Index of ME/CFS Published Research

An A-Z index of the most important published research
Foreword

Welcome to the ME Association Index of Published ME/CFS Research.

This is an A-Z index of the most important published research studies and selected key documents and articles, listed by subject matter, on myalgic encephalomyelitis or chronic fatigue syndrome (ME/CFS). It is correct to 1st August 2021.

The Index is updated at the end of each month and we publish a weekly update of recent research publications that are also available on the MEA website and social media.

The Index adopts the subject headings used in the MEA Clinical and Research Guide which provides a review of current clinical knowledge and research evidence and is updated annually.

This authoritative and very popular book is written by Dr Charles Shepherd, Hon. Medical Adviser to the ME Association.

The latest edition is available to order from the MEA website shop. We are pleased to be able to offer free hard copies to health professionals upon application and it is also available on Kindle.

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Contents

Foreword ........................................................................................................................................... 1
1. Nomenclature and definition ........................................................................................................ 6
  1.1 Prevalence .................................................................................................................................. 10
2. Epidemiology ................................................................................................................................... 11
3. Co-morbidity ................................................................................................................................... 14
4. Biomedical Research ..................................................................................................................... 17
  4.1 Biobank UK ME/CFS .................................................................................................................. 17
  4.2 Biomarker Identification ............................................................................................................. 18
  4.2.1 Biomarker Landscape Project ............................................................................................... 19
  4.3 Cardiac Function ....................................................................................................................... 20
  4.4 Endothelial cells ......................................................................................................................... 25
  4.5 Exercise physiology/testing ...................................................................................................... 26
  4.6 Extracellular vesicles ............................................................................................................... 28
  4.7 Gastrointestinal and microbiome .............................................................................................. 29
  4.8 Gene expression ........................................................................................................................ 31
  4.8.1 Epigenetics ............................................................................................................................ 36
  4.9 General reviews ........................................................................................................................ 37
  4.10 Genetic predisposition ............................................................................................................. 42
  4.11 Immunology ............................................................................................................................ 43
  4.12 Infection ................................................................................................................................... 55
  4.13 Ion channels ................................................................................................................................ 64
  4.14 Microclots .................................................................................................................................. 65
  4.15 Metabolomics ........................................................................................................................... 65
  4.16 Miscellaneous .......................................................................................................................... 68
  4.17 Mitochondria and energy production ....................................................................................... 73
  4.18 Muscle ....................................................................................................................................... 77
  4.19 Neurology: Autonomic nervous system (ANS) dysfunction .................................................. 79
  4.20 Neurology: Central nervous system and neuroimaging ......................................................... 83
  4.21 Neurology: Hypothalamic and neuroendocrine function ....................................................... 93
  4.22 Neurology: Neuropsychology and cognitive function ............................................................. 96
  4.23 Neurology: Neurotransmitter function ..................................................................................... 98
## 10.7 Wearables and activity monitoring .......................................................... 185
## 11. Vaccinations .................................................................................................. 185
## 12. Children and adolescents ................................................................................ 188
## 13. Government Documents ................................................................................ 200
      13.1 Disability support .................................................................................... 200
      13.2 Economic cost to the UK ......................................................................... 201
      13.3 General reports, debates, and statements .................................................. 202
## 14. Healthcare ...................................................................................................... 204
      14.1. NICE Guidelines ...................................................................................... 207
## 15. Case studies and case reports ......................................................................... 208
## 16. Long-COVID which cover ME/CFS .............................................................. 208
      16.1 Evidence of overlap with ME/CFS ............................................................. 208
      16.2 Endothelial cells ....................................................................................... 209
      16.3 Microclots ................................................................................................. 209
      16.4. Miscellaneous .......................................................................................... 209
      16.5 Predictors .................................................................................................. 210
      16.6 Prognosis and quality of life ...................................................................... 210
      16.7 Symptoms ................................................................................................ 210
      16.8 Unclassified list! (Unsorted) ..................................................................... 210
## 17. Miscellaneous ................................................................................................ 216
## 18. Master and Doctoral Theses ........................................................................... 218
The ME Association: Please support our vital work .............................................. 219
ME Connect

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Do you need to talk?

ME Connect is the telephone helpline service of the ME Association. It provides information and support for people with ME and those who live with or care for them.

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1. Nomenclature and definition


Brurberg et al. (2013) Case definitions for chronic fatigue syndrome/myalgic encephalomyelitis (CFS/ME): a systematic review. BMJ Open 4 (2). Link: https://bmjopen.bmj.com/content/4/2/e003973


1.1 Prevalence


2. Epidemiology


3. Co-morbidity


### 4. Biomedical Research

#### 4.1 Biobank UK ME/CFS


Lacerda EM et al. (2017) The UK ME/CFS Biobank for biomedical research on Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) and Multiple Sclerosis. *Open Journal of Bioresources* 4: 4. Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5482226/

### 4.2 Biomarker Identification


**Hanevik K et al.** (2022) No difference in serum levels of B-cell activating receptor and antibodies against cytolethal distending toxin B and flagellin in post-infectious irritable bowel syndrome and chronic fatigue syndrome after *Giardia* infection. *JGH Open* (2022):1-4. Link: doi.org/10.1002/jgh3.12724


**Nunes M et al.** (2022) The occurrence of hyperactivated platelets and fibrinoid microclots in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). *ResearchSquare* [Preprint]. Link: [doi.org/10.21203/rs.3.rs-1727226/v1](https://doi.org/10.21203/rs.3.rs-1727226/v1) (*NEW*)

**Patterson BK et al.** (2022) Cytokine Hub Classification of PASC, ME-CFS and other PASC-like Conditions. *ResearchSquare* [Preprint]. Link: [doi.org/10.21203/rs.3.rs-1598634/v1](https://doi.org/10.21203/rs.3.rs-1598634/v1) (*NEW*)


**Sepúlveda N et al.** (2022) Revisiting IgG antibody reactivity to Epstein-Barr virus in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome and its potential application to disease diagnosis. *medRxiv* [Preprint]. Link: [https://www.medrxiv.org/content/10.1101/2022.04.20.22273990v1](https://www.medrxiv.org/content/10.1101/2022.04.20.22273990v1)

### 4.2.1 Biomarker Landscape Project


4.3 Cardiac Function


van Campen CM and Visser FC (2022) The higher resting heart rate in myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) patients compared to healthy controls: relation with stroke volumes. Medical Research Archives10 (6). Link: doi.org/10.18103/mra.v10i6.2891 (**NEW)
Campen CM et al. (2020) Cerebral blood flow is reduced in ME/CFS during head-up tilt testing even in the absence of hypotension or tachycardia: a quantitative, controlled study using Doppler echography. Clinical Neurophysiology Practise [Epub ahead or print]. Link: https://www.sciencedirect.com/science/article/pii/S2467981X20300044


Davenport T et al. (2020) Cardiopulmonary responses to exercise in an individual with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome during long-term treatment with intravenous saline: A case study. *Work* 66 (2): 353-359. Link: [https://content.iospress.com/articles/work/wor203214?fbclid=IwAR1cFTpQx7hm-0TqXrtYG6f6ox30nU1AwOj-oyEA3RJp-pZjQbeCJ6wc](https://content.iospress.com/articles/work/wor203214?fbclid=IwAR1cFTpQx7hm-0TqXrtYG6f6ox30nU1AwOj-oyEA3RJp-pZjQbeCJ6wc)


4.4 Endothelial cells

Blauensteiner J et al. (2021) Altered endothelial dysfunction-related miRs in plasma from ME/CFS patients. Scientific Reports 11: 10604. Link: https://www.nature.com/articles/s41598-021-89834-9#citeas


Cambras T et al. (2022) Circadian skin temperature rhythm and dysautonomia in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome: the role of endothelin-1 in the vascular dysregulation. ResearchSquare [preprint]. Link: doi.org/10.21203/rs.3.rs-2044838/v1 (*NEW) Comment


4.5 Exercise physiology/testing

Baraniuk JN et al. (2021) Differential Effects of Exercise on fMRI of the Midbrain Ascending Arousal Network Nuclei in Myalgic Encephalomyelitis / Chronic Fatigue Syndrome (ME/CFS) and Gulf War Illness (GWI) in a Model of Postexertional Malaise (PEM). *Preprints*: 2021110420. Link: [https://www.preprints.org/manuscript/202111.0420/v1](https://www.preprints.org/manuscript/202111.0420/v1)


Davenport T et al. (2020) Properties of measurements obtained during cardiopulmonary exercise testing in individuals with myalgic encephalomyelitis/chronic fatigue syndrome. *Work* [Epub ahead of print]. Link: [https://content.iospress.com/articles/work/wor203170](https://content.iospress.com/articles/work/wor203170)


4.6 Extracellular vesicles


4.7 Gastrointestinal and microbiome


Hanevik K et al. (2022) No difference in serum levels of B-cell activating receptor and antibodies against cytolethal distending toxin B and flagellin in post-infectious irritable bowel syndrome and chronic fatigue syndrome after Giardia infection. JGH Open (2022):1-4. Link: doi.org/10.1002/jgh3.12724

Kenyon J et al. (2019) A Retrospective Outcome Study of 42 Patients with Chronic Fatigue Syndrome, 30 of Whom had Irritable Bowel Syndrome. Half were treated with oral approaches, and half were treated with Faecal Microbiome Transplantation. Human Microbiome Journal 13. Link: https://tinyurl.com/y2cqxzgf


Xiong R et al. (2021) Multi-‘omics of host-microbiome interactions in short- and long-term Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). bioRxiv. [Epub ahead of print.] Link: https://www.biorxiv.org/content/10.1101/2021.10.27.466150v1

4.8 Gene expression

Asad HN et al. (2022) A Causal-Pathway Phenotype of Chronic Fatigue Syndrome due to Hemodialysis in Patients with End-Stage Renal Disease. CNS & Neurological Disorders Drug Targets. [Epub ahead of print.] Link: doi.org/10.2174/187152732166220401140747

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Wang Z et al. (2022) Autoimmune Gene Expression Profiling of Fingerstick Whole Blood in Chronic Fatigue Syndrome. *ResearchSquare* [Preprint]. Link: doi.org/10.21203/rs.3.rs-1942047/v1


### 4.8.1 Epigenetics

Almenar-Perez et al. (2019) miRNA profiling of circulating EVs in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). *Journal of Extracellular Vesicles*, 7: 139. Link: [https://tinyurl.com/y4b8durc](https://tinyurl.com/y4b8durc)


4.9 General reviews


van Eeden C et al. (2022) Fatigue in ANCA-associated vasculitis (AAV) and systemic sclerosis (SSc); similarities with Myalgic encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). A critical review of the literature. Expert Review of Clinical Immunology. Link: doi.org/10.1080/1744666X.2022.2116002 (*NEW)


4.10 Genetic predisposition


Kendler K et al. (2022). A distinctive profile of family genetic risk scores in a Swedish national sample of cases of fibromyalgia, irritable bowel syndrome, and chronic fatigue syndrome compared to rheumatoid arthritis and major depression. Psychological Medicine: 1-8. Link: doi.org/10.1017/S0033291722000526

4.11 Immunology


Groven N et al. (2020) MCP-1 is Increased in Patients with CFS and FM, whilst several other immune markers are significantly lower than healthy controls. Brain, Behaviour & Immunity- health 4: 100067. Link: doi.org/10.1016/j.bbih.2020.100067


Hornig M et al. (2015) Distinct plasma immune signatures in ME/CFS are present early in the course of illness. Science Advances 1(1): e1400121. Link: http://advances.sciencemag.org/content/1/1/e1400121


Jonsjo MA et al. (2019) Patients with ME/CFS (Myalgic Encephalomyelitis/Chronic Fatigue Syndrome) and chronic pain report similar level of sickness behavior as individuals injected with bacterial endotoxin at peak inflammation. *Brain, Behavior & immunity - Health* 2:100028. Link: doi.org/10.1016/j.bbih.2019.100028


Marks DF (2021) Myalgic encephalomyelitis/ chronic fatigue syndrome as a breakdown of homeostasis. Qeios. Link: https://www.qeios.com/read/FZ1Y68.2


Patterson BK et al. (2022) Cytokine Hub Classification of PASC, ME-CFS and other PASC-like Conditions. ResearchSquare [Preprint]. Link: doi.org/10.21203/rs.3.rs-1598634/v1 (**NEW)


Ueland M et al. (2022) No replication of previously reported association with genetic variants in the T cell receptor alpha (TRA) locus for myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS). Translational Psychiatry 12: 277. Link: doi.org/10.1038/s41398-022-02046-1 (**NEW)


4.12 Infection


Asprusten T et al. (2019) EBV-requisitioning physicians’ guess on fatigue state 6 months after acute EBV infection. BMJ Paediatrics Open 3 (1). Link: https://tinyurl.com/y39pwy8r


Cox BS et al. (2022) EBV/HHV-6A dUTPases contribute to Myalgic Encephalomyelitis/Chronic-Fatigue-Syndrome pathophysiology by enhancing TFH cell differentiation and extrafollicular activities. *JCI Insight*: e158193. [Epub ahead of print.] Link: doi.org/10.1172/jci.insight.158193


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4.13 Ion channels


**Nguyen T et al.** (2016) Impaired calcium mobilization in natural killer cells from chronic fatigue syndrome/myalgic encephalomyelitis patients is associated with transient receptor potential melastatin 3 ion channels. *Clinical and Experimental Immunology* 187 (2): 284-293. Link: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5217865/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5217865/)


### 4.14 Microclots


### 4.15 Metabolomics


Germain A et al. (2022) Plasma metabolomics reveals disrupted response and recovery following maximal exercise in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome. JCI Insight 7(9): e157621. Link: doi.org/10.1172/jci.insight.157621


Yamano E et al. (2016) Index markers of chronic fatigue syndrome with dysfunction of TCA and urea cycles. Science Reports doi: 10.1038/srep34990. Link: https://www.nature.com/articles/srep34990


4.16 Miscellaneous


Maes M et al. (2022) In Schizophrenia, Chronic Fatigue Syndrome- and Fibromyalgia-Like Symptoms are Driven by Breakdown of the Paracellular Pathway with Increased Zonulin and Immune Activation-Associated Neurotoxicity. CNS & Neurological Disorders - Drug Targets 21. Link: doi.org/10.2174/1871527321666220806100600 (**NEW)


4.17 Mitochondria and energy production


Bohne V and Bohne O (2019) Suggested Pathology of Systemic Exertion Intolerance Disease: Impairment of the E3 Subunit or Crossover of Swinging Arms of the E2 Subunit of the Pyruvate Dehydrogenase Complex Decreases Regeneration of Cofactor Dihydrolipoic Acid of the E2 Subunit. *Medical Hypothesis* [Epub ahead of print] Link: https://tinyurl.com/y6fbud4g


Kuvyani B et al. (2022) Could the kynurenine pathway be the key missing piece of Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) complex puzzle? *Cellular and Molecular Life Science* 79 (8): 412. Link: doi.org/10.1007/s00018-022-04380-5 (*NEW*)


Schoeman EM et al. (2017) Clinically proven mtDNA mutations are not common in those with chronic fatigue syndrome. *MBC Medical Genetics* 18: 29. Link: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5356238/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5356238/)


Tsilioni I et al. (2022) Exosome-Associated Mitochondrial DNA from Patients with ME/CFS Stimulates Human Cultured Microglia to Release IL-1β. The European Journal Neuroscience [Epub ahead of print]. Link: doi.org/10.1111/ejn.15828 (*NEW)


4.18 Muscle


4.19 Neurology: Autonomic nervous system (ANS) dysfunction


**Cambras T et al.** (2022) Circadian skin temperature rhythm and dysautonomia in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome: the role of endothelin-1 in the vascular dysregulation. ResearchSquare [preprint]. Link: [doi.org/10.21203/rs.3.rs-2044838/v1](https://doi.org/10.21203/rs.3.rs-2044838/v1) (**NEW**) Comment


**Eccles J et al.** (2022) Mechanistic factors contributing to pain and fatigue in fibromyalgia and me/cfs: autonomic and inflammatory insights from an experimental medicine study. *Annals of the rheumatic diseases* 81: 1719. Link: [https://ard.bmj.com/content/81/Suppl_1/1719.2](https://ard.bmj.com/content/81/Suppl_1/1719.2) (**NEW**)


Lee J et al. (2020) Clinically accessible tools for documenting the impact of orthostatic intolerance on symptoms and function in ME/CFS. Work [Epub ahead of print]. Link: https://content.iospress.com/articles/work/wor203169

Li H et al. (2014) Autoimmune Basis for Postural Tachycardia Syndrome. Journal of the American Heart Association 3: e000755. Link: http://jaha.ahajournals.org/content/3/1/e000755


Morrow AK et al. (2022) Long-Term COVID 19 Sequelae in Adolescents: the Overlap with Orthostatic Intolerance and ME/CFS. Current Paediatric Reports. Link: doi.org/10.1007/s40124-022-00261-4


Wheeler C et al. (2022) Cardiovascular Autonomic Regulation, ETCO$_2$ and the Heart Rate Response to the Tilt Table Test in Patients with Orthostatic Intolerance. Applied Psychophysiology and Biofeedback. Link: doi.org/10.1007/s10484-022-09536-4


4.20 Neurology: Central nervous system and neuroimaging


Baraniuk JN *et al.* (2021) Differential Effects of Exercise on fMRI of the Midbrain Ascending Arousal Network Nuclei in Myalgic Encephalomyelitis / Chronic Fatigue Syndrome (ME/CFS) and Gulf War Illness (GWI) in a Model of Postexertional Malaise (PEM). *Preprints*: 2021110420. Link: https://www.preprints.org/manuscript/202111.0420/v1


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Martinez ARM et al. (2012) Sensory Neuronopathy and Autoimmune Diseases. *Autoimmune Diseases*. Link: [https://www.hindawi.com/journals/ad/2012/873587/](https://www.hindawi.com/journals/ad/2012/873587/)


McCrae CS et al. (2015) Fibromyalgia patients have reduced hippocampal volume compared with healthy controls. *Journal of Pain Research* 8: 47-52. Link: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4321661/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4321661/)


**Renz-Polster H & Bienzle D** (2021) Broken Connections: The Evidence for Neuroglial Failure in ME/CFS. OSF Preprints. Link: [https://osf.io/ef3n4/](https://osf.io/ef3n4/)


Thapaliya K et al. (2022) Volumetric differences in hippocampal subfields and associations with clinical measures in myalgic encephalomyelitis/chronic fatigue syndrome. Journal of Neuroscience Research 100 (7): 1476-1486. Link: doi.org/10.1002/jnr.25048


4.21 Neurology: Hypothalamic and neuroendocrine function


4.22 Neurology: Neuropsychology and cognitive function


### 4.23 Neurology: Neurotransmitter function


4.24 Pain


Barhost EE et al. (2021) Pain-related post-exertional malaise in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) and Fibromyalgia: A systematic review and three-level meta-analysis. *Pain Medicine*: pnab308. [Epub ahead of print.] Link: [doi.org/10.1093/pm/pnab308](doi.org/10.1093/pm/pnab308)


Eccles J et al. (2022) Mechanistic factors contributing to pain and fatigue in fibromyalgia and me/cfs: autonomic and inflammatory insights from an experimental medicine study. *Annals of the Rheumatic Diseases* 81: 1719. Link: [https://ard.bmj.com/content/81/Suppl_1/1719.2](https://ard.bmj.com/content/81/Suppl_1/1719.2) (*NEW*)


4.25 Phenotypes and sub-groups


4.26 Post-Exertional Malaise (PEM)

Baraniuk JN et al. (2021) Differential Effects of Exercise on fMRI of the Midbrain Ascending Arousal Network Nuclei in Myalgic Encephalomyelitis / Chronic Fatigue Syndrome (ME/CFS) and Gulf War Illness (GWI) in a Model of Postexertional Malaise (PEM). Preprints: 2021110420. Link: https://www.preprints.org/manuscript/202111.0420/v1


4.27 Post-mortem research


4.28 Relapse and recovery cycles


4.29 Sleep disturbance


### 4.30 Vision


5. Psychiatry and psychology


Loades M (2022) Improving the identification and treatment of co-morbid depression and/or anxiety in adolescents with Chronic Fatigue Syndrome (CFS/ME). [Doctoral dissertation, University of Bristol] Link: [https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.852541](https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.852541)


6. Sociology


7. Future research recommendations


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Ramlil A et al. (2021) You + ME Registry: A Research Platform to Facilitate Clinical and Therapeutic Discoveries in ME/CFS and Related Diseases. Preprints: 2021110478. Link: https://www.preprints.org/manuscript/202111.0478/v1


Tokunaga K et al. (2020) Inclusion of family members without ME/CFS in research studies promotes discovery of biomarkers specific for ME/CFS. Work 66 (2): 327-337. Link: doi.org/10.3233/WOR-203177


7.1 Platforms to facilitate research


Ramiller A et al. (2021) You + ME Registry: A Research Platform to Facilitate Clinical and Therapeutic Discoveries in ME/CFS and Related Diseases. Preprints: 2021110478. Link: https://www.preprints.org/manuscript/202111.0478/v1


Rekeland IG et al. (2022) Activity monitoring and patient-reported outcome measures in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome patients. PLOS ONE 17(9): e0274472. Link: doi.org/10.1371/journal.pone.0274472 (*NEW) Comment


8. Clinical assessment, symptoms, and diagnosis

8.1 General


Newton JL et al. (2008) Fatigue in non-alcoholic fatty liver disease (NAFLD) is significant and associates with inactivity and excessive daytime sleepiness but not with liver disease severity or insulin resistance. Gut 57(6): 807-813. Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2127024/


Tokumasu K et al. (2022) Clinical Characteristics of Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) Diagnosed in Patients with Long COVID. Medicina 58: 850. Link: doi.org/10.3390/medicina58070850 (*NEW)


8.2 Investigations


8.3 Physical examination


8.4 Symptoms

Pain – see Biomedical Research, 4.21 above.
Post-Exertional Malaise – see Biomedical Research, 4.23 above.
Sleep disturbance – see Biomedical Research, 4.26 above.
Vision – see Biomedical Research, 4.28 above.
9. Management

9.1 Cognitive Behavioural Therapy (CBT)


Albers E et al. (2021) Effectiveness of Internet-Based Cognitive Behavior Therapy (Fatigue in Teenagers on the Internet) for Adolescents With Chronic Fatigue Syndrome in Routine Clinical Care: Observational Study. Journal of Medical Internet Research 23 (8): e24839. Link: https://pubmed.ncbi.nlm.nih.gov/34397389/


9.2 Complementary and alternative therapies


Fangfang X et al. (2021) Can prolong life with nine turn method (Yan Nian Jiu Zhuan) Qigong alleviates Fatigue, Sleep quality, Depression and anxiety on Patients with Chronic Fatigue Syndrome: a Randomized, Controlled, Clinical Study? [ResearchSquare] [Epub ahead of print.] Link: https://www.researchsquare.com/article/rs-965010/v1


Xue K et al. (2021) The efficacy and safety of moxibustion for chronic fatigue syndrome: A protocol for systematic review and meta-analysis. Medicine, 100 (18): p e25742. Link: https://europepmc.org/article/med/33950958


9.3 Diet and nutrition


**Castro-Marrero J et al. (2022)** Does Dietary Coenzyme Q10 plus Selenium Supplementation Ameliorate Clinical Outcomes by Modulating Oxidative Stress and Inflammation in Individuals with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome? *Antioxidants & Redox Signalling* 36 (10-12): 729-739. Link: [doi.org/10.1089/ars.2022.0018](https://doi.org/10.1089/ars.2022.0018)


9.4 Exercise, Pacing and activity management


Clague-Baker N et al. (2021) Survey of people with Myalgic Encephalomyelitis (ME) to explore their use and experiences of physiotherapy services in the UK. Physiotherapy P076 113 (1): E101-E102. Link: https://www.physiotherapyjournal.com/article/S0031-9406(21)00164-4/fulltext#relatedArticles


Zhu Y et al. (2022) Electroacupuncture at BL15 attenuates chronic fatigue syndrome by downregulating iNOS/NO signaling in C57BL/6 mice. Anatomical Record (Hoboken) [Epub ahead of print]. Link: doi.org/10.1002/ar.24953 (**NEW)


9.5 General management


Froehlich L et al. (2021) Medical Care Situation of People with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome in Germany. *Medicina* 57, 646. Link: [https://www.mdpi.com/1648-9144/57/7/646](https://www.mdpi.com/1648-9144/57/7/646)


9.6 PACE Trial


Vink M. PACE trial authors continue to ignore their own null effect. Journal of Health Psychology 22 (9): 1134-1140. Link: https://www.ncbi.nlm.nih.gov/pubmed/28805519


9.7 Pharmacological treatment


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9.8 Immunoadsorption/ Apheresis


9.9 Pregnancy


### 10. Prognosis and quality of life

#### 10.1 Age


#### 10.2 Carers

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### 10.6 Severe ME


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13. Government Documents

13.1 Disability support


The ME Association, 7 Apollo Office Court, Radcliffe Road, Gawcott, Bucks, MK18 4DF. ME Connect Helpline: 0344 576 5326 Available every day of the year, during the hours of 10am-12noon, 2pm-4pm and 7pm-9pm. The ME Association is a registered charity number 801279.


13.2 Economic cost to the UK


13.3 General reports, debates, and statements

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14. Healthcare


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16. Long-COVID which cover ME/CFS

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### 16.2 Endothelial cells


### 16.3 Microclots


### 16.4. Miscellaneous

16.5 Predictors


16.6 Prognosis and quality of life


16.7 Symptoms


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