Understanding the Carbon Footprint of the American Academy of Orthopaedic Surgeons Annual Meeting.

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INTRODUCTION:

Climate change poses a significant threat to global health. The Intergovernmental Panel on Climate Change (IPCC) has called for a reduction in greenhouse gas (GHG) emissions. Commercial aviation contributes significantly to GHG emissions. Academia represents a group with notably high carbon footprints, with some institutions reporting up to 33-73% of their carbon emissions being attributable to academic air travel. The AAOS meeting and the numerous smaller-scale orthopedic meetings promote knowledge exchange, professional connections, and foster unity within the orthopedic community. However, many orthopedists fail to understand the extensive environmental impact of this academic travel. In this study, we estimated the air and ground travel-related emissions of meeting participants for the 2023 AAOS annual meeting.

METHODS:

We conducted a retrospective quantitative analysis of GHG emissions reported in CO2 equivalents (CO2e) in tons (t) from travel for the AAOS 2023 Annual Meeting in Las Vegas, NV. Attendee demographics were gathered from the published attendee profile, detailing the number of surgeon attendees from each state and the continent or sub-continent of origin for international guests. We then calculated estimated emissions for the same cohort of attendees at three alternative locations: New Orleans, Chicago, and New York City. We also estimated emissions for a theoretical hybrid in-person and virtual meeting structure, envisioning the AAOS meeting occurring in several regional hubs where each hub can interact in real time with other hubs in parallel sessions via videoconferencing. In a secondary analysis, we quantitatively examined the distribution of orthopedic surgeons in the U.S. by state. Data from the Association of American Medical Colleges (AAMC) Workforce Report was employed to report distribution both as number of surgeons per state and surgeons per 1000 square miles (sq. mi.) to depict the geographic spread and density of surgeons by state. This analysis serves to provide meeting planners with a means to evaluate orthopedic surgeons' geographic distribution and to aid in selection of future meeting locations that minimize air travel.

RESULTS:

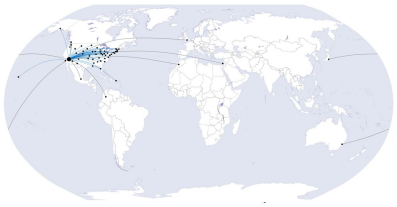
17,808 people attended the 2023 annual meeting in Las Vegas, 10,050 were medical professionals. 43.6% (7,758) of attendees represented industry partners and their emissions couldn't be calculated because state of origin was not reported. 7,857 (78.2%) of medical professional attendees were domestic and 2,193 (21.8%) were international. The total CO2e emissions from travel for medical professions were 9,459 t, with 49.9% (4,722 t) attributable to domestic and 50.1% (4,737 t) to international travel. Domestic attendees emitted a mean of 0.60 t per person, while international guests emitted 2.16 t per person.

If we transpose the assumed group of medical professionals to meeting locations in Chicago, New York City, or New Orleans, the projected travel related CO2e emissions for each location would have been 7,074, 7,678, and 7,397 t. Mean emissions per attendee in Chicago were 0.40 t for domestic and 1.81 t for international participants. For New York City and New Orleans, the figures were 0.49 and 1.74 t, and 0.45 and 1.76 t.

The hybrid meeting was estimated to have 8,561 attendees, as international partners would host their own regional meeting hub, resulting in a total emission of 1,368 t from travel. In this scenario, attendees from Canada participated in the Chicago meeting, while those from Central America attended in New Orleans. Projected attendance figures for the meeting locations were 2,256 for Las Vegas, 2,323 for Chicago, 2,105 for New York, and 1,877 for New Orleans. The corresponding CO2e emissions for each location were 385, 305, 151, and 527 t, respectively (table1). The overall mean CO2 emissions per attendee for the entire meeting was 0.16 t.

DISCUSSION AND CONCLUSION:

Chicago had the lowest travel-related emissions for all single-location meetings, followed by New Orleans, New York City, and Las Vegas. The regional hub model resulted in an 81-86% decrease in travel emissions.



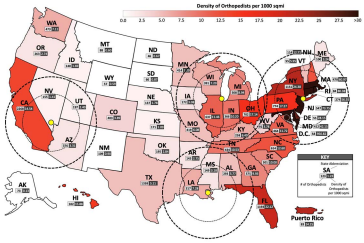


Table 1: Carbon Footprint Estimates by Meeting Participants' Origin Locations in the Multi-Hub AAOS Annual Meeting Model

Las Vegas (West)		Chicago (Mid-West)		New York City (North-East)		New Orleans (South)	
State (participants)	Total CO_2e	State (participants)	Total CO_2e	State (participants)	Total CO_2e	State (participants)	Total CO_2e
California (1215)	121.5	North Dakota (26)	8.06	Maine (13)	1.56	Louisiana (102)	0
Oregon (104)	34.32	South Dakota (20)	6.8	Virginia (148)	19.24	Texas (495)	207.9
Nevada (165)	0	Nebraska (56)	10.08	Pennsylvania (338)	50.7	Oklahoma (40)	10
Washington (168)	63.84	Kansas (42)	18.06	Washington DC (52)	6.76	Arkansas (41)	6.15
Idaho (36)	8.28	West Virginia (36)	6.48	Maryland (189)	20.79	Mississippi (25)	1.75
Montana (18)	5.4	Missouri (138)	15.18	Delaware (14)	0.98	Alabama (45)	6.3
Utah (104)	16.64	Minnesota (226)	33.9	Rhode Island (34)	3.74	Georgia (357)	28.26
Arizona (182)	20.02	Iowa (54)	7.02	New Jersey (241)	4.82	Florida (400)	84
Hawaii (38)	45.6	Illinois (360)	0	New York (725)	0	South Carolina (75)	21
Wyoming (17)	4.25	Wisconsin (98)	3.92	Vermont (18)	2.16	Tennessee (142)	28.4
Colorado (148)	39.96	Michigan (217)	30.38	Massachusetts (220)	28.6	North Carolina (186)	50.4
New Mexico (45)	9.45	Indiana (118)	11.8	Connecticut (79)	6.32	Puerto Rico (27)	20.25
Alaska (16)	16	Kentucky (86)	10.32	New Hampshire (34)	5.1		
		Ohio (289)	37.57				
		Canada (Toronto, 557)	105.83				
Total Participants	2256		2323		2105		1729
Mean CO_2e/Participant	0.35		0.17		0.1		0.24
Total Emissions (CO_2e)	385.26		305.4		150.77		464.41
Grand Total Emissions (CO_2e)							1305.84