Introduction

- Over 85% of children with epilepsy (CWE) live in low and lower-middle-income countries (LLMIC). Most of these countries are in Africa.
- Co-morbidities (co-occurrence of two or more conditions) in CWE are common in high income countries (HIC).
- Data from Sub-Saharan Africa (SSA) in CWE is limited
  - Few population-based studies of co-morbidities or of factors affecting the treatment and education gap.

Aims of study

To determine in a population in SSA:
- prevalence and risk factors for epilepsy in children
- number and type of abnormalities on EEG and CT
- prevalence and associations of co-morbidities
- factors influencing treatment and education
- the effects of epilepsy on CWE and their families

Study Design

- Population based study
- Hai District, Tanzania
- Case-control study
  - Risk factors
  - Cognition
  - Behaviour

Study Design

<table>
<thead>
<tr>
<th>Census / Questionnaire</th>
<th>Case Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Assessment</td>
<td>Clinical assessment of Cases &amp; Controls</td>
</tr>
<tr>
<td>Secondary Assessment</td>
<td>Cognitive &amp; Behavioural Assessment</td>
</tr>
<tr>
<td>Investigations</td>
<td>CT / EEG / Bloods</td>
</tr>
</tbody>
</table>
Methods

• Village enumerators taught about epilepsy

• All children aged 6 to 14 yrs who were positive responders and all those thought to have epilepsy by trained village enumerators were assessed for a diagnosis.

• Controls were randomly chosen (matched for age +/- 1 yr, sex and village) from the same population using the population census.

Definition of Active Epilepsy

Children with at least two afebrile seizures (unrelated to acute infections, metabolic or neurological disorders or drugs) within the previous five years, or who were on anticonvulsant medication.

Case Ascertainment

Behaviour Assessment
Rutter A2 Parent scale

• Developed in 1970 in the UK
• Assessment of children aged 7 to 13 yrs.
• Screening instrument for emotional or behavioural disorder.
• Standard scoring system
• Total scores of 13+ are abnormal
• Translated into Kiswahili and refined using the back translation method.

Cognitive assessment

• Used the Goodenough-Harris Draw-A-Person Test (GHDT) to give an estimate of IQ.

• Drew a picture of a man and a woman and pictures scored on set criteria to give a standardised score for age.

• Those scoring less than 70 (<2 s.d. below the mean) were designated as having cognitive impairment.
Sample drawings

Co-morbidities

- Behavioural problems (Rutter score)
- Cognitive impairment (GHDST)
- Motor difficulties (clinical assessment)
- Hearing or visual impairment (functional hearing at 3m, Snellen chart with letter matching)
- Feeding problems (combination of coughing, choking or taking >1/2 hour to feed)
- Burns and injuries (clinical assessment)

Qualitative study

- CWE were purposively recruited (considering variation by age, gender and residence)
- In-depth interviews were performed with carers
- Focus group discussions were conducted in two villages; one semi-urban and a rural village
- Analyzed using content analysis approach
- NVivo programme used to identify recurring themes and for purposes of triangulation.

Results

Demographic Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, male</td>
<td>57</td>
<td>51%</td>
</tr>
<tr>
<td>Sex, female</td>
<td>55</td>
<td>49%</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>11.4</td>
<td>95% CI 11.0-11.8</td>
</tr>
<tr>
<td>Education of head of household</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>6</td>
<td>5.4%</td>
</tr>
<tr>
<td>1º</td>
<td>93</td>
<td>83%</td>
</tr>
<tr>
<td>2º</td>
<td>11</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

Positive responders from census aged 6-14 yrs from Hai district (23.9% of total population of 161,119) 38,523

Died 2
Refused 1
Not found/Travelled 8
Of these 3 were known to have had active epilepsy.

104 Not cases of active epilepsy
32 Psychogenic falls/faints
5 Febrile seizures in past
5 Epileptic seizures >5 yrs ago
4 Behavioural stereotypies
13 Other

Total number of children aged 6-14 yrs identified as active case of epilepsy 112
Cases identified by enumerators and not on census 40
Prevalence and risk factors

- Unadjusted Prevalence of epilepsy was 2.91 per 1000 children (95% CI 2.4–3.5)

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95%CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of adverse perinatal events</td>
<td>14.9</td>
<td>1.4–151.3</td>
<td>0.024</td>
</tr>
<tr>
<td>Family history of non-febrile seizures</td>
<td>6.2</td>
<td>1.4–27.8</td>
<td>0.046</td>
</tr>
<tr>
<td>Poor scholastic attainment</td>
<td>8.6</td>
<td>3.9–18.4</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Number of parents resident at home

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2.8</td>
<td>6.2</td>
</tr>
<tr>
<td></td>
<td>1.1–6.5</td>
<td>1.5–25.5</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.023</td>
<td>0.011</td>
<td></td>
</tr>
</tbody>
</table>

Co-morbidities

- Co-morbidity:
  - 85% (95/112) of cases
    - (27% of controls [5% CI, 17% BP, 3% H&V, 6% B])
    - OR 14.8, 95% CI 7.6–28.6, p<0.001
  - In children with epilepsy:
    - 64% (72) had cognitive impairment
    - 26% (29) had burns and other previous injuries
    - 17% (19) had cerebral palsy (9 had feeding difficulties)
    - Multiple co-morbidities in 62% (69/112) of CWE
(4% of controls)

Cognitive Assessment Scores

<table>
<thead>
<tr>
<th>IQ Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>52-59</td>
<td>26/112</td>
</tr>
<tr>
<td>60-69</td>
<td>31/112</td>
</tr>
<tr>
<td>70-79</td>
<td>21/112</td>
</tr>
<tr>
<td>80-89</td>
<td>17/112</td>
</tr>
<tr>
<td>90-99</td>
<td>15/112</td>
</tr>
<tr>
<td>100-109</td>
<td>12/112</td>
</tr>
<tr>
<td>110 and over</td>
<td>19/112</td>
</tr>
</tbody>
</table>

Cognitive Impairment

- Very common in children with epilepsy:
  - Cases 64%
  - Controls 5%
  - OR 37.2, 95% CI 14.7–94.2, p<0.001
- Not associated with antiepileptic drug use.
- Associated with motor difficulties, early onset and frequent seizures in multivariable model

Behaviour - Rutter Scores

<table>
<thead>
<tr>
<th>Rutter Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>26/112</td>
</tr>
<tr>
<td>10-20</td>
<td>31/112</td>
</tr>
<tr>
<td>20-30</td>
<td>21/112</td>
</tr>
<tr>
<td>30-40</td>
<td>17/112</td>
</tr>
<tr>
<td>40-50</td>
<td>15/112</td>
</tr>
<tr>
<td>50-60</td>
<td>12/112</td>
</tr>
<tr>
<td>60 and over</td>
<td>19/112</td>
</tr>
</tbody>
</table>
Behaviour Disorders

• **66%** (68/103) CWE had behavioural problems (cf 19% controls)

  OR 8.2, 95% CI 4.3 – 15.6, p<0.001

• In CWE, was associated with frequent seizures but not with antiepileptic drug usage.


• Cognitive impairment found in 31% if Kenyan children in CWE and 6% of controls (Kariuki et al, *Epilepsy & Behavior* 23 (2012) 41–49)

• Cognitive impairment found in 23% African PWE and was associated with abnormal EEG, AED use, frequent seizures, status epilepticus and age at onset of seizures (Kariuki et al for the SEEDS group, &ipet.15125656)

• Behaviour disorder in children in India: 54% had significant psychopathology on the CBCL: Associated on univariate analysis with income, living in urban area, length of seizure disorder and polytherapy. (Datta et al, *Seizure* (2005) 14, 190–197)

• Behavioural problems in Kenyan children (on CBQFP) aged 6-9 years found of 49% CWE and 26% controls. Associated with active epilepsy and focal seizures. (Kariuki et al, *Epilepsy & Behavior* 23 (2012) 41–46)

• Underlying brain disorder
  * Epilepsy syndrome
  * Genetics
  * Seizures
  * Neurobehavioural problems
  * Antiepileptic medication
  * Psychosocial factors/stigma

Treatment with AED

• No Treatment: 68/112 (61%)

• On Treatment: 30/112 (27%)
  (mostly phenobarbitol)

• Under-treated for weight: 14/30 (47%)

• Treatment no longer indicated: 14/112 (12%)

• Treatment gap 75%
Reasons for Treatment Gap

- Epilepsy misdiagnosed
- Preferential use of traditional treatments
- Cost and availability of biomedical treatment
- Lack of efficacy (usually low dose of AED or taking AED following a seizure)

“When she was 8 years old, we thought it is Malaria, so we gave her anti-malarial medicine, but after six months she started to shake again. When we went to the hospital they said it is malaria. But in our family they thought it was convulsion, or something to do with cultural issues. She didn’t get any relief until one day a visiting doctor came and said it might be epilepsy and he gave her some anti-epileptic drugs.”

“Other parents said this problem doesn’t have treatment; and some of them lost their children by going to the traditional healer and they tried to convince me but I said I believe the treatment of the hospital.”

“Sometimes it is difficult, we can’t get the medicine, the pharmacist will ask for the money and you just find you don’t have the money, so we can stay for 1 or 2 days without the medicine and she will fall down until I get the money and buy the medicine.”

Systematic reviews of TG

- TG estimated as >75% in LIC (<10% in HIC)
- TG associated with:

  **Health systems:** Inadequate skilled manpower, cost of treatment, unavailability of drugs

  **Individual factors:** Cultural beliefs, traditional treatment, distance to health facilities

“The epilepsy treatment gap in developing countries: A systematic review of the magnitude, causes, and intervention strategies.”

Emelie A. Hynes, William X. Nyan, Valerie E. Emmett, and Helen V. Davies.}

The epilepsy treatment gap in developing countries: A systematic review of the magnitude, causes, and intervention strategies.
The Education Gap

- 50% (56/112) CWE were not attending school regularly
- CWE with co-morbidities were much less likely to attend school
- Single co-morbidity, for not attending school, OR 4.7 (95%CI 1.1-19.1, p=0.033)
- Multiple co-morbidities OR 50.2 (95%CI 14.2-177.1, p<0.001)

Reasons for not attending school:
- Seizures – being sent home from school
- Physical disability – unable to get to school
- Learning difficulties – “not teachable”
- Behaviour problems (13%) – disruptive
- Stigma
- Few other studies on the education gap in CWE in LLMIC and very few on the causes
- Confirm that access to education is poor
  (43% lacked education and then later unemployment in 57%, Kariuki et al, Epilepsia, 55(1):76-85, 2014)

“Yes the big problem is when she was going to school, she will not stay for a long time; they will bring her back when she has fails, so she is missing the lessons at school.”

“Teachers in our schools do not have skills to educate or take care of epileptic children.”

“It has affected him, he can’t do anything, he can’t even pick a cup, or go somewhere, he can’t go to school, and he can’t read or write.”

“He is very angry, he likes to beat others, it is not easy for him to go to school.”

“My friends do discriminate against me, when it happens, they all run away from me, and if I call someone, they pretend not to hear me.”

“My mother-in-law cursed me because I brought a disease from my family since such disease had never happened in their family.”

“The family think that I am a witch.”

“We can’t go to work, both me and his mother. If I have to go to work that means his mother must be at home taking care of him, and we have been spending a lot of money trying to find his treatment and it’s very hard.”

Conclusion

Co-morbidity was very common in these CWE especially cognitive impairment and behavioural problems

The treatment gap was high as expected; highlights the need for training health care workers and sustainable source of low-cost AED

School attendance was poor amongst CWE and associated with presence of co-morbidities

Epilepsy in children is associated with a profound adverse effect on the child and their family.
With thanks....
Professor Charles Newton, Professor Richard Walker, Professor Brian Neville, Dr Matthew Burton, Dr Ewan Hunter, Declare Mushi; all in the Hai District Team

Funded by BMA, Wellcome Trust and Northumbria Healthcare Trust

References

- **Epilepsy in Tanzanian children: association with perinatal events and other risk factors.**

- **Co-morbidity of epilepsy in Tanzanian children: A community-based case-control study.**

- **Behavioural comorbidity in Tanzanian children with epilepsy: A community-based case-control study.**

- **Perceptions, social life, treatment and education gap of Tanzanian children with epilepsy: A community-based study.**