombia	4	0.7	0.08	1	0.3	0.02	4	100	Low-M	High
Costa Rica	3	0.5	0.6	—	—	—	3	100	Upper-M	High
Ecuador	1	0.2	0.06	—	—	—	1	100	Upper-M	High
Guatemala	1	0.2	0.06	—	—	—	1	100	Upper-M	Medium
Guyana	1	0.2	1.25	—	—	—	1	100	Upper-M	Medium
Haiti	1	0.2	0.09	—	—	—	1	100	Low	Low
Jamaica	1	0.2	0.34	—	—	—	1	100	Upper-M	High
Mexico	22	3.8	0.17	12	3.5	0.1	11	50	Upper-M	High
Paraguay	1	0.2	0.14	—	—	—	1	100	Upper-M	High
Peru	3	0.5	0.09	2		0.06	3	100	Upper-M	High
Venezuela	2	0.4	0.07	—	—	—	2	100	Upper-M	High
Europe and Central Asia	64	11.2	0.24	23	6.5	0.09	45	70.3	—	—
Bulgaria	3	0.5	0.43	—	—	—	3	100	Upper-M	Very high
Romania	2	0.4	0.1	1	0.3	0.05	2	100	Upper-M	Very high
Russia	51	8.9	0.35	21	6.1	0.15	32	62.7	Upper-M	Very high
Serbia	2	0.4	0.29	1	0.3	0.14	2	100	Upper-M	High
Tunisia	1	0.2	0.09	—	—	—	1	100	Upper-M	High
Ukraine	4	0.7	0.09	—	—	—	4	100	Low-M	High
Uzbekistan	1	0.2	0.03	—	—	—	1	100	Low-M	High
Middle East and North Africa	51	8.9	0.18	17	4.9	0.06	30	58.8	—	—
Egypt	7	1.2	0.07	2	0.6	0.02	6	85.7	Low-M	High
Iran	5	0.9	0.01	1	0.3	0.01	5	100	Upper-M	High
Jordan	3	0.5	0.3	—	—	—	3	100	Upper-M	High
Lebanon	9	1.6	1.32	4	1.2	0.59	9	100	Upper-M	High
Turkey	27	4.7	0.33	10	2.9	0.12	7	74.1	Low-M	Very high
Sub-Saharan Africa	26	4.6	0.05	9	2.6	0.02	26	100	—	—
Ghana	1	0.2	0.03	—	—	—	1	100	Low-M	Medium
Guinea-Bissau	1	0.2	0.53	—	—	—	1	100	Low	Low
Kenya	2	0.4	0.04	—	—	—	2	100	Low-M	Medium
Malawi	2	0.4	0.11	2	0.6	0.11	2	100	Low	Medium
Nigeria	6	1	0.03	3	0.9	0.02	6	100	Low-M	Low
Senegal	1	0.2	0.06	—	—	—	1	100	Low-M	Low
South Africa	6	1	0.1	—	—	—	6	100	Upper-M	High
Tanzania	3	0.5	0.05	2	0.6	0.04	3	100	Low	Low
Uganda	3	0.5	0.07	1	0.3	0.02	3	100	Low	Low
Zambia	1	0.2	0.06	1	0.3	0.06	1	100	Low-M	Medium

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TABLE A1. Contributions From LMICs to the 2018 ASH (Continued)

Country and Region	Participation			First Author Abstracts			HIC Collaborations		Income[a]	HDI
	No.	%	Per Million Population	No.	%	Per Million Population	No.	%	Stratum	Stratum
Eastern Asia and Pacific	267	46.7	0.15	207	59.8	0.12	125	46.5	—	—
China	249	43.5	0.18	199	57.5	0.14	111	44.6	Upper-M	High
Indonesia	1	0.2	< 0.01	—	—	—	1	100	Low-M	High
Malaysia	1	0.2	0.03	—	—	—	1	100	Upper-M	Very high
Thailand	16	2.8	0.23	8	2.3	0.12	11	68.8	Upper-M	High
Southern Asia	42	7.3	0.03	25	7.2	0.02	23	54.8	—	—
Bangladesh	1	0.2	0.01	—	—	—	0	0	Low-M	Medium
India	41	7.2	0.03	25	7.2	0.02	23	43.9	Low-M	Medium
All	572	100	—	346	100	—	342	—	—	—

Abbreviations: ASH, American Society of Hematology Meeting; HDI, Human Development Index; HIC, high-income country; Low-M, low-middle income; Upper-M, upper-middle income.

[a]Income according to the 2018 World Bank classification.