

## Introduction

- Functional Neurological Disorders represent genuine involuntary neurological symptoms and signs including seizures, weakness and sensory disturbance which have characteristic clinical features and represent a problem of voluntary control and perception despite normal basic structure of the nervous system [1].
- FNDs carry a significant impact on patients' quality of life [2, 3], and depression and anxiety occur in up to 40% of FND patients [4, 5]
- Delayed diagnoses of FND leads to worse outcomes for patients [4], as well as preventable costs, such as missed work, GP and specialist appointments, investigations etc, as well as multiple consultations over several years before receiving a diagnosis of FND [6] These costs carry a burden to patients, clinicians, and healthcare systems, as well as to the economy.
- FND patients have been found to be more likely to not be working for health reasons, and more likely to be receiving disability-related state financial benefits than "organic" neurological patients [7].
- Health care utilisation and costs offer two different methods of measuring resource usage.
- The costs of FND (and other medical conditions) can be thought of as direct and indirect costs.
- Direct costs represent resources utilised for health care (e.g. cost of investigations, time spent on assessment by a doctor etc),
- Indirect costs represent productivity losses arising from morbidity-related sickness absence (e.g. loss of employment, cost of childcare while hospitalised etc.).
- Direct and indirect costs together constitute the economic burden of FND, which can be quantified via cost-of-illness studies (COI).
- In COI, the costs of an illness are estimated by measurement and monetary valuation of health care utilisation and lost productivity in patient samples or by extraction of this information from routine data.

## Purpose of Review

### Aims

Given the obvious costs that FND place on patients, those who care for them, and the economy as a whole, we felt it would be important to quantify these costs, and to identify how they might be reduced.

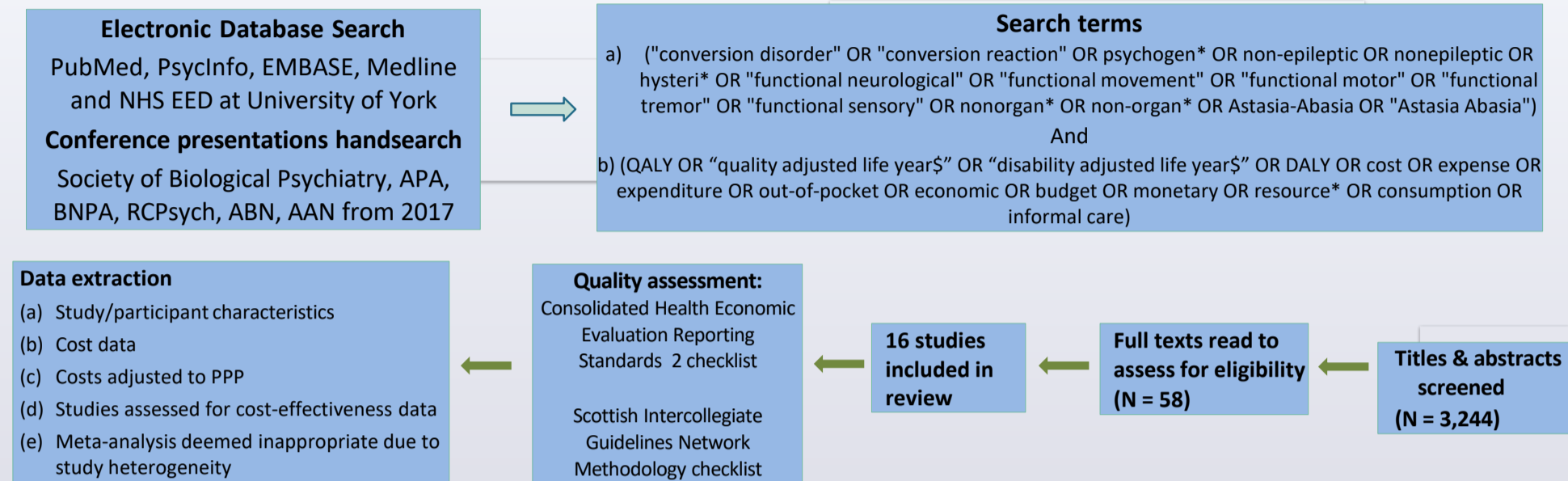
### Objectives

- To investigate the direct and indirect costs of Functional Neurological Disorders
- To investigate whether any interventions to treat Functional Neurological Disorders appear to be cost-effective

## Inclusion Criteria

- Contain original cost or cost-effectiveness data for functional neurological disorders.
- English language
- investigate the effects of literacy instruction with at least one dependent variable related to single- word reading

## Methods



## Results

### Study Characteristics

- Sample sizes varied from 11 to 64,138.
- 5 studies were conducted in the USA, 4 in Great Britain, 2 in Denmark, and 1 in each of Italy, Ireland, Australia, Canada, and India.
- Ten studies focused on PNES, four studies focused on FND / Conversion Disorder, and two studies focused on Functional Movement Disorder
- Study designs were made up of three types:**
  - COI studies** which included a comparator group (n = 4)
  - COI studies** which did not include a comparator group. (n = 4)
  - Economic Evaluations (EE)** of interventions which were either pre-post cohort studies (n = 6) or randomized controlled trials (n = 2).
- Of these, 5 studies assessed **active interventions**,
- 3 studies assessed costs **before and after a definitive diagnosis** of FND

### Overall cost

- Overall costs vary significantly due to the studies' methodological and geographical heterogeneity
- After costs were adjusted to **Purchasing Power Parities (PPP)** for Gross domestic product, mean annual costs per patient of range from:
  - 4,964 2021 USD to 45,567 2021 USD for Functional Seizures,
  - 21,433 2021 USD to 86,722 2021 USD for FMD

### Study heterogeneity

- Studies varied in terms of the detail of their breakdown of costs of FND.
- 8 studies assessed only hospital costs (inpatient and specialist outpatient services), with 7 of these studies focused only on hospital in-patient costs.
- Only 4 studies assessed costs for medication costs outside of hospital.
- 3 studies assessed productivity losses to the patient resulting from their FND.
- Geographical heterogeneity meant variation in methods of calculating costs. For example, studies conducted in the USA often used hospital charge data, which often greatly exceeds actual costs [9], with the average cost-to-charge ratio being 0.47 (range, 0.06-1.87)

### Studies included

- Stephen, C.D., et al., Assessment of emergency department and inpatient use and costs in adult and pediatric functional neurological disorders. *JAMA neurology*, 2021. 78(1): p. 88-101.
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- Luthy, S.K., et al., Characteristics of children hospitalized for psychogenic nonepileptic seizures due to conversion disorder versus epilepsy. *Hospital Pediatrics*, 2018. 8(6): p. 321-329.
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- Tinazzi, M., et al., Functional motor disorders associated with other neurological diseases: beyond the boundaries of "organic" neurology. *European journal of neurology*, 2021. 28(5): p. 1752-1758.
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- Feinstein, A., et al., Psychiatric outcome in patients with a psychogenic movement disorder: a prospective study. *Cognitive and Behavioral Neurology*, 2001. 14(3): p. 169-176.
- Butler, M., et al., International online survey of 1048 individuals with functional neurological disorder. *European Journal of Neurology*, 2021. 28(11): p. 3591-3602.
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- Sanyal, R., et al., The use of hypnosis as treatment for functional stroke: A case series from a single center in the UK. *International Journal of Stroke*, 2022. 17(1): p. 59-66.
- Mayor, R., et al., Long-term outcome of brief augmented psychodynamic interpersonal therapy for psychogenic nonepileptic seizures: seizure control and health care utilization. *Epilepsia*, 2010. 51(7): p. 1169-1176.

## Discussion & Implications

### Comparison to other disorders

- 2 high quality studies reported FND and PNES to have **similar mean direct cost per patient as epilepsy**.
- Stephen et al reported **similar mean direct costs per adult FND patient FND as with demyelinating disorders**.
- Given that FND patients have levels of physical disability equivalent to these disorders, and higher frequencies of psychological comorbidities, one might expect similar or greater indirect and intangible costs.

*This provides powerful insight into the economic impact of a disorder which has relatively limited awareness in the medical community*

### Intervention

- Each study which assessed costs before/after an intervention (psychotherapy or definitive diagnosis) showed cost reduction, or improved QALYs, in the period after the intervention
- Non-economic research also suggests that healthcare utilisation is decreased following diagnosis of FND [10,11]

*Early diagnosis and treatment of FND would minimise excessive and inappropriate medications, lessening direct and indirect economic costs, while minimising harm to the patient and improving their prognosis .*

### Lack of cost-effective treatment

- To date, there has been **no large studies showing a cost-effective treatment of FND**
- Less rigorous studies have showed promise of cost-effectiveness for physiotherapy [12], tilt table tests combined with video-EEG [13], hypnosis [14], and psychodynamic interpersonal therapy (15)
- High healthcare resource use by FND patients, and the reduction of this following intervention, indicate that future research and service provision might consider investigating cost-effectiveness beyond costs per QALY.

V-EEG represents a low-cost intervention, and results of the studies assessing healthcare costs before/after diagnosis using vEEG, formal . diagnosis might prove to be cost effective, and this should be investigated further

## Conclusion

- FNDs carry significant economic costs to patients and the exchequer, as well as intangible losses.
- Interventions, including accurate diagnosis, appear to offer an avenue towards reducing these costs.
- Significant heterogeneity exists between studies in this area, and we found a relative lack of research on indirect and intangible costs.