

Carbon footprint of EMWA activities: A first estimate

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Abstract

The Sustainability Special Interest Group (SUS-SIG) of EMWA was established in 2020 to support the United Nations 2030 agenda for sustainable development from the perspective of a not-for-profit professional organisation for medical writers and communicators. One of the SUS-SIG's initiatives was to estimate EMWA's carbon footprint, which can serve as a baseline for future carbon reduction strategies. This article presents the first estimate of EMWA's annual greenhouse gas emissions, expressed as CO₂ equivalent (CO₂E).

Introduction

The United Nations 2030 agenda for sustainable development includes 17 sustainable development goals (SDG) described as transformative steps which are urgently needed to shift the world onto a sustainable and resilient path.¹ SDG 13 in the 2030 agenda is to "take urgent action to combat climate change and its impacts". One of the targets of this SDG is to integrate such climate change actions into national policies, strategies, planning, and monitoring progress.

Greenhouse gas emissions (GHGEs; also

simply known as carbon emissions) are the main drivers of climate change. The primary greenhouse gas is carbon dioxide (CO₂); others include methane, nitrous oxide, water vapour, and fluorinated gases.²

Legislations and policies in Europe that have aligned to the UN SDGs include the Directive 2014/95/EU (also called the EU Corporate Sustainability Reporting Directive) and the UK Climate Change Act 2008, which require large companies to report their GHGE targets and carbon accounting. Many companies, including major pharmaceutical companies, have set strong decarbonisation commitments as part of their environmental, social, and governance policies.³

The European Medical Writers Association (EMWA) is a not-for-profit organisation for medical writing and communications professionals. While EMWA does not fall within the purview of the abovementioned legislations, many of its members are employees of or service providers for pharmaceutical and medical device companies that do. These companies – and thus, medical writers by association – are part of the broader healthcare industry, which is recognised as one of the major contributors to global emissions.⁴

The Sustainability Special Interest Group (SUS-SIG) of EMWA was established in 2020 to support the UN SDGs. One of the SIG's initiatives was to estimate the carbon footprint of EMWA, thereby promoting sustainability awareness among its membership and beyond.

Objectives

This article reports a first estimate of EMWA's annual GHGE expressed as CO₂ equivalents (CO₂E). These baseline data aim to serve not only as basis for shaping EMWA's sustainability policy but also to pave the way for future research on measures for similar organisations and activities.

Methods

EMWA activities

The core activities of EMWA were classified under three broad categories, with subactivities listed under each category (Figure 1):

- Operations and Membership Care, including head office (HO) activities, journal, website, and executive committee (EC) activities.
- Education, including conferences and webinars.
- Other initiatives related to collaborations within EMWA (i.e., through the SIGs), and with external organisations (e.g., Ambassador Programme).

The emissions associated with each activity were estimated and normalised as CO₂E/year. Conversion factors used to convert GHGE into CO₂E were based on published literature and other commonly used factors (Table 1).

Calculations were based on retrospective data (where available) retrieved from EMWA HO records.

Computer use

The majority of EMWA activities involve computer work. Calculations of emissions associated with computer work were based on the methodology used in the article by Faber 2021.⁵ Emissions linked to computer use included energy use, the computer's life cycle emissions (accounting for different brands of laptops and the percentage of a laptop's useful

life spent participating in the activity), and data use. In addition, the use of an external monitor and a desk lamp was also included (see Table 1 and Table 2).

Three types of computer-related emissions were considered:

- Emissions linked to standard day-to-day computer use and low volume data use (e.g., documents, emails, etc.).
- Emissions linked to computer work involving moderate volume data use, such as small-scale virtual team meetings.

The Sustainability Special Interest Group of EMWA was established in 2020 to support the UN sustainable development goals. One of the special interest group's initiatives was to estimate the carbon footprint of EMWA.



- Emissions due to large-scale events, such as virtual conference activities and webinars, intensive data use (i.e., streaming), and additional activities by event organisers.

Office space

Long-term EMWA office space use was mainly

linked to the EMWA HO operations. The energy consumption of HO (electricity, air conditioning, heating) could not be calculated directly because of the use of shared space and services. Instead, energy consumption was extrapolated from estimated energy consumption values per m² of air-conditioned office space (Table 1). Each

full time employee was allocated 10 m² of office space, a recommended estimate from the Carbon Trust (Table 2).⁶

Temporary office space use included face-to-face (F2F) conference venues and F2F meeting spaces of the EC outside of conferences. At the F2F conference, the same space was shared

Table 1. Conversion factors used to calculate greenhouse gas emissions

Activity	Conversion factor	Source
Standard computer work ^a	0.5 kg CO ₂ E/hour	Adapted from Faber 2021 ⁵
Computer work for virtual meetings ^b	1.2 kg CO ₂ E/hour	Adapted from Faber 2021 ⁵
Computer work for virtual conference and webinars ^c	1.3 kg CO ₂ E/hour	Adapted from Faber 2021 ⁵
Office/ conference room space usage	154.3 kg CO ₂ E/m ² /year	Lyle 2009 ⁶
Air travel	250 kg CO ₂ /passenger/hour	https://www.carbonindependent.org/22.html
Train travel	0.006 kg CO ₂ E/km	https://ourworldindata.org/travel-carbon-footprint
EMWA website	0.00337 kg CO ₂ E/visit	https://www.websitecarbon.com/
Paper printing (journal and handouts for workshops)	0.0043 kg CO ₂ E/A4 page	Dias 2012 ⁷
Postage of journal	0.025 kg CO ₂ E/letter	https://www.theguardian.com/environment/green-living-blog/2009/nov/05/environmental-impact-mail
Hotel stays	11.5 kg CO ₂ E/room night	https://www.hotelfootprints.org/
Standard lunches	1.88 kg CO ₂ E/meal	Scarborough 2013 ⁸
Vegetarian lunches	1.27 kg CO ₂ E/meal	Scarborough 2013 ⁸

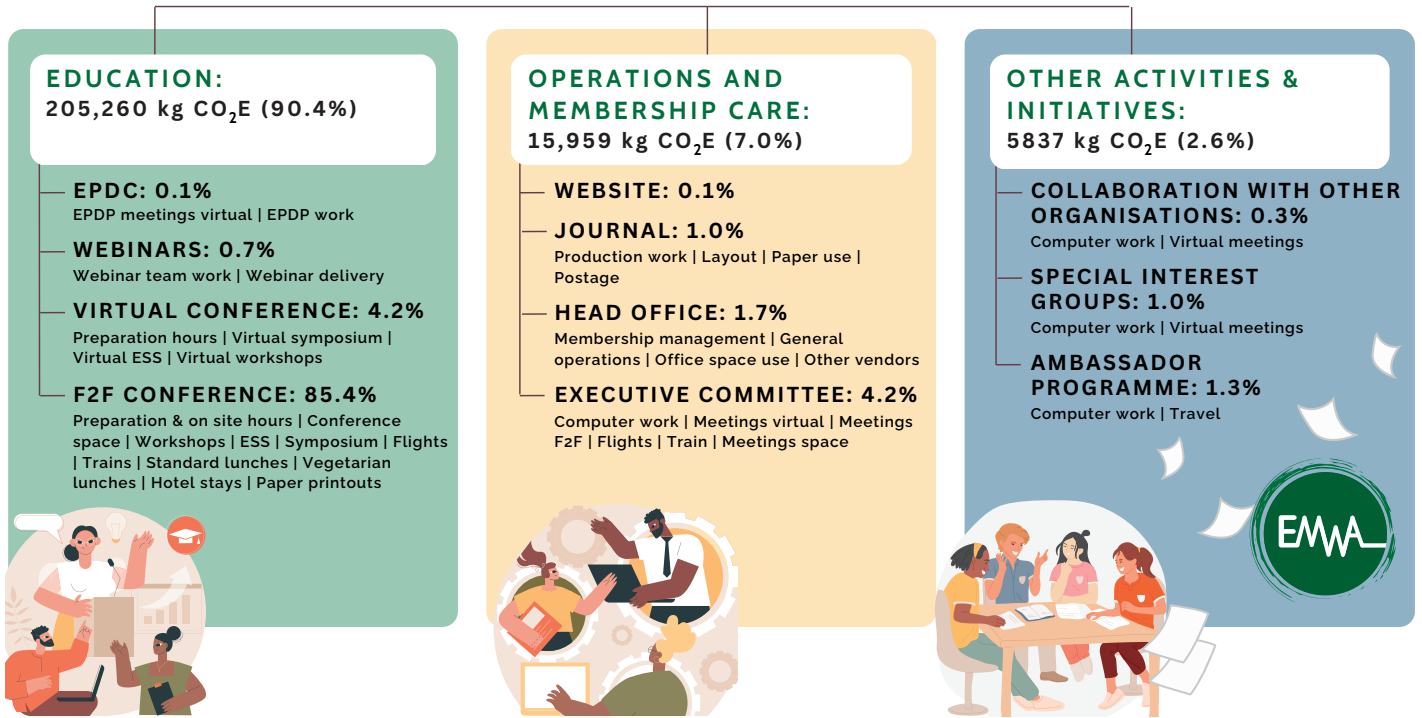
Abbreviation: CO₂E, carbon dioxide equivalent

^a Standard computer work: laptop + external monitor + desk lamp + low data volume + server

^b Computer work with online meetings: laptop + monitor+ desk lamp+ moderate data volume + server + website visits

^c Computer work for virtual conference and webinars: laptop + monitor+ desk lamp+ high data volume (i.e., streaming) + server + website visits + organiser activities

EMWA'S TOTAL CARBON EMISSIONS: 227 TONNES CO₂E



EMWA'S TOTAL CARBON EMISSIONS PER CATEGORY

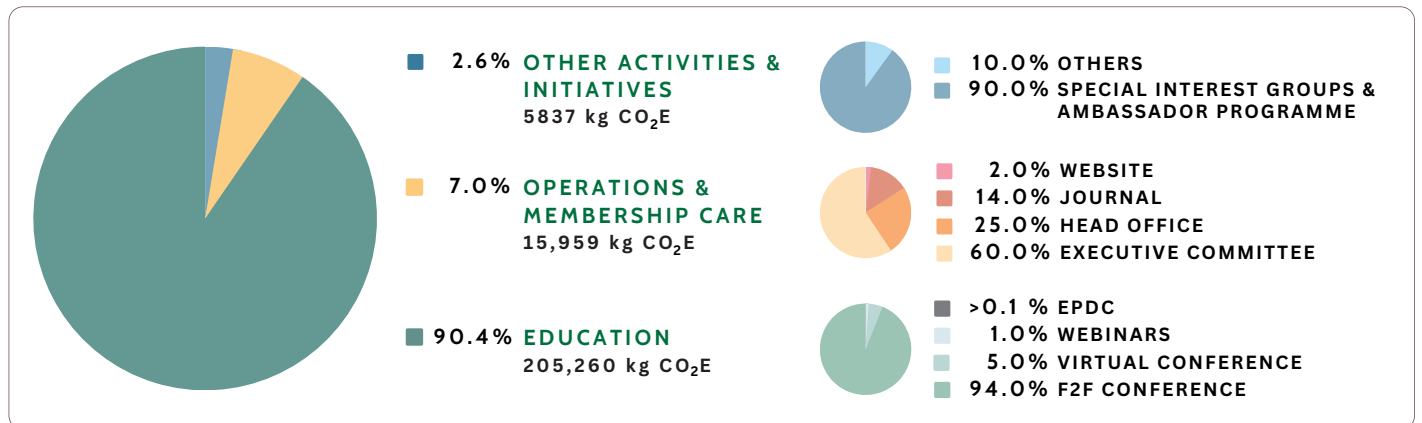


Figure 1. EMWA activities and corresponding greenhouse gas emissions expressed in carbon dioxide equivalents (CO₂E)

Top panel: Percentage of each category and subcategory was calculated with denominator representing EMWA's total annual carbon emissions.

Bottom panel (left): Percentage of each category was calculated with denominator representing EMWA's total annual emission.

Bottom panel (right): Percentage of each category was calculated with denominator representing each category (Education, Operations and Membership Care, and Other Activities and Initiatives).

Abbreviations: CO₂E, carbon dioxide equivalent; EPDC, EMWA Professional Development Programme Committee; ESS, Expert Seminar Series; F2F, face to face

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across the different events; hence calculations for workshops, symposium, expert seminar series (ESS) and similar events were aggregated (Table 2).

Paper use

Paper use was mainly due to the EMWA journal (*Medical Writing*) and workshop handouts at the F2F conference (Table 2). Calculating emissions due to paper consumption used conservative assumptions, including the life cycle of paper from the tree.⁷

Events

Calculations for large-scale EMWA events were based on data from conferences (F2F and virtual) and webinars. For F2F conference calculations, we used metrics from the Vienna Spring Conference 2019, the last in-person spring conference before the COVID-19 pandemic. In addition to space (as discussed above), computer use as part of the conference preparation, onsite operations, and delivery of the symposium, workshops, and the ESS was also considered. Other items included in the calculations were travel and overnight stays of delegates, conference lunches (with distinction made between standard and vegetarian meals) and the use of paper handouts (as discussed above; see Table 1 and Table 2).

The virtual conference calculations were based on data from the virtual May 2021 conference, with emissions mainly coming from computer use. Data from these two conferences were deemed to be representative of EMWA's conference activities from 2023 onwards.

Assumptions and limitations

In cases where data were not available, assumptions and approximations were made based on existing metrics (Table 2). In all cases, assumptions made were those that tended to overestimate rather than underestimate emissions (i.e., when several conversion factors were available).

The following limitations of these estimates were taken into account:

- Estimates are based on assumptions and

commonly used conversion factors (Table 1) and did not use the standardised scoping process per the Greenhouse Gas (GHG) Protocol.²

- EMWA HO operations were based on a shared services model, so direct energy use could not be obtained.
- Estimates were based only on data from two conferences, not on data collected from several conferences across many years. However, the 2019 Vienna conference was among the most well-attended (≈ 450 attendees). The May 2021 virtual conference attendance (≈ 300 attendees) was similar in size to previous autumn conferences.
- Emissions per unit of electricity were based on the US average,⁵ whereas EMWA activities took place in Europe.
- No actual data were available for travel. Travel emissions were based on flights and long-distance train trips (assuming half of the delegates travelled by air, the other half by rail). The use of local public transport and private vehicles was not considered. EMWA conferences are normally held in major European cities with efficient public transport systems.

Results

Overall emissions

EMWA's total carbon emission per year was 227,056.47 kg (227 tonnes) CO₂E (Figure 1). The bulk of EMWA's emissions come from Education (205,260.49 kg CO₂E/year, 90.4% of total EMWA emissions). Operations and Membership Care and Other Initiatives accounted for 15,958.65 kg CO₂E/year (7%) and 5837.32 kg CO₂E/year (2.6%), respectively (Figure 1; Table 2).

Educational activities

Of all the educational activities (Figure 1, Table 2), the F2F conference was the main emission source (193,912.47 kg CO₂E/year; 94% of education emissions; 85% of total emissions), followed by the virtual conference (9576.95 kg CO₂E/year; 5% of education emissions; 4.22% of total emissions).

These two activities were large-scale events involving a large number of participants.

The major contributor to the high emissions

of the F2F conference was flights (168,750.00 kg CO₂E, 87% of F2F conference emissions; 74% of total EMWA emissions), based on the assumption that half of the participants travelled to the conference by air (see Figure 2; Table 2). Other key contributors to the F2F conference emissions (Figure 2) were hotel stays (15,525 kg CO₂E) and conference space (5400.50 kg CO₂E). The main emission source for the virtual conference were virtual workshops (computer use with high data volume, 3783 kg CO₂E), virtual symposium (026.4 CO₂E), and Expert Seminar Series (ESS) (2017.6 CO₂E).

Operations and membership care

Operations of the organisation and membership care accounted for 7% of total emissions. Activities of the EC (9601 kg CO₂E/year, 4.23% of total EMWA emissions), and HO (3925.3 kg CO₂E/year, 1.73% of total EMWA emissions), were the main contributors (Figure 1; Table 2).

Journal and website accounted for <1% of total emissions each (Figure 1; Table 2). Based on the conversion factor used by Dias (2010)⁷ for paper, one printed copy of the EMWA journal (excluding emissions linked to transport) produced approximately 300 g of CO₂E. Total emissions of the journal paper copies printed and delivered per issue (4 issues per year) amounted to 2172.80 kg CO₂E/year (including computer work of production and lay out).

A total of 77,000 visits to the EMWA website in 2021 accounted for 259.49 kg CO₂E for that year, based on website analysis metrics (see Table 1; Table 2).

Other initiatives

Other initiatives that include activities of the SIGs, the Ambassador Programme, and collaborations outside of EMWA accounted for 2.6% (5837.32 kg CO₂E/year) of the organisation's total emissions (Figure 1; Table 2).

Discussion

EMWA's total GHGE are approximately 227 tonnes of CO₂E/year. Based on the average of 1400 members annually, this breaks down to approximately 162 kg CO₂E per member per year.

Educational activities account for 90.4% of EMWA's emissions, with the F2F conference as the highest driver (85.4% of EMWA's total

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Table 2. EMWA greenhouse gas emissions by activity: Assumptions, metrics, and estimates

EMWA activity subactivity	Assumptions	Metrics for calculations	Estimated GHGE in kg CO ₂ E/year
OPERATIONS AND MEMBERSHIP CARE			15,958.65
Head office			3925.30
General operations by HO	Standard computer work ^a	276 hours/year	140.73
Other vendors	Standard computer work ^a	352 hours/year	179.48
Membership management by HO	Standard computer work ^a	1018 hours/year	519.08
Office space use	10 m ² /FTE	4 persons part time, equivalent to 2 FTEs = 20 m ² /year	3086.00
Executive Committee activities (9 members)			9601.06
EC F2F meeting space (outside of conferences)	10 m ² /person	100 m ² space, 2x a year = 0.55 m ² /year	84.87
EC virtual meetings	Computer work for small virtual meetings ^b	108 hours/year	129.38
EC F2F meeting (outside of conference), computer use	Standard computer work ^a	256 hours/year	130.53
EC work (excluding meetings)	Standard computer work ^a	432 hours/year	220.28
EC travel to F2F meetings	50% by train: 500 km one way 50% by air: 1.5-hour flight, one way (equivalent to London-Berlin)	3 persons, 2x year, round trip = 6000 km/year 6 persons, round trip, 2x a year = 36 hours/year	36.00 9000.00
EMWA website			259.49
Website	–	77,000 page visits/year ^d	259.49
EMWA Journal^e			2172.81
Layout	Standard computer work ^a Average 15 min/page. 120 single-sided pages/issue, 4 issues/year	120 hours/year	61.19
Postage journal	CO ₂ emissions/letter – within the UK	5624 copies of journals posted/year	140.60
Production work	Standard computer work ^a	86 hours/month = 1032 hours/year	526.22
Paper use	Average of 1400 journals printed/issue Average of 60 A4 pages/issue, 4 issues/ year	336,000 pieces of A4 paper/year	1444.80
EDUCATION			205,260.49
Professional Development Programme Committee			202.81
EPDC work (excluding meetings)	Standard computer work ^a	2 hours/month, 6 persons = 144 hours/year	73.43
EPDC meetings virtual	Computer use for small virtual meetings ^b	6 meetings/year, 3 hours, 6 persons = 108 hours/year	129.38
Webinars			1568.27
Webinar team work	Standard computer work ^a	3 hours/month, 3 persons = 108 hours/year	55.07
Webinar delivery	Computer use for webinars ^c	100 participants, 1 webinar/month = 1200 hours/year	1513.20
Virtual conference^f (once a year)			9576.95
Preparation hours	Computer use for small virtual meetings ^b	626 hours/year	749.95
Virtual ESS	Computer use for virtual conferences ^c	8 hours, 200 participants = 1600 hours/year	2017.60
Virtual symposium	Computer use for virtual conferences ^c	8 hours, 300 participants = 2400 hours/year	3026.40
Virtual workshops	Computer use for virtual conferences ^c	30 workshops, 4 hours, 25 participants = 3000 hours/year	3783.00

EMWA activity subactivity	Assumptions	Metrics for calculations	Estimated GHGE in kg CO ₂ E/year
Face-to-Face conference⁹ (once a year)			193,912.47
Workshops + expert seminar series + symposium	Standard computer work ^a	60 events (workshops + ESS + symposium, other seminars), 3 hours/session = 180 hours/year	91.78
Paper printouts	A4 size	36,582 pages/year	157.30
Preparation + on site hours	Standard computer work ¹	479 hours/year	244.24
Lunches	Vegetarian	212 lunches/year	269.24
	Standard	1130 lunches/year	2124.40
Conference space	3200 m ² used during 4 days of conference	4 days = 35 m ² /year	5400.50
Hotel overnight stay	Average of 3 nights for 450 participants, average from very low to low-environmental impact hotels (Europe) ^h	1350 hotel stays/year	15,525.00
Travel to the venue	50% of participants travel by train (500 km one way)	225 participants, round trip = 225,000 km/year	1350.00
	50% of participants fly to the venue (1.5-hour flight, Berlin-London)	225 participants x 3h (round trip) = 675 hours/year	168,750.00

OTHER ACTIVITIES AND INITIATIVES: COOPERATION AND COLLABORATION**5837.32**

Special Interest Groups			2230.08
Virtual meetings	Computer work for small virtual meetings ^b 7 EMWA members/SIG	10 SIGs, 1-hour meeting/month = 840 hours/year	1006.32
Computer work outside of meetings	Standard computer work ^a 5 EMWA members/SIG	10 SIGs, 4 hours/month = 2400 hours/year	1223.76
Ambassador Programme			3024.48
Ambassador programme work	Standard computer work ^a	4 persons, 2 hours, every 2 months = 48 hours/year	24.48
Ambassador programme travel	4 events, 1.5-hour flight one way (equivalent to London-Berlin)	1 person, 3-hour flight (round trip) times per year = 12 hours/year	3000.00
Collaboration with other organisations			582.77
Virtual meetings	Computer work for small virtual meetings ^b 3 EMWA members/project	5 projects, 1-hour meeting/month = 180 hours/year	215.64
Computer work	Standard computer work ^a 3 EMWA members/project	5 projects, 4 hours/month = 720 hours/year	367.13

Abbreviations: CO₂E, carbon dioxide equivalent; EC, Executive Committee; EPDC, EMWA Professional Development Programme Committee; ESS, Expert Seminar Series; F2F, face to face; FTE, full time equivalent; GHGE, greenhouse gas emissions; HO, head office; SIG, special interest group
All data from 2019, except where otherwise indicated. See Table 1 for conversion factors used in the calculations.

^a Standard computer work: laptop + external monitor + desk lamp + low data volume + server

^b Computer work with online meetings: laptop + monitor + desk lamp + moderate data volume + server + website visits

^c Computer work for virtual conference and webinars: laptop + monitor + desk lamp + high data volume (i.e., streaming) + server + website visits + organiser activities

^d Website visits from 2021

^e Data from 2020 and 2021 (Issues from December 2020, March 2021, July 2021, and September 2021).

^f Data from virtual EMWA conference May 2021. Calculations based on actual data provided by HO.

^g Data from F2F EMWA conference in Vienna in May 2019. Calculations based on actual data provided by HO.

^h Based on environment impact ratings of European hotels <https://www.hotelfootprints.org/>

CARBON EMISSIONS OF EMWA CONFERENCES



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Figure 2. EMWA greenhouse gas emissions by activity: Assumptions, metrics, and estimates

Abbreviations: CO₂E, carbon dioxide equivalent; ESS, Expert Seminar Series; F2F, face to face

*The major contributors to the emissions are flights.

Flights have been excluded from the stacked bars to ease visualisation of the other categories

Percentage of each category was calculated with denominator representing total carbon emissions of specific conference type.

emissions). This is not surprising as this large-scale event fulfils one of EMWA's core missions – continuing education for its members. The 2019 F2F conference in Vienna (450 attendees) generated a mean of 431 kg CO₂E per attendee. The specific activity with the highest environmental impact was air travel to the F2F conference, followed by hotel stays. Although we did not distinguish between the scopes of the emissions, it is clear that the bulk of EMWA's carbon footprint falls under Scope 3, i.e., indirect emissions that include transportation and distribution.²

The emissions of the F2F conference were about 20 times higher than the virtual conference in absolute value (Figure 2). However, when corrected for number of participants, the F2F conference emission was about 13 times higher compared with a virtual conference.

The UK National Institute for Health and Care Research recommends the use of virtual meetings as part of carbon reduction guidelines for clinical trials.⁹ The COVID-19 pandemic forced companies and organisations to adopt these practices. Several publications^{5,10} report on the significant reduction in emissions by shifting to virtual conferences. Our data on EMWA's emissions also reflect these findings.

However, F2F activities come with clear benefits and advantages that virtual events cannot fully provide. For all decarbonisation strategies, the balance between the need for direct human interactions and the minimisation of environmental impact needs to be considered.

To the best of our knowledge, no emissions data of organisations of comparable type and size to EMWA have been published to date. To compare with other activities in the healthcare industry, the multicentre international CRASH-2 trial with over 10,000 participants emitted approximately 108 tonnes a year (92 kg CO₂E per participant).⁶ The pharmaceutical sector emits, on average, approximately 48.6 tonnes of CO₂E per USD 1 million revenue per year.⁴ In 2019, each resident in Europe generated 6.8 tonnes of CO₂ on average.¹¹

In the last 2 years, EMWA has implemented measures to reduce the organisation's carbon footprint, directly and indirectly. Data from these measures have not been incorporated in the calculations reported here.

Direct measures already in place are:

- Ending paper handouts at F2F conferences
- Encouraging more sustainable forms of travel for EMWA volunteers (see current EMWA reimbursement policy)
- Allowing for some sessions at the F2F conferences to be hybrid, enabling some speakers and registrants to participate online.
- Enabling a fully open access journal, with the option to forego receiving a printed copy of the EMWA journal. To date, 42 (3%) members have opted out of the paper copy.
- Engaging *Medical Writing* as one of over 200 journals to support the September 2021 global editorial.^{12,13}
- Organising events that revolved around the theme of sustainability, including webinars and the first Expert Seminar Series on Sustainable Communications in 2022.
- Supporting initiatives such as Plant a Tree and Pens for Kids (see the EMWA SUS-SIG webpage for details).

Initiatives planned are:

- Fully virtual EMWA autumn conferences starting 2023.
- Upgrade of the EMWA website, which will enable more efficient computer use and data transfer.
- Improved data collection (e.g., collecting information on travel mode to F2F conference; use of industry validated CO₂ calculators for future estimates).
- Screening of vendors and venues based on their CO₂ footprint.

Conclusions

SDG 13 in the 2030 UN Agenda is to “take urgent action to combat climate change and its impacts.” EMWA as a professional organisation within the health sector, has the responsibility to seriously consider our environmental impact and

F2F activities come with clear benefits and advantages that virtual events cannot fully provide. For all decarbonisation strategies, the balance between the need for direct human interactions and the minimisation of environmental impact needs to be considered.

protect planetary health. This first estimate of approximately 227 tonnes of CO₂E GHGE per year provides a baseline that EMWA can use to develop carbon reduction strategies toward carbon neutrality.

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The opinions expressed in this article are the authors' own and not necessarily shared by their respective employers or EMWA.

Disclosures and conflicts of interest

The authors are employed in the pharmaceutical industry and active members of EMWA. The authors declare no conflicts of interest.

Data availability statement

For inquiries about availability of data and other supplemental information, please contact the corresponding author.

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Raquel Billiones, PhD, Editor-in-Chief of *Medical Writing*, has been a regulatory medical writer for more than 15 years for pharma and medical devices. Her core competencies include development of regulatory documents, public disclosure, and data protection. As founding member of the Sustainability SIG, she strongly advocates for human and planetary health. Her personal carbon footprint (excluding work-related emissions) in the last 12 months was 10.09 tonnes CO₂E, 60% of which were due to family-related inter-continental travel.¹⁴