



A Critical Understanding of Inclusion in Oral Microbiome Research through the Lens of Racial Capitalism

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There are important calls for greater inclusion of Indigenous and racialised communities in oral microbiome research. This paper uses the concept of racial capitalism (the extractive continuity of colonialism) to critically examine this inclusion agenda. Racial capitalism explicitly links capitalist exploitations with wider social oppressions e.g., racisms, sexism, ableism. It is not confined to the commercial sector but pervades white institutions, including universities. By using the lens of racial capitalism, we find inclusion agendas allow white institutions to extract social and economic value from relations of race. Racially inclusive research is perceived as a social good, therefore, it attracts funding. Knowledge and treatments developed from research create immense value for universities and pharmaceutical companies with limited benefits for the communities themselves. Moreover, microbiome research tends to drift from conceptualisations that recognise it as something that is shaped by the social, including racisms, to one that is determined genetically and biologically. This location of problems within racialised bodies reinforces racial oppressions and allows companies to further profit from raciality. Inclusion in oral microbiome research must consider ways to mitigate racial capitalism. Researchers can be less extractive by using an anti-racism praxis framework. This includes working with communities to co-design studies, create safer spaces, giving marginalised communities the power to set and frame agendas, sharing research knowledges and treatments through accessible knowledge distributions, open publications, and open health technologies. Most importantly, inclusion agendas must not displace ambitions of the deeper anti-oppression social reforms needed to tackle health inequalities and create meaningful inclusion.

Keywords: *Racial Capitalism, Capitalism, Racism, Decolonisation, Power, Inclusion, Equality, Diversity, Equity, Indigenous health, Racial health inequalities, Commercial determinants of health, Social determinants of health, Oral Microbiome*

Introduction

Oral microbiome research is gaining increasing traction. It is touted as having exciting transformative healthcare potentials. These include the development of prebiotics, probiotics, and oral microbiome transplants to promote a healthy oral microbiome that is more resistant to dental caries, periodontal diseases, oral cancer and even diabetes and neurological diseases (Bowen *et al.*, 2018; Nath *et al.*, 2021b). If successful treatments are developed, it will indeed transform oral healthcare.

To date, the fast-moving oral microbiome research spheres have somewhat neglected to include marginalised communities adequately. Concerns are raised that research findings and subsequent treatment benefits may underserve Indigenous and racially minoritised peoples. Moreover, minoritised communities experience poorer oral health when compared with their white counterparts (Hedges *et al.*, 2021; Nath *et al.*, 2021a; Office for Health Improvement and Disparities, 2023). There are important calls for greater inclusion in oral microbiome research to understand and serve the needs of marginalised communities better, and therefore, mitigate health inequalities (Nath *et al.*, 2021; Porras and Brito, 2019).

Oral health is predominantly socially determined, through access to healthy food, clean water, and mouth care products

e.g., toothbrushes, interdental cleaning aids and fluoridated toothpastes. Therefore, oral health inequalities are socially patterned. The social determinants of oral health include the commercial, namely the sugar, alcohol, and tobacco industries. Critical public health discourse on the ‘commercial determinants of health’ recognises that capitalist interests and exploitations create health inequalities (Kickbusch *et al.*, 2016). The racial and political dimensions to these patterns of exploitation are increasingly highlighted (Kickbusch, 2015; Maani *et al.*, 2021; Stuckler, 2013; Williams and Sternthal, 2010). And so we see that commercially determined oral diseases like dental caries and oral cancer are marked along class, and racial lines (Broomhead *et al.*, 2020; Como *et al.*, 2019; Office for Health Improvement and Disparities, 2023; Warnakulasuriya, 2009).

Capitalist interests also pervade research and healthcare systems (Moynihan *et al.*, 2019). And since these interests are enacted and experienced differentially along racial lines (Robinson, 2021), research inclusion policies may inadvertently reproduce and reinforce patterns of exploitations experienced by marginalised communities.

This paper critically examines inclusion in oral microbiome research through the lens of racial capitalism, that is, the mutual interdependence of racisms and capitalism, to surface the complex relations of power that work to reproduce and reinforce racial inequalities.

What is Racial Capitalism?

The concept of racial capitalism recognises the mutual interdependence of racism and capitalism and asserts that capitalism creates differential exploitations across social categories. It acknowledges that after slavery and colonialism, capitalism did not bring equal freedoms and opportunities to create an equal, universal subject/class. Capitalism continues to extract, dispose, divide, and marginalise along constructed racial hierarchies to reproduce and further entrench historically embedded inequalities (Robinson, 2021).

The inadequacy of waged labour to pay for the essential needs like food and shelter, that in turn shape health, is not a matter of individual failure; rather it is the structural preservation of the social inequalities inherited from non-capitalist economies like slavery (Kundani, 2020). This is observed with the present cost-of-living crisis. Rising prices and stagnating wages disproportionately impact racialised minorities, especially racialised women, and their health (Edmiston *et al.*, 2022). Indeed, racial capitalism analysis can be supplemented with the work of social feminists who highlight capitalism's gendered reliance and extraction of unwaged domestic labour (Bhattacharyya, 2018; Federici, 2021; Gilmore, 2022, 2007; Mies, 2014; Smith, 2005).

Racial capitalism is a set of techniques and a social arrangement that relies on division, othering, and exclusion to extract social and economic value. That is, it is a formation that enables capital accumulation (Bhattacharyya, 2018; Leong, 2013). Sugar, the principal aetiological agent of dental caries, starkly illustrates the continuity of slavery and colonialism through racial capitalism. The global sugar corporate, Tate and Lyle, who were likely involved in the slave trade, donated millions of pounds to lobby for Brexit (the UK's exit from the European Union). Subsequently, a post-Brexit UK-Australia trade deal allows the company to import tariff-free sugar cane to the UK from its sugar farms in the Caribbean (Savage, 2020). Thus, sugar shows how capitalism continues to exploit racialised bodies and persists in the devastating extraction from Indigenous lands.

Racial capitalism is not something confined to commercial industries. It permeates white institutions such as universities, hospitals, research funding bodies, and governments. Examples are when hospitals publicly set targets for ethnic minority representation at senior board level (NHS Equality and Diversity Council, 2019), or universities purposefully feature racial diversity on their websites that may or may not reflect their racially minoritised student body (Ford and Patterson, 2019). In contemporary society, racial diversity is seen as a social good. Therefore, these equality and diversity initiatives allow white institutions to extract social value from relations of race. This social value can convert to economic value; for instance, as more students enrol into the 'socially conscious' universities. This is not to say equality and inclusion initiatives are inherently suspect; in fact, they are often necessary, at least in the short term. However, Leong (2013) argues that this 'thin diversity' displaces deeper anti-oppression social reforms needed to create meaningful equity and inclusion. I argue that the inclusion agenda in oral microbiome research also risks shifting attention away from the deeper social reforms needed to tackle racial health inequalities.

Health Inequalities and Racial Capitalism

The call for greater inclusion of Indigenous and racially minoritised communities in oral microbiome research stems from a public health position that aims to reduce health inequalities. Dominant understandings of health inequalities in public health and dentistry place them as experienced along a socio-economic gradient (Marmot *et al.*, 2010; Watt, 2007). However, to adequately co-develop policies and practice that tackle health inequalities amongst marginalised communities, we must attempt to understand how different forms of inequalities, be they racial, gendered or disablism, mediate people's position along the socio-economic gradient. That is how racism, sexism, and ableism influence opportunities for jobs, education, housing, access to services such as healthcare. These differential opportunities, along intersecting axes of oppression, work towards determining people's socio-economic position and health.

Racial capitalism expressly links capitalist exploitations with wider social oppressions. It allows us to conceptualise how the logics of race; irrespective of the marginalised population (e.g., women, Indigenous communities, people living with disabilities) mediates socio-economic position or class (Bhattacharyya, 2018).

Inclusion in Oral Microbiome Research through the Lens of Racial Capitalism

Microbiomes in our bodies, such as gut, vagina, and mouth play important roles in health (Hou *et al.*, 2022). The oral microbiome is conceptualised as the world of microorganisms and their genomes in the mouth. It encompasses microorganisms including bacteria, viruses, fungi, archaea, eukaryocytes and their surrounding micro-environments such as structural elements and metabolites. Within this conception, the oral microbiome is not simply microbes, but microbial communities. It is therefore shaped by human histories and their living conditions (Dewhirst *et al.*, 2010; Delgado and Baedke, 2021).

Social categories e.g., race, class, and gender shape the ecological complexity of the microbiome (De Wolfe *et al.*, 2021). Social categories, powerfully mediate opportunities such as access to healthcare, antibiotics use, and diet; all of which influence the constituent microbiome (Benezra, 2020; He *et al.*, 2018; Quin and Gibson, 2020). So, people's socio-economic position, mediated by relations of race, gender or disability, shapes the oral microbiome and health.

Nevertheless, each person has a unique microbiome (Benezra, 2020). As such, microbiome research tends to drift away from conceptualisations recognising it as something that is shaped by the social and moves towards the problematic terrain of biological race science. Specifically, states of health are understood microbially, such as an overabundance of streptococcus mutans in the case of dental caries. And some racialised communities' genetic constitution or biology makes their microbiome more at-risk to certain disease prone microbes (Delgado and Baedke, 2021). This racial positioning is both conceptually flawed and risks being counterproductive when working towards inclusion.

From a conceptual perspective, race is socially constructed. It is a series of socially, not biologically, constructed categories. A person from Ghana can be placed in the same racial category (Black) as someone from the UK with one Jamaican grandparent. It is illogical to assume that Black people, with their diverse ancestries will have biological or genetic similarities. Similarly, it is irrational to examine genetic, and or biological differences between non-white and white people, because white people also have diverse geographic ancestries (Saini, 2020). Population geneticists confirm that a population level, humans are highly homogenous genetically (Kaufman and Cooper, 2010; Rose, 2001). This is not to say that genetic and biological differences do not exist. But that they are exaggerated, and do not map onto socially constructed categories of race.

Moreover, racial identity is multiple, fluid and complex. UK dental epidemiological survey results show that an appreciable proportion of racialised communities tick the 'Other' box when asked to identify their racial identity (Office for Health Improvement and Disparities, 2023). This is because racialised communities do not identify with the racial categories made available or assigned to them by white dental institutions. For example, a British Sudanese person may identify as British, African, Black, and Arab. Institutional categorisation processes do not attempt to understand the complexity, fluidity, and plurality of identities.

From a public health perspective, the determinants of disease within populations and the determinants of disease for an individual are two different issues. The two issues require different, albeit complementary approaches (Rose, 2001). An individual, marginalised or otherwise, with a disease prone microbiome would benefit from available treatments. Therefore, equity in healthcare systems is important to ensure fair access to treatments. However, any oral microbiome differences between populations, such as those amongst Indigenous communities when compared with white people, are likely due to the social and not the biological/genetic determinants. Social determinants include racisms and capitalist exploitations and not race per se (De Wolfe *et al.*, 2021). By fixating on race, inclusion policies may counterproductively increase inequalities through problematising racialised bodies and 'lifestyles'. By locating problems within racialised bodies, companies are able to sell more treatments, and therefore further profit from raciality. Moreover, the biological/genetic lens displaces the broader anti-oppression social reforms needed to tackle racial health inequalities.

Specifically for oral diseases, there are consistently observed differences along racial lines (Hedges *et al.*, 2021; Nath *et al.*, 2021a; Office for Health Improvement and Disparities, 2023). That is not to say biological and genetic differences do not exist, such as genetic conditions in families, and research must understand them. However, at a population level, for oral diseases like dental caries, the social determinants play a dominant role in health states, rather than biological and genetic ones.

Healthcare systems are designed to deliver treatments to individuals. This lofty goal of personalised medicine drifts understandings of differences in the health states of populations into the terrain of biological and genetic differences. For example, in the UK, mirroring trends

across western countries, death rates from Covid-19 were highest amongst ethnic minority communities (Public Health England, 2020). Medical researchers hypothesised this may be due to genetic or biological differences. Nevertheless, the differences in Covid-19-related deaths were social; specifically racisms. Racisms included low paid, high human contact, precarious work amongst racialised communities, such as taxi driving (Public Health England, 2020). Black nurses were disproportionately placed on Covid-19 wards, with lower access to personal protective equipment when compared with their white colleagues (Jones-Berry, 2020; Lala, 2022). So, it is racial capitalism, the division, differential extraction, and marginalisation of communities, both within and beyond medical spaces that explain differences in Covid-19 mortality rates.

Akin to Covid-19, dubious claims of the biological differences of racialised bodies is seen in microbiome research. The microbiome of Indigenous and racialised communities is described as at-risk, or disease prone. These risks are ascribed to stereotypical tropes of the poor nutritional and lifestyle habits of communities or the biological flaws of racialised bodies (Delgado and Baedke, 2021). Public health understandings of the social determinants of health seem to be thrown out of the window.

On the flip side, in gut microbiome research (which is more advanced than oral microbiome research) scientists have described the high abundance of rare microbes in the gut of 'traditional populations' as conducive to health (Sonnenburg and Sonnenburg, 2019). "Traditional populations" is likely code for Indigenous, non-white, and even undeveloped. Scientists infer from these results that western diets, C-sections, living in industrialised spaces lead to the loss of vital microbes. Treatments such as probiotics aim to 'rewild' (reintroduce rare microbes) into the modern, developed, western gut. Language of re-wilding conjures up racist stereotypes of Indigenous persons as wild, uncivilised, with unmedicalised/unsanitised birthing practices. It reduces present day Indigenous peoples as proxies for humans that lived thousands of years ago (Benezra, 2020; Delgado and Baedke, 2021). Maroney (2017) aptly describes this blithe negligence of Indigenous communities' cultural progress as a depoliticisation of people's current day realities; whereby researchers objectify people's lives to mere "living fossils". These racialised microbiome inferences are published in high-impact journals including Nature. So, the use of raciality, othering, and objectification gives immense value to researchers and universities, with little benefit for Indigenous communities (Benezra, 2020).

There are many examples of extraction of value by medical researchers from racialised communities with limited benefits for communities themselves. A high-profile example is the case of Henrietta Lacks, a Black American woman who had cervical cancer. Whilst diagnosing and treating Lacks, doctors took samples of her cancerous tissue and donated some to a researcher without her consent. Subsequently, the researcher found that Lacks' cells had an extraordinary capability to reproduce and survive. Her cells (HeLa) were essentially immortal, and therefore, widely shared amongst other researchers. For over a century now, HeLa cells are used for scientific discoveries in multiple fields including cancer, immunology, and infectious diseases. HeLa cells

were used to develop vaccines against Covid-19. Undoubtedly, an array of white institutions, such as universities and pharmaceutical companies, continue to profit by the literal extraction from the body of a Black woman. Henrietta Lacks died of cervical cancer. She personally did not benefit from this extraction, nor did her family receive any profits companies gained from her cells (Editorial, 2020).

More broadly, despite HeLa cells being used to develop Covid-19 vaccines, only one third of people in low-income countries have had at least one dose of the vaccine, when compared with three quarters of the population in high income countries (United Nations Data Platform, 2023). As such, the extraction from a Black woman continues to disproportionately benefit white communities, and institutions and underserves the racialised majorities of the world. Furthermore, Henrietta Lacks' legacies of benefitting ethnically diverse communities highlights the folly of biological race science.

There are parallels with the Lacks case and the inclusion agenda in oral microbiome research. Universities and corporations are gearing up to capture funding grants and patent any emergent treatments. Therefore, white institutions will use racialised bodies to extract. The extracted knowledge and benefits will likely be locked away in university libraries, paywalled academic publications, intellectual property rights, and corporate patents.

Given the powerful multi-system penetration of racial capitalism, inclusion policies in oral microbiome research need careful ethical reflection. The inclusion agenda is not inherently suspect, but models of inclusion must consider ways to mitigate racial capitalism.

Mitigating Racial Capitalism in Oral Microbiome Research

Unsurprisingly, racialised communities have a significant mistrust of medical researchers, healthcare systems, and the commercial sector. For Indigenous communities, research is a dirty word. It reminds people of the worst elements of colonial dehumanisation, exploitation and extraction (Smith, 2012).

To decolonise research practice, the inclusion of racialised communities must avoid undertaking research on communities and work with them. There must be active, continual efforts to be less extractive. Researchers must slowly, and iteratively co-design studies with community groups, grassroots organisations, and community researchers. The time communities give to make research praxis more equitable must be properly remunerated.

By using an anti-racism praxis framework, like that by Came and Griffith (2018), researchers can navigate relationship-building, socio-political education, and structural power analysis needed to co-design inclusive research projects. Structural power analysis includes researchers and allies to reflect on our power, position and privileges. We must challenge our dominant professional values and narratives, create safer spaces to centre counter-narratives, and give marginalised communities the power to set and frame the agendas. Moreover, research findings, knowledge, and health technologies for treatments must be shared with communities. This can be done through open access publications, wider accessible knowledge distribution channels such as blogs and videos, and open health technologies.

Akin to the oral microbiome, racial health inequalities are shaped by social determinants. Inclusion policies in oral microbiome research and healthcare systems are important. But to tackle oral health inequalities meaningfully, we must not be distracted from the blue-sky goal of deeper anti-oppression social reforms.

Conclusions

Oral health is largely socially determined and patterned. Nonetheless, healthcare, including treatments developed from oral microbiome research, are important to mitigate and treat diseases in individuals. As such, oral microbiome research must include marginalised communities to ensure any treatments developed are appropriate for diverse populations.

Racial capitalism is the extractive continuity of colonialism that shapes oral health. It penetrates healthcare and research institutions. With an anti-racism praxis framework researchers can work with marginalised communities to ensure research is less extractive and more inclusive. This includes steps to make knowledge and health technologies open and widely accessible.

Conceptual research frameworks should centre the social determinants of oral health and the oral microbiome. Conceptual drifts from the social determinants position to the biological/genetic one risks othering and further marginalising racialised communities. Moreover, othering and division along racial lines maybe harnessed to extract value by a range of white institutions. Genetic and biological differences do exist. However, they need analyses through detailed, nuanced conceptual frameworks. It would be methodologically and conceptually flawed to infer biological and genetic conclusions based on differences found from the crude social constructions of race.

Most importantly, the inclusion agenda and personalised healthcare goals in oral microbiome research must not displace the wider public health ambition of achieving deeper social reforms to tackle racial health inequalities.

References

- Benezra, A. (2020): Race in the Microbiome. *Science, Technology, & Human Values* **45**, 877–902.
- Bhattacharyya, G. (2018): *Rethinking Racial Capitalism: Questions of Reproduction and Survival*. London, New York: Rowman & Littlefield International, Lanham.
- Bowen, W.H., Burne, R.A., Wu, H. and Koo, H. (2018): Oral Biofilms: Pathogens, Matrix and Polymicrobial Interactions in Microenvironments. *Trends in Microbiology* **26**, 229–242.
- Broomhead, T., Rodd, H.D., Baker, S.R., Jones, K., Davies, G., White, S., Wilcox, D., Allen. and Marshman, Z. (2020): National patterns in paediatric hospital admissions for dental extractions in England. *Community Dentistry and Oral Epidemiology* **49**, 322–329.
- Came, H. and Griffith, D. (2018): Tackling racism as a “wicked” public health problem: Enabling allies in anti-racism praxis. *Social Science & Medicine* **199**, 181-188
- Como, D.H., Stein Duker, L.I., Polido, J.C. and Cermak, S.A. (2019): The Persistence of Oral Health Disparities for African American Children: A Scoping Review. *International Journal of Environmental Research and Public Health* **16**, 710.
- De Wolfe, T.J., Arefin, M.R., Benezra, A. and Gómez, M.R. (2021): Chasing Ghosts: Race, Racism and the Future of Microbiome Research. *mSystems* **6**, e0060421.

- Dewhurst, F.E., Chen, T., Izard, J., Paster, B.J., Tanner, A.C.R., Yu, W.-H., Lakshmanan, A. and Wade, W.G. (2010): The human oral microbiome. *Journal of Bacteriology* **192**, 5002–5017.
- Editorial (2020). Henrietta Lacks: science must right a historical wrong. *Nature* **585**, 7.
- Edmiston, D., Begum, S., Kataria, M. (2022). *Falling Faster amidst a Cost-of-Living Crisis: Poverty, Inequality and Ethnicity in the UK*. Employment and Economy. Runnymede. <https://www.runnymedetrust.org/publications/falling-faster-amidst-a-cost-of-living-crisis-poverty-inequality-and-ethnicity-in-the-uk>
- Federici, S. (2021): *Caliban and the Witch: Women, the Body and Primitive Accumulation*. London: Penguin.
- Ford, K.S. and Patterson, A.N. (2019): “Cosmetic diversity”: University websites and the transformation of race categories. *Journal of Diversity in Higher Education* **12**, 99–114.
- Gilmore, R.W. (2022): *Abolition Geography: Essays Towards Liberation*. London, Brooklyn, New York: Verso.
- Gilmore, R.W. (2007): *Golden Gulag: Prisons, Surplus, Crisis and Opposition in Globalizing California*. Berkeley, Los Angeles,: University of California Press.
- He, Y., Wu, W., Wu, S., Zheng, H.-M., Li, P., Sheng, H.-F., Chen, M.-X., Chen, Z.-H., Ji, G.-Y., Zheng, Z.-D.-X., Mujagond, P., Chen, X.-J., Rong, Z.-H., Chen, P., Lyu, L.-Y., Wang, X., Xu, J.-B., Wu, C.-B., Yu, N., Xu, Y.-J., Yin, J., Raes, J., Ma, W.-J. and Zhou, H.-W. (2018): Linking gut microbiota, metabolic syndrome and economic status based on a population-level analysis. *Microbiome* **6**, 172.
- Hedges, J., Haag, D., Paradies, Y. and Jamieson, L. (2021): Racism and oral health inequities among Indigenous Australians. *Community Dental Health* **38**, 150–155.
- Hou, K., Wu, Z.-X., Chen, X.-Y., Wang, J.-Q., Zhang, D., Xiao, C., Zhu, D., Koya, J.B., Wei, L., Li, J. and Chen, Z.-S. (2022): Microbiota in health and diseases. *Signal Transduction and Targeted Therapy* **7**, 135.
- Jones-Berry, S. (2020): COVID-19: PPE harder to access for BAME nurses, *Nursing Standard*. <https://rcni.com/nursing-standard/newsroom/news/covid-19-ppe-harder-to-access-bame-nurses-161386>
- Kaufman, J.S. and Cooper, R.S. (2010): *Use of racial and ethnic identity in medical evaluations and treatments, in: What's the Use of Race?: Modern Governance and the Biology of Difference*. In: *Use of racial and ethnic identity in medical evaluations and treatments*, ed: Whitmarsh I., Jones D.S. pp. 187–286. Cambridge, Massachusetts: MIT Press.
- Kickbusch, I. (2015): The political determinants of health-10 years on. *British Medical Journal* **350**.
- Kickbusch, I., Allen, L. and Franz, C. (2016): The commercial determinants of health. *The Lancet Global Health* **4**, 12
- Kundani, A. (2020): *What is racial capitalism?* Arun Kundani on race, culture and empire. <https://www.kundnani.org/what-is-racial-capitalism/>
- Lala, R. (2022): *Exposed: a documentary illuminating the shameful racism in the NHS*. Now Then, Sheffield. <https://nowthenmagazine.com/articles/exposed-a-documentary-illuminating-the-shameful-racism-in-the-nhs>
- Leong, N. (2013): Racial Capitalism. *Harvard Law Review* **126** (8), 2151–2226.
- Maani, N., Van Schalkwyk, M.C., Petticrew, M. and Galea, S. (2021): The Commercial Determinants of Three Contemporary National Crises: How Corporate Practices Intersect With the COVID-19 Pandemic, Economic Downturn and Racial Inequity. *The Milbank Quarterly* **99**, 503–518.
- Marmot, M., Atkinson, T., Bell, J., Black, C., Broadfoot, P., Cumberlege, J., Gilmore, I., Ham, C., Meacher, M. and Mulgan, G. (2010): *Fair Society, Healthy Lives (The Marmot Review)*. Institute of Health Equity. <https://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review>
- Maroney, S. (2017): *Reviving colonial science in ancestral microbiome research*. MicrobioSocial. <https://microbiosocial.wordpress.com/2017/01/10/reviving-colonial-science-in-ancestral-microbiome-research/>
- Mies, M. (2014). *Patriarchy and Accumulation on a World Scale: Women in the International Division of Labour*, 2nd ed. London: Zed Books Ltd.
- Moynihan, R., Macdonald, H., Heneghan, C., Bero, L. and Godlee, F. (2019). Commercial interests, transparency and independence: a call for submissions. *British Medical Journal* **365**, 11706.
- Nath, S., Handsley-Davis, M., Weyrich, L.S. and Jamieson, L.M. (2021). Diversity and bias in oral microbiome research: A commentary. *EClinicalMedicine* **36**, 100923.
- Nath, S., Poirier, B.F., Ju, X., Kapellas, K., Haag, D.G., Ribeiro Santiago, P.H. and Jamieson, L.M. (2021a). Dental Health Inequalities among Indigenous Populations: A Systematic Review and Meta-Analysis. *Caries Research* **55**, 268–287.
- Nath, S., Zilm, P., Jamieson, L., Kapellas, K., Goswami, N., Ketagoda, K. and Weyrich, L.S., (2021b): Development and characterization of an oral microbiome transplant among Australians for the treatment of dental caries and periodontal disease: A study protocol. *PLoS One* **16**, e0260433.
- NHS Equality and Diversity Council (2019): *Workforce Race Equality Standard 2018 - WRES data analysis report for eight national healthcare organisations*. NHS England <https://www.england.nhs.uk/publication/2018-wres-data-analysis-report-for-eight-national-healthcare-organisations/>
- Nieves Delgado, A. and Baedke, J. (2021): Does the human microbiome tell us something about race? *Humanities and Social Sciences Communications* **8**, 97
- Office for Health Improvement and Disparities (2023): *Official Statistics National Dental Epidemiology Programme (NDEP) for England: oral health survey of 5 year old children 2022*. London: UK Government.
- Porras, A.M. and Brito, I.L. (2019): The internationalization of human microbiome research. *Current Opinion in Microbiology* **50**, 50–55.
- Public Health England. (2020): *Disparities in the risk and outcomes of COVID-19*. London: PHE Publications. https://assets.publishing.service.gov.uk/media/5f328354d3bf7f1b12a7023a/Disparities_in_the_risk_and_outcomes_of_COVID_August_2020_update.pdf
- Quin, C. and Gibson, D.L. (2020): Human behavior, not race or geography, is the strongest predictor of microbial succession in the gut bacteriome of infants. *Gut Microbes* **11**, 1143–1171.
- Robinson, C.J. (2021). *Black Marxism: The Making of the Black Radical Tradition*. 3rd eds. London: Penguin Classics
- Rose, G. (2001): Sick individuals and sick populations. *International Journal of Epidemiology* **30**, 427–432.
- Saini, A. (2020). The art of medicine - Stereotype threat. *The Lancet* **395**, 1604–1605.
- Savage, M. (2020). *Brexit backers Tate & Lyle set to gain £73m from end of EU trade tariffs*. The Observer.
- Smith, D.E. (2005). *Institutional Ethnography: A Sociology for People*. Walnut Creek, CA: AltaMira Press.
- Smith, L.T. (2012). *Decolonizing Methodologies: Research and Indigenous Peoples*, 2nd eds. London: Zed Books Ltd.
- Sonnenburg, E.D. and Sonnenburg, J.L. (2019). The ancestral and industrialized gut microbiota and implications for human health. *Nature Review Microbiology* **17**, 383–390.
- Stuckler, D. and Basu, S. (2013). *The Body Economic: Why Austerity Kills*. New York: Basic Books,
- United Nations Data Platform (2023): *Global Dashboard for Vaccine Equity. Global Dashboard for Vaccine Equity*. <https://data.undp.org/vaccine-equity/>
- Warnakulasuriya, S. (2009): Significant oral cancer risk associated with low socioeconomic status. *Evidence Based Dentistry* **10**, 4–5.
- Watt, R.G. (2007): From victim blaming to upstream action: tackling the social determinants of oral health inequalities. *Community Dentistry and Oral Epidemiology* **35**, 1–11.
- Williams, D.R. and Sternthal, M. (2010): Understanding racial-ethnic disparities in health: sociological contributions. *Journal of Health and Social Behavior* **51** (1-Suppl), S15–S27.