Epilepsy & Climate Change

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Why think about climate change in epilepsy?

World Scientists’ Warning of a Climate Emergency

Scientists have a moral obligation to clearly warn humanity of any catastrophic threat and to “tell it like it is.” On the basis of this obligation and the graphical indicators presented below, we declare, with more than 11,000 scientist signatories from around the world, clearly and unequivocally that planet Earth is facing a climate emergency.

Ripple et al. https://doi.org/10.1093/biosci/biz152
Climate Change: happening now

Ripple et al. https://doi.org/10.1093/biosci/biz152
People with epilepsy and their carers

Happening now, with consequences now – anecdotal data

Many people, many processes: multiplicative, complicated effects
Those with less resilience likely to be affected first and more

Even in wealthy countries, health systems can collapse
Global challenges happen, and should be met with global action
Dramatic responses are possible, even with a very acute challenge
What are the main mediators?

Sisodiya et al. Epilepsia Open 2019, adapted from IPCC, 2014
Temperature and channel function

Mutation causing Dravet-like phenotype modelled in CHO cells

Fletcher et al. J Biol Chem. 2011;286:36700-8

Genetic risk: not just in rare epilepsies

Silvennoinen et al., in preparation; data courtesy of C Esguerra
Risks: multifactorial

2°C rise: 3-4 weeks of activity/year by 2030 in Southern England

Medlock & Leach, Lancet Infect Dis 2015

Emerging pathogens:
SARS-CoV-2
A 9.0-magnitude earthquake occurred off the coast of Sanriku at 14:46 p.m. on Friday, March 11, 2011. The earthquake and subsequent tsunami caused severe damage mainly to the Tohoku region.

The earthquake was the largest ever recorded in Japan and the fourth biggest in the world since 1900.

<table>
<thead>
<tr>
<th>Human damage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead</td>
<td>15,894</td>
</tr>
<tr>
<td>Missing</td>
<td>2,546</td>
</tr>
<tr>
<td>Injured</td>
<td>6,156</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Damage to buildings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely destroyed</td>
<td>121,772</td>
</tr>
<tr>
<td>Half destroyed</td>
<td>280,921</td>
</tr>
<tr>
<td>Partially destroyed</td>
<td>726,509</td>
</tr>
</tbody>
</table>

(Surveyed by the National Police Agency; as of December 8, 2017)

<table>
<thead>
<tr>
<th>Disaster victim support</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Evacuees nationwide</td>
<td>75,206</td>
</tr>
</tbody>
</table>

(Surveyed by the Reconstruction Agency; as of January 16, 2018)
Drugs and supply chains

Q1. How many days of usually antiepileptic drugs stockpiled before the earthquake occurred? (N=89)

- 15-28days: 4.5% (N=4)
- 4.5% (N=4)
- 8-14days: 19.1% (N=17)
- 19.1% (N=17)
- 4-7days: 40.4% (N=36)
- 4-7days: 40.4% (N=36)
- ≤3days: 28.0% (N=25)
- ≤3days: 28.0% (N=25)
- ≥29days: 7.9% (N=7)
- ≥29days: 7.9% (N=7)

Q2. Before the earthquake, where had the patient been obtaining his/her medicine? (N=161)

- Pharmacy outside our hospital: 39.1% (N=63)
- Pharmacy outside our hospital: 39.1% (N=63)
- In-hospital pharmacy: 60.9% (N=98)
- In-hospital pharmacy: 60.9% (N=98)

Q3. Did the patient have sufficient medicine during the acute phase of the disaster after the earthquake? (N=161)

- Yes: 71.4% (N=115)
- Yes: 71.4% (N=115)
- No: 28.6% (N=46)
- No: 28.6% (N=46)

Q4. For patients answered “No” at Q3. Could they contact us through any communication methods?

- No: 45.7% (N=21)
- No: 45.7% (N=21)
- Yes: 54.3% (N=25)
- Yes: 54.3% (N=25)
Drugs and supply chains

UK, 2020

(ABN Epilepsy Advisory Group re drug shortages)
Do we contribute to climate change?

In 2014 SFN meeting in Washington, DC, we estimate the mean round-trip distance traveled per person at ~7,500 kilometers, which gives the meeting a carbon footprint of 22,000 metric tons, roughly equivalent to the annual carbon footprint of 1000 medium-sized laboratories.

Driving 10 miles/day generates ~1 ton CO₂/year
Complexities in epilepsy

+1°C deviation in night-time temperature was associated with an increase of three nights of self-reported insufficient sleep per 100 people per month

Inequality

Changes will not be the same across the world

Low and middle income countries will be most affected

Regional variation will occur: those with historically least variation are already showing signals of change

Africa, Central and South America and South East Asia projected to experience more than 30 extra seasonal heatwave days per °C of global warming
“impacts ... have been observed across genes, species, and ecosystems to reveal a world already undergoing substantial change.”

“Multiplicative impacts from gene to community levels scale up to produce ecological regime shifts, in which one ecosystem state shifts to an alternative state”

Scheffers et al. Science 2016;354(6313)
What do people with epilepsy think?

Q5 Would you be interested in seeing more work on the possible effects of climate change on epilepsy and what we could do about it?

- Yes: 966
- No: 3
- Unsure: 0

Q6 Do you think climate change will have a significant effect on:

- Everyone: 80%
- My children/grandchildren: 40%
- Me: 20%
- People I know in the UK: 30%
- People in other countries: 20%
- I don’t think climate change will make any difference: 0%

Answered: 72
Skipped: 0

Courtesy of N. Swanborough
Welcome to Epilepsy Climate Change (EpiCC)

What is EpiCC?
We are, as fellow professionals, deeply concerned about the possible effects of climate change on people with epilepsy.
We outline our concerns and thoughts in this article published in Epilepsia Open.

As the renowned naturalist Sir David Attenborough said recently, we face an existential threat to life on earth.
The Bulletin of the Atomic Scientists’ Doomsday Clock places us close to the midnight hour.

What’s next?
Healthcare organisations across the world are already considering, and responding to, many of the issues around climate change and healthcare. We argue for more research in this area, but also for action today.
Actions now are likely to generate co-benefits for healthcare, including care in epilepsy, resulting from efforts to decarbonise, mitigate effects of climate change that have already happened, and plan for adaptation to climate change.

EpiCC may seem a small effort in the face of overwhelming odds, but we feel that for everyone of us today, including people with epilepsy, and for all those to come tomorrow, this is important. If we all act, we can help make a difference.

& Association of British Neurologists Sustainability Special Interest Group

Research | Raise awareness | Take action: move to sustainability
What can we do?

In EpilepsyClimateChange:

- engagement with organisations
- surveys of opinions of people with epilepsy
- review of existing information
- effects of temperature & humidity on various aspects of epilepsy
- longitudinal data
- models, genetics, laboratory studies
2. Hot Period

2.1. Living Room

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Cool min</th>
<th>Cool Q1</th>
<th>Cool median</th>
<th>Cool mean</th>
<th>Cool Q3</th>
<th>Cool max</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 July 2019</td>
<td>22.621</td>
<td>24.54804</td>
<td>25.08663</td>
<td>25.58900</td>
<td>29.37596</td>
<td>34.24667</td>
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G Petrou, P Symonds, A Mavrogianni, The Bartlett School of Environment, Energy and Resources, UCL
Action

Take action: move to sustainability

• NHS is the UK’s (& Europe’s) largest public greenhouse gas emitter
• NHS emissions ~21 million tonnes CO2e/year = whole of Northern Ireland

• Main contributors are:
  • building energy use (22%)
  • pharmaceuticals and their production (20%)
  • travel (18%)

• NHS patient, visitor and staff travel = 5% of all road traffic in England in 2007, with 12 billion km driven.

Laboratories: cost proportionately more than offices, produce more plastic and generate more emissions

Nature 2017;546:565
Action

Take action: move to sustainability

Action

10 outpatient clinics at Chalfont site
6.5 months (16/03/20 – 30/09/20)

1567 virtual appointments
1277 patients
112 additional attendees
Of course more complicated....

embedded and lifetime costs

health costs....
- unable to judge consequences of treatment changes
- unable to admit as easily
- still being evaluated

psychological benefits for patients (and clinicians)
Action

Take action: move to sustainability

Actions in epilepsy care

- Clinics and Travel – new ways of working; hub+spoke
- Conferences – reducing carbon footprint, changing the model
- Labs + Offices – sustainability, energy saving: https://www.mygreenlab.org/
- Goods – cost and carbon
- Lobbying – governments, administrations, healthcare providers
- Information – colleagues, people with epilepsy, carers

- Travel less
- Become as paperless as possible
- Appropriate triaging to increase efficiency and reduce travel
- Support telephone clinics where appropriate
- Regular rationalisation of medication
- Review the effectiveness of regular immunoglobulin use in patients
- Join hospital sustainability group to help raise awareness
- Open meetings to remote attendance
- Support measures which, although small in themselves, raise awareness of the issues:
  reusing conference badges and bags, having electronic meeting programmes
  raising freezer temp from -80 to -70; close fume hoods when not in use

CO-BENEFITS
Acknowledgements

University College London Hospitals  NHS  UCB Pharma

Association of British Neurologists Sustainability Special Interest Group

https://www.epilepsysociety.org.uk/climatechange
cf: ‘fine old crusted characters who had a decided taste for living without worry’

Thomas Hardy, The Mayor of Casterbridge