

The Gut Microbiome of Youth Who Have Affective Problems: A Scoping Review

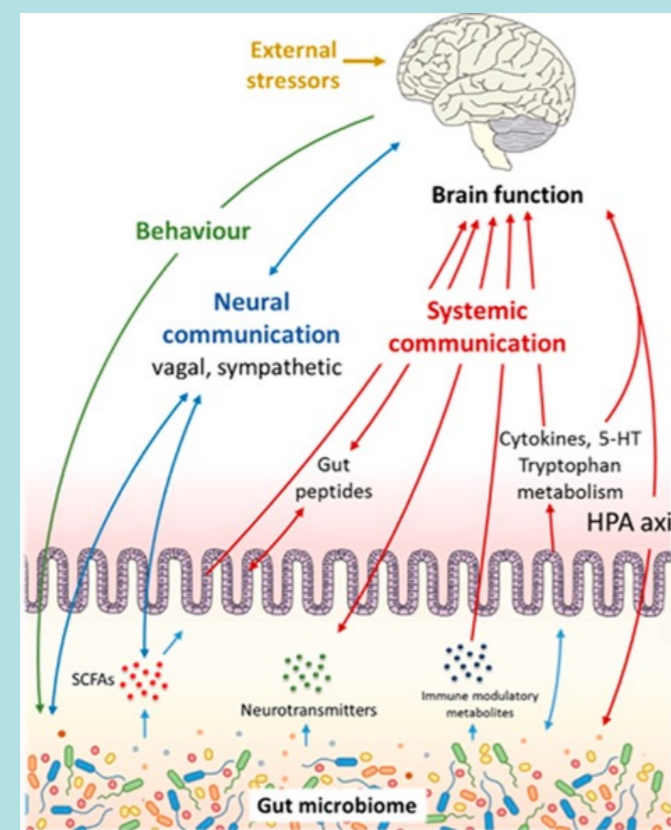
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Background

- Affective problems (ie., anxiety and depression) have increased in youth over the past several decades.
- There is little understanding of the pathophysiology involved.
- There is growing evidence that the gut microbiome is linked to mental health, which is mediated by the pathways of the gut-brain axis (Figure 1).
- The microbiome is the collective genomes of microbes living within the host organism.
- The gut microbiome is made up of 10^{13} microorganisms, 100x more genes than the human genome.
- A significant number of reviews synthesize the relationships of the gut microbiome to adult anxiety and mood in the adult population, but there are no reviews examining the literature on youth.
- Greater insight into the role of the microbiome may inform novel assessment and treatment approaches for youth.
- This scoping review examined existing research on the relationship of the gut microbiome to affective problems of children and youth, comparing findings across these younger age groups.

Figure 1. Gut-brain axis model for communication between the gut microbiome and brain (Rogers et al., 2016)



Aims

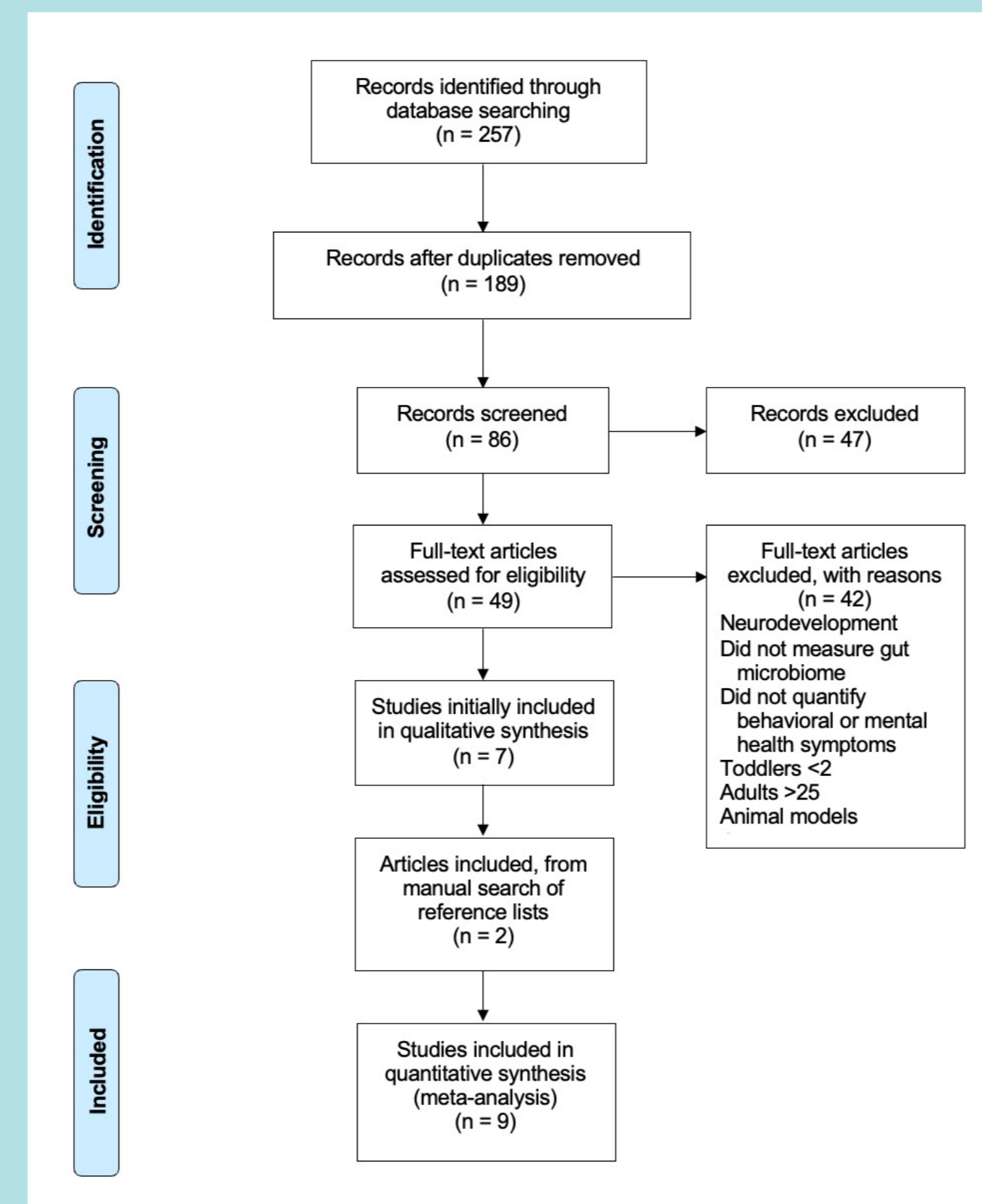
- Identify commonly reported alterations in specific microbiota species that are associated with affective problems.
- Identify differences in diversity of microbial communities that may distinguish youth with affective disorders from those with no known problems.

Methods

- Arksey and O'Malley's (2003) methodology for scoping reviews was utilized to investigate our aims.

- A literature search using PubMed, PsycINFO, and CINAHL was performed, and bibliographies were manually searched.
- Search terms included the constructs "gut microbiome," "affective disorders," "child," "adolescent," and "youth, and appropriate synonyms.
- Studies were eligible if they involved youth between the ages of 2 and 25 and described outcomes associated with affective disorders, including their diagnosis and symptomology.

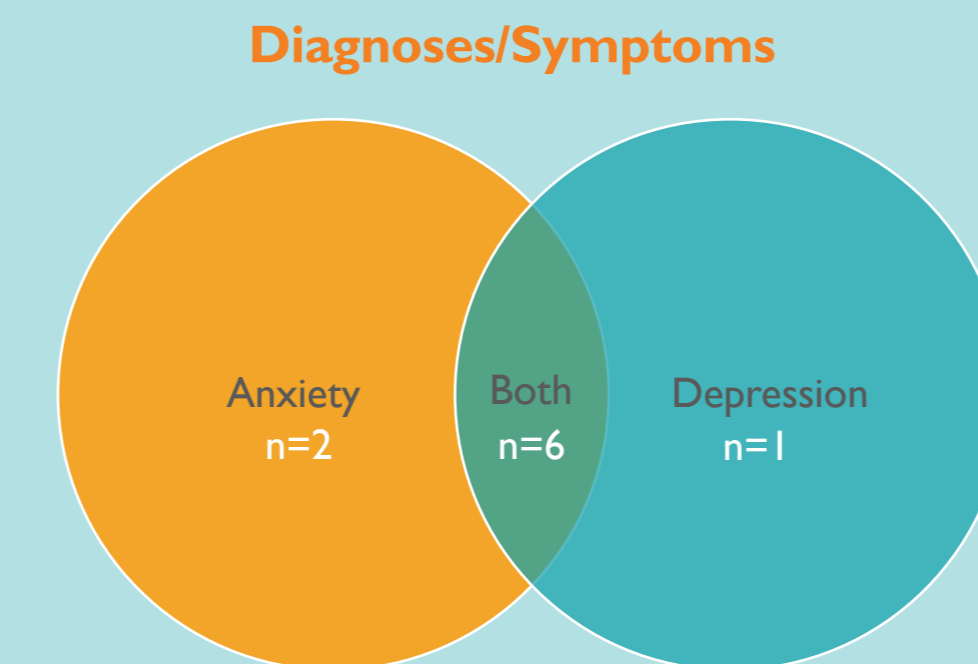
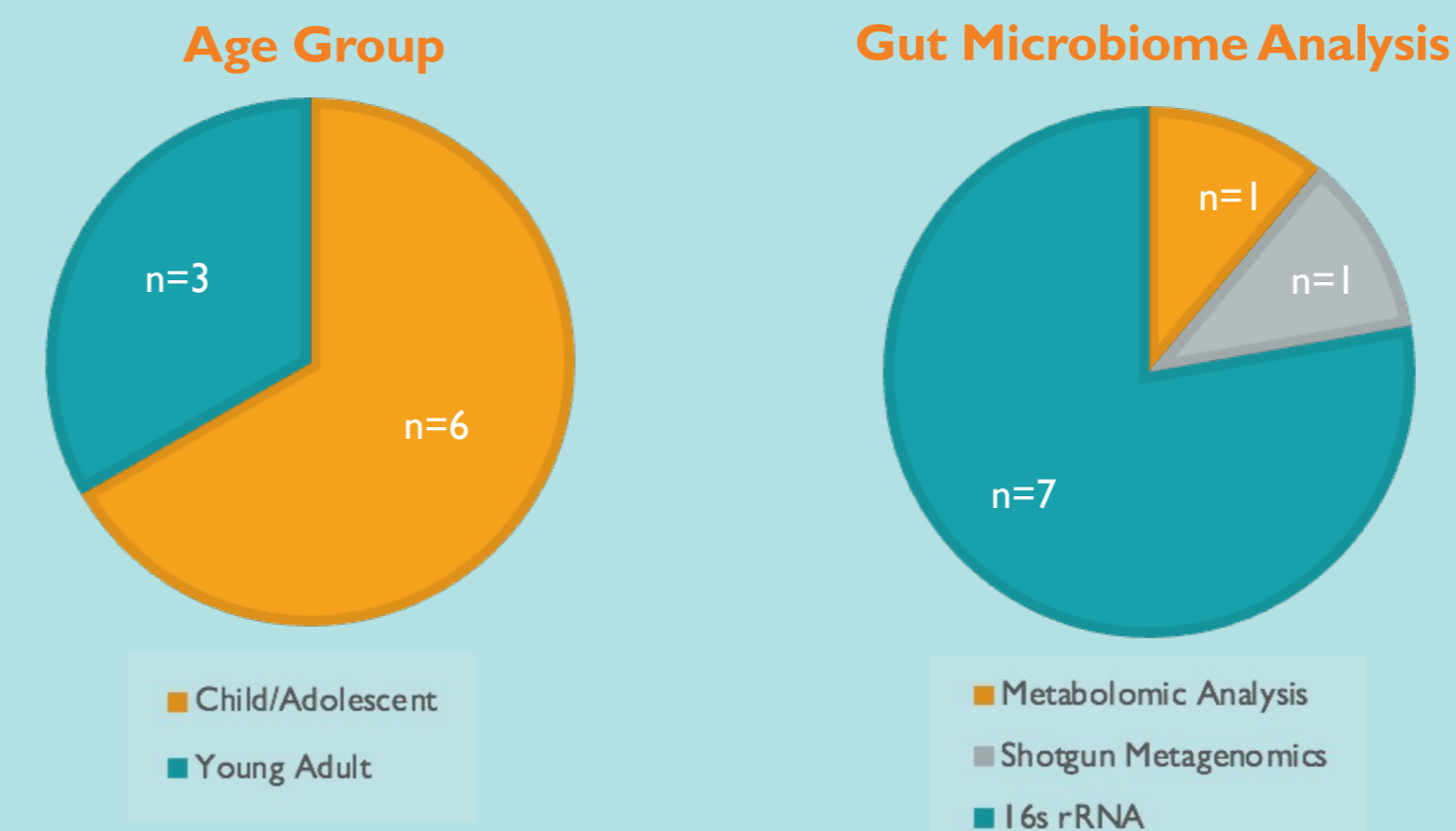
PRISMA Flowchart: Studies Identified During the Literature Search and Abstraction Process



- A table was developed to chart the major characteristics of each study (author and year of publication, study design, sample size, age of participants, sample characteristics, assessments utilized, approach to sequencing of stool samples, and results).
- Findings from each study were evaluated, focusing on bacterial composition and diversity among children/adolescents and young adults.

Results

- There were no studies specifically on the adolescent age group, so data was synthesized comparing the child/adolescent (2 to <18 years of age) and young adult (18-25 years of age) groups.



- There were mixed findings for both age groups, reporting perturbations in varied microbiota species.
- Some studies did not examine diversity of microbial communities.
- Nonetheless, 2 key findings emerged:
 - The abundance of *Bifidobacteria* was decreased for both children/adolescents and young adults with symptoms of depression compared to those not depressed.
 - Alpha diversity (measure for the total number of behavioral taxa in a microbial community) was higher for young adults with Major Depressive Disorder.

Conclusions

- Our findings from this review are congruent with the review of the adult literature in some respects and not others.
- Similarities with the abundance of *Bifidobacteria*:
 - Reduced levels of *Bifidobacteria* have been associated with adult depression.
 - Bifidobacteria* is considered a beneficial bacteria.
 - Bifidobacteria* is commonly found in probiotics and functional foods.
- Differences with alpha diversity:
 - Unlike our study findings, decreased alpha diversity has been reported in depression studies with middle age to older adults.
 - Differences in our results from the adult literature suggest that gut dysbiosis is a characteristic of depression, but it is unclear whether elevated or depleted diversity is pathogenic.

Implications

- Further research is needed to clarify the nature of microbial composition associated with depression and other affective problems across the life span versus characteristics of the gut microbiome unique to specific age groups.
- Inconsistencies of findings across studies are likely due to inclusion of research based on both measures of symptom severity and diagnostic groups, diverse age ranges within studies, and varied research designs or measurements used.
- Future research should replicate studies to confirm findings, examine lower taxonomic levels, consider longitudinal designs to assess for directionality, and conduct clinical trials to examine the effects of probiotics with the same strains in managing depression and other affective problems.

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