Global Health Education in US Pediatric Residency Programs

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abstract

BACKGROUND AND OBJECTIVE: Despite the growing importance of global health (GH) training for pediatric residents, few mechanisms have cataloged GH educational opportunities offered by US pediatric residency programs. We sought to characterize GH education opportunities across pediatric residency programs and identify program characteristics associated with key GH education elements.

METHODS: Data on program and GH training characteristics were sought from program directors or their delegates of all US pediatric residency programs during 2013 to 2014. These data were used to compare programs with and without a GH track as well as across small, medium, and large programs. Program characteristics associated with the presence of key educational elements were identified by using bivariate logistic regression.

RESULTS: Data were collected from 198 of 199 active US pediatric residency programs (99.5%). Seven percent of pediatric trainees went abroad during 2013 to 2014. Forty-nine programs (24.7%) reported having a GH track, 66.1% had a faculty lead, 58.1% offered international field experiences, and 48.5% offered domestic field experiences. Forty-two percent of programs reported international partnerships across 153 countries. Larger programs, those with lead faculty, GH tracks, or partnerships had significantly increased odds of having each GH educational element, including pretravel preparation.

CONCLUSIONS: The number of pediatric residency programs offering GH training opportunities continues to rise. However, smaller programs and those without tracks, lead faculty, or formal partnerships lag behind with organized GH curricula. As GH becomes an integral component of pediatric training, a heightened commitment is needed to ensure consistency of training experiences that encompass best practices in all programs.

WHAT’S KNOWN ON THIS SUBJECT: In response to growing demand from trainees, many pediatric residency programs offer global health (GH) experiences for their residents. There is diversity in what is offered at programs across the country.

WHAT THIS STUDY ADDS: This is the most comprehensive assessment of US pediatric residency training opportunities in GH. These opportunities are prevalent and increasingly formalized as tracks. However, there remain gaps in universal pretravel preparation and coordination across GH partnerships nationally.

WHAT’S NEW ON THIS SUBJECT: In this study, we provide the most comprehensive assessment of US pediatric residency training opportunities in global health (GH). We find that these opportunities are prevalent and increasingly formalized as tracks. However, there remain gaps in universal pretravel preparation and coordination across GH partnerships nationally.

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Global health (GH) is “an area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide.” Globalization, natural disasters, epidemics, and shifts in population demographics have brought GH issues into the public eye in the United States. In addition, many US pediatricians find it important to play an active role in children’s health across the globe as they care for growing numbers of immigrants, refugees, international adoptees, and travelers. Concurrent with this, medical students and residents report increased interest in and commitment to GH issues.

The availability of GH opportunities plays an important role in prospective residents’ choice and ranking of training programs. The benefits associated with GH training include increased medical knowledge, improved diagnostic skills, enhanced cultural humility, increased awareness of social determinants of health, and greater understanding of resource utilization. Accordingly, US pediatric residency programs are establishing GH curricula, supporting opportunities for trainees to participate in GH rotations, and offering specialized residency GH tracks or certificate programs. To date, comprehensive data about GH education offerings in pediatric residency programs across the United States are limited.

In response to the expanding interest and with an aim of promoting high-quality pediatric GH education standards, the Association of Pediatric Program Directors Global Health Pediatric Education Group (APPD GH PEG) developed a database to systematically catalog GH training experiences across all US pediatric residency programs. The goals were to develop an understanding of the current offerings in pediatric GH education and to promote collaboration between residency programs. In this article, we describe the current landscape of GH education in US pediatric residency programs and identify program characteristics associated with key GH curricular elements.

METHODS

Population

US pediatric residency programs were identified through the APPD membership list with confirmation by program directors, APPD regional council members, and the Accreditation Council of Graduate Medical Education Web site. Programs were grouped by APPD region (https://www.appd.org/activities/regions.cfm).

Pediatric GH Education Database

The APPD GH PEG Steering Committee developed a data collection tool to identify elements expected to be useful for monitoring trends in GH education and enhancing collaboration between programs. Members of the Steering Committee and GH PEG pilot tested and refined the final data collection tool during the Annual APPD Spring Meeting in April 2013. Program characteristics included APPD region, number of categorical trainees (residents enrolled in pediatric only 3-year residency programs, rather than combined programs) and number participating in field experiences, identification of a GH faculty leader, and presence of a GH track. GH curricular elements included field experiences (international and domestic/US-based), pretravel preparation, scholarly project requirements, and GH lectures. We also characterized the location and nature of any formal international partnerships (clinical, education, research). Finally, an open-ended question elicited GH program needs. Given the lack of consensus regarding the definitions of pretravel preparation and a GH track, these terms were not predefined for respondents in an effort to be as inclusive as possible.

Data Collection

Members of the GH PEG from each APPD region contacted the residency programs in their region to collect and complete data entry. A program director or program leader assigned by the program director (eg, GH track director, program coordinator, associate program director, chief resident) provided information by phone, in-person, or by E-mail. Data collection occurred from July 2013 to October 2014 with most data collected from July 2013 to June 2014. Regardless of when data were collected, those providing data were asked to provide information as it pertained to the 2013–2014 academic year.

Data Analysis

Data were summarized across all programs by using standard descriptive statistics. Residency programs were categorized as “small” (<30), “medium” (30–60), or “large” (>60 residents). We used Pearson’s χ² test (or Fisher’s exact test when cell sizes were <5) and Student’s t tests (or analysis of variance) to identify differences in program characteristics based on (1) program size and (2) presence of a GH track. We next explored relationships between program characteristics and the presence/absence of GH curricular elements. Bivariate associations between each program characteristic (program size, presence of GH track, GH faculty lead, or international partnerships) and each curricular element (pretravel preparation, international field experience, domestic field experience, or scholarly activity) were identified by using logistic regression. Data were analyzed by using Stata (SE version 12.1; Stata Corp, College Station, TX) and a P value <.05 was considered statistically significant.

The institutional review board of the University of Wisconsin-Madison...
considered this project to be nonhuman subjects research and thus exempt from ethical review.

RESULTS

A total of 214 residency programs were identified; 15 were inactive or not pediatric programs and were excluded. One program did not respond, leaving 198 programs (99.5%) for inclusion in the analysis (Table 1). There was wide variability in the number of pediatric residency programs per APPD region, ranging from 12 programs in the Southwest and New England regions to 40 programs in the Southeast region. The average number of residents per program was 45.9 (range 5–144), and ~30% of programs were characterized as small. Although nearly two-thirds of programs (66.1%) identified a faculty member responsible for GH programming, 49 programs (24.7%) reported having a GH track.

Of 9091 pediatric residents across all programs, 666 (7.3%) went on an international rotation during the 2013–2014 academic year. On average, 3 to 4 residents went abroad per residency program (range 0–30), with 55.1% of programs reporting at least 1 resident having an international field experience. Ninety-six programs (48.5%) offered domestic GH field experiences. GH lectures were offered by 54% of programs. Of the 127 programs that offered either international or domestic field experiences, 84 (66.1%) reported having pretravel preparation.

Eighty-four programs (42.4%) reported having international partnerships in 153 countries (Fig 1). Many programs identified partners in more than 1 country for a total of 281 international partnerships. The focus of these partnerships was mostly clinical (84.5%), followed by education (53.6%), and research (26.2%). Ten or more programs identified partnerships in 8 countries: Haiti (22), Kenya (16), Tanzania (12), Uganda (12), India (12), Guatemala (12), Honduras (10), and the Dominican Republic (10).

GH Tracks

Characteristics of programs with and without a GH track are shown in Table 2. Programs in the Mid-American and Western regions had the highest proportion of GH tracks (20.4% and 18.4%, respectively). Programs with GH tracks were larger (mean 65.5 vs 39.5 residents in programs without a track, \( P < .001 \)), and had more residents participating in international field experiences in the previous year (mean 7.4 vs 2.0 residents in programs without a track, \( P < .001 \)). All GH educational elements were more common in programs with GH tracks. Nearly all programs with GH tracks included international and domestic field experiences (95.9% and 89.9%, respectively), pretravel preparation (89.4%), GH lectures (95.9%), and scholarly projects (79.6%). Among residency programs without GH tracks, the 2 most common GH educational elements were international field experiences (45.6%) and lectures (40.3%).

Residency Program Size

Differences in program characteristics by program size are shown in Table 3. Over half of large residency programs (51.1%) had GH tracks compared with only 5.0% of small programs (\( P < .001 \)). Large programs also had more residents doing international rotations and, compared with small or medium-sized programs, were more likely to offer each GH educational element (\( P < .001 \)). Similar GH educational elements were offered across all programs with GH tracks regardless of size (Supplemental Table 5). There were no differences in focus of international partnership (clinical, education, research) by program size.

Predictors of GH Curricular Elements

Larger program size, the presence of a GH track, presence of a GH faculty lead, and presence of an international partnership were all significantly associated with each of the GH curricular elements with large effect sizes (Table 4). Compared with programs without GH tracks, programs with GH tracks were almost 8 times more likely to offer pretravel preparation (odds ratio 7.6, 95% confidence interval 2.7–21.2) and 3 times more likely to have research-focused international partnerships (odds ratio 3.1, 95% confidence interval 1.1–8.9).

Program Needs

The most commonly identified needs by respondents included funding, administrative support, availability of sustainable international partnerships, sharing of curricular
DISCUSSION

This is the most comprehensive assessment of US pediatric residency training opportunities in global child health, including data from all but 1 pediatric training program. This is also the first study to quantify the breadth of US pediatric residency programs’ international partnerships. GH opportunities in pediatric residency programs are prevalent, and increasingly formalized as GH tracks. Furthermore, our findings help identify certain program characteristics that are associated with key GH curricular elements, which can help guide residency programs in successful GH education implementation.

Two previous US-based studies have attempted to quantify the number of pediatric residency programs offering GH opportunities.4,9 Consistent with these studies, we found that the number of pediatric residency programs offering GH training opportunities and tracks continues to rise. In 1995, 25% of programs offered international field experiences, 52% in 2006, and 58% in this study. We suspect that the 1995 and 2006 numbers may be overestimates given that response rates were 65% and 53%, respectively, and programs with opportunities may have been more likely to respond. The actual increase in international field experiences offered may, therefore, be even larger. The commitment of programs to GH education through the development of a formalized track also has increased substantially, with 49 programs (24.7%) now reporting that they have a GH track, compared with only 6 (6%) in 2006.

These increases in GH training opportunities translate into a sizable number of US pediatric residents abroad each year. Short-term GH experiences have distinct benefits in improving resident understanding of the diseases responsible for the largest proportion of childhood mortality; instilling a deeper appreciation for issues related to cultural humility, professionalism, and public health; and helping to maintain and foster compassion, humanism, and altruism when caring for the world’s most vulnerable populations.3,8,10–12 Nonetheless, GH experiences come with nontrivial risks to the participants, residency programs, host institutions, and communities. Residents struggle with the emotional challenges of practicing in a resource-limited environment.

FIGURE 1
US pediatric residency program affiliated GH partnerships.

Data Source: APPD GH PEG Database, 2014.

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TABLE 2  Characteristics of US Pediatric Residency Programs and GH Training With and Without a GH Track, n = 198

<table>
<thead>
<tr>
<th></th>
<th>Global Health Track, n = 49</th>
<th>No Global Health Track, n = 149</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of programs, by APPD Region, %</td>
<td></td>
<td></td>
<td>.23</td>
</tr>
<tr>
<td>Mid-America</td>
<td>20.4</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>Mid-Atlantic</td>
<td>6.1</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>Midwest</td>
<td>12.2</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>New England</td>
<td>10.2</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>12.2</td>
<td>20.1</td>
<td></td>
</tr>
<tr>
<td>Southeast</td>
<td>16.3</td>
<td>21.5</td>
<td></td>
</tr>
<tr>
<td>Southwest</td>
<td>4.1</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>Western</td>
<td>18.4</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>No. of residents per program, mean (SD)</td>
<td>65.5 (29.0)</td>
<td>39.5 (21.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No. of residents on international field experiences per program, mean (SD)</td>
<td>7.4 (6.5)</td>
<td>2.0 (3.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Presence of GH faculty lead, %</td>
<td>98.0</td>
<td>55.7</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prevalence of GH curricular elements, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International field experience</td>
<td>95.9</td>
<td>45.6</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Domestic field experience</td>
<td>89.8</td>
<td>34.9</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pretravel preparationb</td>
<td>89.4</td>
<td>52.5</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>GH lectures</td>
<td>95.9</td>
<td>40.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Scholarly project</td>
<td>79.6</td>
<td>25.5</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Focus of international partnerships, %</td>
<td></td>
<td></td>
<td>.47</td>
</tr>
<tr>
<td>Clinical</td>
<td>87.5</td>
<td>81.8</td>
<td>.12</td>
</tr>
<tr>
<td>Education</td>
<td>62.5</td>
<td>45.5</td>
<td>.03</td>
</tr>
<tr>
<td>Research</td>
<td>37.5</td>
<td>15.9</td>
<td></td>
</tr>
</tbody>
</table>

* P value by χ² or Student’s t test.
b Of the 127 programs that offer either domestic or international field experiences.
* Of the 84 programs that identified international partnerships.

are subject to the inherent safety risks involved with international travel, and may endure financial strain given the cost of these experiences. Residency programs are faced with challenges in ensuring that their residents are participating in provision of adequate supervision may impose burdens on partner institutions, exacerbating preexisting human resource capacity limitations.13–18

The importance of these aspects of GH training are underscored through the emerging literature on best practices for developing ethical, sustainable, and educationally robust GH training experiences,16,19–24 which include the provision of adequate preparation and orientation before the resident embarks, along with adequate supervision during the experience. Such elements are requisite for programs sending residents overseas, and programs should establish partnerships with institutions, communities, and programs having shared goals, measurable outcomes, parity, and reciprocity.23

Despite these accepted best practices, we found that both pretravel preparation and formal partnerships remain critical national gaps. As may have been expected, results from our study suggest that larger programs, those with GH tracks, or a with GH faculty leader are significantly more likely to report having pretravel training and established partnerships. Establishing and maintaining a GH training track and GH partnerships require substantial institutional commitment and a core group of dedicated faculty. As such, we were not surprised that smaller residency programs reported having fewer tracks and GH opportunities as compared with medium and large programs with a larger faculty from which to draw.

Because we hypothesized that the presence of a GH track may be the most important determinant of whether a program offers pretravel training, and because having a GH track was associated with each program characteristic (ie, program size, GH faculty lead, international partnership), we repeated the analysis shown in Table 4 after

TABLE 3 Characteristics of US Pediatric Residency Programs and Global Health Training According to Program Size, n = 198

<table>
<thead>
<tr>
<th></th>
<th>Small, n = 61</th>
<th>Medium, n = 91</th>
<th>Large, n = 45</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programs with a GH track, %</td>
<td>5.0</td>
<td>24.7</td>
<td>51.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No. of residents on international field experience per program, mean (SD)</td>
<td>0.7 (1.5)</td>
<td>2.6 (2.8)</td>
<td>8.6 (6.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Presence of a GH faculty lead, %</td>
<td>46.7</td>
<td>66.7</td>
<td>91.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prevalence of GH curricular elements, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International field experience</td>
<td>30.0</td>
<td>62.4</td>
<td>86.7</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Domestic field experience</td>
<td>31.7</td>
<td>49.5</td>
<td>89.9</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pretravel preparationb</td>
<td>50.0</td>
<td>57.8</td>
<td>89.7</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>GH lectures</td>
<td>30.0</td>
<td>54.8</td>
<td>84.4</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Scholarly project</td>
<td>18.3</td>
<td>36.6</td>
<td>71.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Focus of international partnerships, %</td>
<td></td>
<td></td>
<td></td>
<td>.98</td>
</tr>
<tr>
<td>Clinical</td>
<td>63.3</td>
<td>85.4</td>
<td>83.9</td>
<td>.23</td>
</tr>
<tr>
<td>Education</td>
<td>33.3</td>
<td>61.0</td>
<td>51.6</td>
<td>.51</td>
</tr>
<tr>
<td>Research</td>
<td>16.7</td>
<td>22.0</td>
<td>35.5</td>
<td></td>
</tr>
</tbody>
</table>

Small (<30 residents), Medium (30–80 residents), Large (>80 residents).
* P value by χ², Fisher’s exact or Student’s t test.
b Of the 127 programs that offer either domestic or international field experiences.
* Of the 84 programs that identified international partnerships.
TABLE 4 Associations Between Pediatric Residency Program Characteristics and GH Educational Elements

<table>
<thead>
<tr>
<th>Program size</th>
<th>Pretravel Preparation,* OR (95% CI)</th>
<th>International Field Experience, OR (95% CI)</th>
<th>Domestic Field Experience, OR (95% CI)</th>
<th>Scholarly Project, OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Medium</td>
<td>1.4 (0.5–3.5)</td>
<td>3.6 (1.8–7.3)</td>
<td>2.0 (1.0–4.0)</td>
<td>2.4 (1.1–5.3)</td>
</tr>
<tr>
<td>Large</td>
<td>8.8 (2.4–32.4)</td>
<td>14.0 (5.0–39.2)</td>
<td>4.5 (2.0–10.4)</td>
<td>10.4 (4.1–26.1)</td>
</tr>
<tr>
<td>GH track</td>
<td>7.6 (2.7–21.2)</td>
<td>26.3 (6.1–112.4)</td>
<td>18.2 (6.0–43.4)</td>
<td>11.3 (5.1–24.9)</td>
</tr>
<tr>
<td>GH faculty lead</td>
<td>6.1 (1.8–20.7)</td>
<td>27.7 (11.8–65.3)</td>
<td>9.7 (4.5–20.7)</td>
<td>13.5 (5.1–35.9)</td>
</tr>
<tr>
<td>International partnership</td>
<td>3.5 (1.6–7.5)</td>
<td>28.7 (11.4–72.3)</td>
<td>3.1 (1.7–5.5)</td>
<td>4.3 (2.5–8.0)</td>
</tr>
</tbody>
</table>

CI, 95% confidence interval; OR, odds ratio.

* Pretravel preparation was included only for programs that offered international or domestic field experiences.

adjusting for the presence of a GH track. Even after accounting for the presence of a GH track, the relationships between pretravel training and program size, a GH faculty lead or international partnerships remained significant (data not shown), suggesting there are independent effects of each of these characteristics on pretravel preparation beyond simply having a GH track. Note that there are few small programs with GH tracks, so the strength of this conclusion is limited and will need to be reexplored as more small programs develop GH tracks. Our observation that medium-sized programs have effect sizes between small and large-sized programs may suggest a “dose-response” relationship between program size and the offering of GH education elements. Future work exploring the barriers and facilitators to offering pretravel preparation, as well as formal partnerships, would be highly valuable.

One strategy to overcome the gap in pretravel training is through resource and information sharing, because much of the pretravel content is uniformly applicable. This approach would minimize the burden, particularly for smaller programs, for developing a new curriculum and is a major outcome objective of this collaborative effort.

Another important observation from this work identifies geographical areas hosting a very high density of partnerships. Perhaps the most striking example of this is in Haiti, a country approximately the size of Vermont, where 22 programs report having partnerships. Adding the Dominican Republic, with which Haiti shares the island of Hispaniola, the number increases to 32 programs. Similarly, in East Africa, 40 US pediatric residency programs have partnerships in the neighboring countries of Uganda, Tanzania, and Kenya. The impact of GH partnerships, particularly those involving trainees (who by definition require orientation, assessment, and supervision), on colleagues and institutions in resource-limited settings cannot be overstated.2,3 and should be monitored in these regions. By coordinating efforts, orientation, and schedules across programs working in the same areas, some of the burden imposed on partners abroad could be offset.

In addition to our international partners, we also should pay special attention to the burdens that our programs and trainees place on domestic GH partners who are often working in resource-limited settings in the United States. Given the sizable health disparities that exist in the United States, engaging residents in these experiences during their training is important. Yet with nearly half of all pediatric residency programs offering domestic GH experiences, the scale of this impact is not inconsequential. This is another area requiring collaboration and coordination across programs.

Findings from our work should be interpreted with certain limitations in mind. Data were self-reported and discrete definitions were not provided for all terms used in the database, which could have introduced bias. We developed the data collection tool for the database, and the program and educational elements included may not represent every important characteristic relevant to this topic. The data collected represent only 1 academic year (2013–2014), and we cannot confirm if these data are reflective of all recent years. As we update the database and make it publicly available via the APPD GH PEG Web site, moving forward we hope that additional years’ worth of data will provide clarity about trends in GH education over time. Finally, as the primary goals of the study were to guide programmatic features of the APPD GH PEG, to identify avenues for collaboration, and to assess the current state of pediatric GH education in the United States, we did not assess quality, longevity, or outcomes of each of the curricular elements. This information could be helpful for guiding program and pediatric GH education impact and improvement, and will be important next steps.

CONCLUSIONS

Our data show that GH experiences are an integral part of many US residency programs, but that there is considerable variability in training experiences. As GH becomes a universal component of pediatric training, heightened commitment to ensure that best practices become uniform and attainable for all programs is an important goal. We have identified multiple areas for possible collaboration, including sharing pretravel training and curricula, and coordination across GH partnerships, which will enhance our efforts to achieve this goal.
ACKNOWLEDGMENTS

The authors acknowledge Melanie Anspacher, Florence Desrosiers, Jackson Williams, Mubariz Naqui, David Wood, and Megan Van Boxtel for their assistance with data collection; the Association of Pediatric Program Directors leadership for their support of the GH PEG; and Ellen Wald and Nicole St Clair for their thoughtful review of the manuscript.

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ABBREVIATIONS

APPD: Association of Pediatric Program Directors
GH: global health
PEG: Pediatric Education Group
AIRLINE SEATS: My wife and I recently flew to England to visit her sister. Trying to save money, we made our airline reservations months in advance. Despite reserving so far in advance, we could not select seats ourselves. Once we boarded the plane, we were disappointed to find that the airline had assigned us seats in the row in front of the window escape—which meant our seats did not recline. Suffice it to say, we did not get much sleep on our flight to England. On the flight home, we spent several minutes at check-in discussing with the airline representative our desire not to be assigned the same seats as before. The representative was quite polite and reassured us that she would not assign us seats in the row in front of the window escape. Alas, she assigned us seats in the last row of the plane—which did not recline. Airlines are trying to make a profit. However, as a customer, should I expect a seat that reclines? Should the airline have given me a reduced price ticket for a seat that does not meet the expectations for the level of service? After all, the airlines are always trying to raise money and charge for any additional items they can.

As reported on CNN (Travel: June 14, 2015), the International Air Transport Association recently recommended that airlines adopt a universal maximum luggage size for storage in overhead bins. Working with aircraft manufacturers, the association decided that luggage no more than 21.5 inches tall, 13.5 inches wide and 7.5 inches deep would maximize storage space for all passengers. This size of bag is considerably smaller than what US airlines currently allow; most roller bags would be too large. Presumably, all carry-on luggage too large would have to be checked—with the passenger paying the associated fees.

It seems that airlines are consistently asking passengers to pay for what was previously free. Perhaps in the future, when I book a reservation, the computer system will prompt me to select seats, and if I want one that reclines, I suspect that soon it may cost more.

Noted by WVR, MD
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