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Brain maturation, poverty and social exclusion: Shifting paradigms of psychopathology

Amresh Srivastava

Western University

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1. Psychosocial treatments are main drivers for pharmacological- biological treatments

2. Biological treatments can be initiated only after few symptoms have appeared and these are targeted to prevent full blown illnesses

3. Whereas social treatments are truly intended to reduce the risk factors and fundamental conditions for prevention
Brain Maturation and poverty: Shifting paradigms for mental disorders

Amresh Srivastava
Associate Professor of Psychiatry
The Western University
### Poverty

- Population Lives on $1 Per day: **40%**
- Population Per day: $1
- Poverty: **35%**
- Depression: **60%**
- Immigrants: 200 Ethnic groups
- Lives on $1 Per day: **40%**

### Cost of Treatment

- Cost of treatment of mental disorder in Canada, Per patient:
  - Community: **$34,418** Per Year
  - In Hospital: **$170,820** Per year

### Poverty and Mental Health

- Poverty
- Displaced
- Refugees
- Disaster
- War

- Community Cost: **$34,418** Per Year
- Hospital Cost: **$170,820** Per year

### Additional Information

- War, Disaster, Refugees, Displaced: Various-related statistics

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**Note:** The above data and statistics are presented in a structured format to reflect the content of the image. The visual elements such as percentages, charts, and tables are integral to understanding the context and findings.
In 2015, more than ONE BILLION people worldwide still live in extreme poverty, especially in sub-Saharan Africa and South Asia.
The Sustainable Development Goals are the world’s #globalgoals for a better tomorrow.
GOAL 1

END POVERTY IN ALL ITS FORMS EVERYWHERE

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal
Addressing poverty is a public policy priority. When 1.57 million people live in poverty in as prosperous a place as Ontario, there is a clear need to adapt public supports and investments.
High rates of mental disorder
Global Burden

High costs of mental health
Unemployed

Up to 30%

Not working

2x unemployed

Fared badly during the crisis

70%

Working
High rates of mental disorder in poverty

No Access to health care

70% Suffering from mild to moderate mental illness

Less productive

Struggle
High Prevalence of mental disorder in Developing countries: WHO Study

- Schizophrenia:
  - Developed Countries: 7.5%
  - Developing Countries: 37.5%
- Epilepsy:
  - Developed Countries: 7%
  - Developing Countries: 38%
Socio-economic risk factor

Consequences

Mental disorder

Poverty

Education

Nutrition

Homelessness

Substance abuse

Trauma

Abuse

Economic

Early onset trauma and neuronal changes
Measurement and outcome indices of poverty

Cultural Geopolitical causes of poverty

Poverty within rich and Poor countries

Income based poverty
Below Poverty line, Ontario

The accompanying chart illustrates that income support for a single person on ODSP or OW is far below a subsistence level. Individuals on ODSP are 34% below the poverty line, while those on OW are 63% below.

Poverty
Social deprivation
Poor rearing environment
Brain insult
Violence
Adverse life event
Trauma
Social deprivation
Discrimination
Anger
Hostility
Abnormal behavioural response
Depression
Poor response to treatment
Adverse life event
Violence
Early life trauma
Low intelligence
Glucocorticoids
Poor cognition
Neuro anatomical changes
HPA axis
Early life trauma
Depression
Amygdala
Hippocampus
Poor rearing environment
inequalities
Low socio-economic status
Poverty
disability

Neuroscience
Mental illness
Brain development
Neuronal disorganization
Loss of grey matter
Cognitive impairment

Epigenetic's
Neurobiological Changes

Poverty

Cortical Loss

Cognitive dysfunction

Neuronal changes
Most of the mental disorders begin in very early age in life, earlier than age 14 years.

<table>
<thead>
<tr>
<th>Neuroscience</th>
<th>Cognitive dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low intelligence</td>
</tr>
<tr>
<td></td>
<td>Neuronal architecture</td>
</tr>
<tr>
<td></td>
<td>Neuronal density</td>
</tr>
<tr>
<td></td>
<td>Age related progressive</td>
</tr>
</tbody>
</table>
Cognitive dysfunction

<table>
<thead>
<tr>
<th>Education</th>
<th>Cognitive parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive impairment</td>
<td>Low intelligence</td>
</tr>
</tbody>
</table>
Disparities between and within rich societies

Educational outcome

- Maths: Poor families = 34, National average = 69
- Literacy: Poor families = 32, National average = 69
- Income: Poor families = 32, National average = 63
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>examine health consequences</td>
<td>persist in adulthood</td>
</tr>
<tr>
<td>parameters of health outcomes</td>
<td></td>
</tr>
<tr>
<td>Neurobiological</td>
<td>negative physical and mental health outcome</td>
</tr>
<tr>
<td></td>
<td>Susceptibility to mental disorder</td>
</tr>
<tr>
<td>Neurocognitive changes</td>
<td>excursive function, memory, language, processing network and development of brain</td>
</tr>
<tr>
<td>targeted intervention program or alleviating neuronal effects of poverty</td>
<td></td>
</tr>
</tbody>
</table>
Poverty → Mental disorder → Social exclusion

Nutritional
Psychological
Income

Intervention
identification
Prevention
Harm and risk reduction

Stigma
Productivity
Homelessness
Employment
Education

Neurobiological advances
abuse, ALE & trauma

Risk factors for loss of brain maturation

Substance Abuse

Nutrition

Maternal separation

Later in life

Early years

Brain infections

BOH diseases

Substances

Cannabis

Prenatal

Post-natal
Social conditions

Mental disorder

Social exclusion + mental disorder

Poverty

Mental disorder

Loss of Brain Maturation

Epigenetic's

Genetic factors

Poverty
Risk factor and vulnerability

- Poverty
  - Vulnerability
    - Nutrition
    - Substance abuse
    - Pregnancy
    - Post-natal
    - Socio-economics
  - Brain Maturation

Mental disorders
- At-risk states
- Social exclusion
- Poverty
- Stigma
- Homelessness
- SUD
- Nutrition
Brain changes and poverty

What happened in a brain of individuals with mental disorder?

Two types of main changes occur in the brain

1. Loss of Grey matter
2. Decreased neurocognition

These changes are caused by a complex interaction between Genetic framework & Environmental factor

Brain changes and poverty
Brain maturation

<table>
<thead>
<tr>
<th>Structural changes</th>
<th>Functional changes</th>
<th>Cognition</th>
<th>Neurochemistry</th>
<th>Neuronal anatomy</th>
</tr>
</thead>
</table>

Structural and functional brain changes

Early phase of illness

Grey matter loss. MRI studies (NIMH studies)

Computed for progressive change
Brain changes due to poverty

1. Changes due to socio-economic conditions

Severe poverty affects children's brain development, study finds

That kids who grow up poor do less well in school is well documented, but researchers find that part of that poor performance stems from how their brains grow and work.

A CT scan of a brain. A study conducted at University of Wisconsin-Madison, which combines the expertise of neuroscientists and economists, found that the parts of the brain tied to academic performance were 8 per cent to 10 per cent smaller for children who grow up in very poor households.
Neurobehavioural effects of developmental toxicity

Dr Philippe Grandjean, MD, Philip J Landrigan, MD

Open Access

Brain Development and Poverty 201

Figure 7.6 Association Between Cerebellar Gray Matter Volume and Family Income

Source: Authors' compilation based on NIH MRI Study of Normal Brain Development (National Institutes of Health 2012).

Note: Values adjusted for demographic variables. Unit of measure is number of gray matter voxels, a measure of regional volume commonly used in structural neuroimaging analyses. Error bars show the standard error for each group.
The home environment: cognitive stimulation

Neurocognition

All cognitive system, Language, executive function, memory, spatial cognition and visual

Middle class children n do better

Interventions target low SE condition children
## Brain developmental changes in poverty

<table>
<thead>
<tr>
<th>Definite association between poverty and brain maturation</th>
<th>Prenatal influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey matter loss 6%</td>
<td>Ecology</td>
</tr>
<tr>
<td>Main deficit is in neurocognition,</td>
<td>brain functioning predispose people to a particular level of</td>
</tr>
<tr>
<td>Memory and executive function</td>
<td>Increases vulnerability</td>
</tr>
<tr>
<td>Drop in IQ by 10 points</td>
<td>Parental care</td>
</tr>
<tr>
<td>Toxic substances are one of the causes</td>
<td>Endocrinal</td>
</tr>
</tbody>
</table>

experiences that are typical of different levels of SES affect brain development (‘social
Neurochemistry

HPA-Axis

Glucocorticoid

Substance P

Dopamine

Neuroendocrine, neuromodulator

11. Changes due to socio-economic conditions
Neuroprotection, which refers to treatment that helps maintain central nervous system functionality in response to neurobiologic stress, may be responsible for prevention of disease progression and deterioration.

<table>
<thead>
<tr>
<th>Neuroprotection</th>
<th>Antipsychotics</th>
<th>Olanzapine</th>
<th>Protein substances</th>
<th>BDNF</th>
<th>NG1</th>
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Neuroplasticity
# Why brain changes

**Glutamate Excitotoxicity**

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Most of the mental disorders begin in very early age in life, earlier than age 14 years.

Psychosocial stress

Risk factors

Clusters showing significant reductions in Cth in stressed subjects.

Cth in controls - stressed subjects

Savic I Cereb. Cortex 2013; cercor.bht348

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15. Changes due to socio-economic conditions
3. What can change?

Intervention

Prevention

+  

1. Decreasing vulnerability

2. Decreasing risk factors

Early treatment

Neuroplasticity

better health of neutrons

Preserving further deterioration

- Decreasing risk factors
..in a nut shell

Direct effect of brain development
Loss brain maturation is likely cause mental disorders
very early in age
Grey matter loss and impaired neurocognition

To some extent this is preventable
Preserving brain development is necessary
Prevention of mental disorders

Improvement in course of brain maturation

Improving socio-economic conditions which lead to brain changes