Near perfect balance in a microbiome paper - hopeful yet no hype: The microbiome of the built environment and mental health

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When I saw the title of this I cringed a bit, worried that this paper would be overselling what we know about the microbiome and mental health. But in fact my instincts we wrong, and this is a good overview of the state of the field and the importance of future work in this area. The wording in this paper is very careful to avoid overselling what we know and yet at the same time highlight the potential importance of this topic.

Abstract

The microbiome of the built environment (MoBE) is a relatively new area of study. While some knowledge has been gained regarding impacts of the MoBE on the human microbiome and disease vulnerability, there is little knowledge of the impacts of the MoBE on mental health. Depending on the specific microbial species involved, the transfer of microorganisms from the built environment to occupant’s cutaneous or mucosal membranes has the potential to increase or disrupt immunoregulation and/or exaggerate or suppress inflammation. Preclinical evidence highlighting the influence of the microbiota on systemic inflammation supports the assertion that microorganisms, including those originating from the built environment, have the potential to either increase or decrease the risk of inflammation-induced psychiatric conditions and their symptom severity. With advanced understanding of both the ecology of the built environment, and its influence on the human...
microbiome, it may be possible to develop bioinformed strategies for management of the built environment to promote mental health. Here we present a brief summary of microbiome research in both areas and highlight two interdependencies including the following: (1) effects of the MoBE on the human microbiome and (2) potential opportunities for manipulation of the MoBE in order to improve mental health. In addition, we propose future research directions including strategies for assessment of changes in the microbiome of common areas of built environments shared by multiple human occupants, and associated cohort-level changes in the mental health of those who spend time in the buildings. Overall, our understanding of the fields of both the MoBE and influence of host-associated microorganisms on mental health are advancing at a rapid pace and, if linked, could offer considerable benefit to health and wellness.

I highlight below some sections where I think the authors did a great job in providing balanced wording:

Specifically, there is an increasing appreciation regarding the potential association between inflammation and mental health, ranging from wellness to neuropsychiatric disease [20—24].

Really well done. Emphasizing “potential association” – thus showing we don’t know if there is a strong association (i.e., potential) and that we do not know cause and effect in most cases (i.e., association).

One factor contributing to this increase is thought to be failing immunoregulation, attributable to reduced exposure to the microbial environment within which the mammalian immune system co-evolved [23].

Also well done – “thought to be” provides a good caveat to this.

We, along with others, have proposed that faulty immunoregulation is also driving increases in some psychiatric disorders [23, 25—27].

This too is good – “have proposed” means that it is a theory not a fact.

One popular model for conceptualizing the onset of psychiatric disorders is the stress-diathesis model [43, 44]. The model suggests that individuals have biopsychosocial vulnerabilities for developing mental health illnesses (diathesis) that can be realized through stressors. We contend that model has parallels to a model for unhealthy buildings (Fig. 1).

Again, well done – emphasizing proposed models and that they “contend” but have not proven, a theory.

Research is sparse on whether these microbial communities, transferred from occupants to the air and surfaces within a building, are conveyed to other occupants. We think it is important to identify whether the existing MoBE can alter the occupants’ microbiome and, subsequently, mental health.

Again, well done. Terms like “whether” and emphasizing “We think it is important” rather than “It is important”.

However, to develop that database, knowledge of which microorganisms are beneficial is required. In the context of this review on mental health, we provide a summary in Table 1 of microorganisms that have been linked to positive mental health outcomes.

I like the “that have been linked to positive mental health outcomes.” Again not saying things cause positive health outcomes but that they have been linked.

However, as noted by Green, research to date is not yet sufficient to define interactions between microorganisms and the built environment, and the effects that manipulation of the MoBE could have on the occupants.

Again well written to emphasize that we do not yet know what effects might be.
One important under-recognized contributory role to the MoBE is that of pets. Their microbiome is known to interact with that of their owners. Exposure to pets during childhood has been associated with lower prevalence of allergic disease, potentially through increased pet-driven indoor exposure to saprophytic soil organisms with immunomodulatory potential (see Table 1).

Also very nice. Emphasizing what we don’t know and also what is an interesting association and also the possible mechanism behind the association.

However, pets also carry indoors microorganisms with potential long-term detrimental effects on mental health.

Also important because some people are making claims that pets are magically beneficial all the time.

Despite the massive effort in the human microbiome project, researchers observed that variation in the healthy human microbiome was not well correlated with biometrics (gender, body temperature, blood pressure, etc.) and concluded that other factors might be important [111]. One such factor could be the MoBE that surrounds individuals.

Again, nice to be toned down with “one such factor” and also what the prior work was about and how they work led to a conclusion but not necessarily a fact.

It is possible that intentional modification of the built environment to increase microbial biodiversity, or to increase exposure to immunoregulatory antigens or probiotics, would result in improved mental health conditions.

Again, emphasis on possible.

Moreover, mental health and MoBE studies logically extend to autism spectrum disorders and other neurodevelopmental disorders, such as schizophrenia, that have been investigated with a human microbiome perspective [116-118].

Well put. Logically extend is true but not claiming that these conditions are caused by microbiome issues.

Overall a remarkably well done paper on a very important topic. Kudos to the authors Andrew J. Hoisington, Lisa A. Brenner, Kerry A. Kinney, Teodor T. Postolache and Christopher A. Lowry.