Andréia Maria Araújo Drummond

INIQUIDADES ENTRE ADOLESCENTES BRASILEIROS RELACIONADAS A RAÇA/ETNIA: a cárie dentária como indicador de saúde bucal

Faculdade de Odontologia

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INIQUIDADES ENTRE ADOLESCENTES BRASILEIROS RELACIONADAS

A RAÇA/ETNIA: a cárie dentária como indicador de saúde bucal

Tese apresentada ao Colegiado do Programa de Pós-Graduação em Odontologia da Faculdade de Odontologia da Universidade Federal de Minas Gerais, como requisito parcial para obtenção do título de Doutor em Odontologia, área de concentração em Saúde Coletiva.

Orientadores: Profª. Drª. Efigênia Ferreira e Ferreira
Prof. Dr. Wagner Marcenes
Profª. Drª. Viviane Elisângela Gomes

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INIQUIDADES ENTRE ADOLESCENTES BRASILEIROS RELACIONADAS A RAÇA/ETNIA: a cárie dentária como indicador de saúde bucal

ANDREIA MARIA ARAÚJO DRUMMOND

Tese submetida à Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação em Odontologia, como requisito para obtenção do grau de Doutor em Odontologia, área de concentração saúde coletiva.

Aprovada em 21 de junho de 2016, pela banca constituída pelos membros:

Prof(a). Efigenia Ferreira e Ferreira - Orientador
UFMG

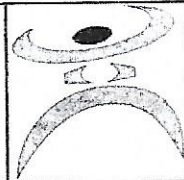Prof(a). Viviane Elisangela Gomes
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Belo Horizonte, 21 de junho de 2016.

ATA DA DEFESA DE TESE DA ALUNA
ANDREIA MARIA ARAÚJO DRUMMOND

Aos 21 dias de junho de 2016, às 08:30 horas, na sala 3403 da Faculdade de Odontologia da Universidade Federal de Minas Gerais, reuniu-se a Comissão Examinadora composta pelos professores Efigenia Ferreira e Ferreira (Orientadora) – FO/UFMG, Viviane Elisangela Gomes – FO/UFMG, Andrea Maria Duarte Vargas – FO/UFMG, Patricia Maria Pereira de Araujo Zarzar – FO/UFMG, Samuel Jorge Moysés – PUCPR e Janice Simpson de Paula – FACSETE para julgamento da tese intitulada: **Iniquidades entre adolescentes brasileiros relacionadas a raça/etnia: a cárie dentária como indicador de saúde bucal.** A Presidente da Banca, abriu os trabalhos e apresentou a Comissão Examinadora. Após a exposição oral do trabalho pela aluna e arguição pelos membros da banca, a Comissão Examinadora considerou a tese:

(X) Aprovada

( ) Reprovada

Finalizados os trabalhos, lavrou-se a presente ata que, lida e aprovada, vai assinada por mim e pelos demais membros da Comissão. Belo Horizonte, 21 de junho de 2016.

Prof(a). Efigenia Ferreira e Ferreira

Prof(a). Viviane Elisangela Gomes

Prof(a). Andrea Maria Duarte Vargas

Prof(a). Patricia Maria Pereira de Araujo Zarzar

Prof(a). Samuel Jorge Moysés

Prof(a). Janice Simpson de Paula

Dedico esse trabalho aos meus pais, **Adilson** e **Elza** que me inspiram, incentivam e apoiam incondicionalmente.

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RESUMO

INIQUIDADES ENTRE ADOLESCENTES BRASILEIROS RELACIONADAS A RAÇA/ETNIA: a cárie dentária como indicador de saúde bucal

Esta tese contempla três estudos epidemiológicos e uma revisão sistemática cujo objetivo foi avaliar a iniquidade entre adolescentes brasileiros relacionadas à raça/etnia e experiência de cárie dentária, cárie não tratada, dentes perdidos e restaurados e, testar se indicadores socioeconômicos explicam as diferenças observadas. Realizou-se uma revisão sistemática nas bases de dados *PubMed* e *Scopus* para avaliar a associação entre raça/etnia e experiência de cárie. Os dados do Projeto SB Brasil 2003 (n=16.833) e 2010 (n=5.367) foram utilizados para análises de prevalência, teste qui-quadrado, modelo conceitual hierárquico e mediação. Entre 2003 e 2010 observou-se uma diminuição na prevalência de experiência de cárie, cárie não tratada, dentes perdidos e restaurados, e constatou-se a persistência das iniquidades relacionadas à raça/etnia. Brancos tiveram uma redução significativa de na experiência de cárie (19,4%) e apenas 10,2% de cárie não tratada, enquanto entre Indígenas houve uma diminuição de cárie não tratada (17,4%) e 15,5% entre Pardos. Entretanto, em 2003, Negros tiveram 19% menos chances, e em 2010, 32% mais chance de terem experiência de cárie do que Brancos. Ainda, em 2003, Pardos e Brancos tiveram chances semelhantes de terem experiência de cárie, e em 2010, Pardos tiveram 69% mais chance do que Brancos. E, em 2010, Negros, Pardos e Indígenas tiveram mais chance de terem dentes cariados não tratados do que Brancos. A prevalência de dentes perdidos diminuiu entre todos os grupos e observou-se uma redução de 17,2% de dentes restaurados entre Brancos e um aumento de 14,8% entre Pardos, sendo que em 2010, Pardos tiveram 21% mais chance de terem dentes restaurados do que Brancos. A análise do modelo conceitual hierárquico realizada nos dados do SB Brasil 2010 confirmou a associação entre a experiência de cárie, cárie não tratada, dentes perdidos e restaurados e raça/etnia. Pardos e Amarelos tiveram 1,44 e 1,81 vezes, respectivamente, mais chance de terem experiência de cárie; Pardos tiveram 1,52 vezes mais chance de terem dentes perdidos; e Negros e Pardos tiveram 0,67 e 0,85 vezes, respectivamente, menos chance de terem dentes restaurados quando comparados com Brancos. Os

resultados da análise de mediação confirmaram que as iniquidades observadas foram mediadas através das variáveis educação e renda. A revisão sistemática sugere uma associação das iniquidades raciais/étnicas na experiência de cárie, sendo raça/etnia um constructo social que precisa ser combinado com outros fatores determinantes para melhor compreensão e abordagem. Apesar das políticas públicas vigentes no Brasil, as análises dos dados demonstraram uma persistência das iniquidades e os adolescentes Brancos têm se beneficiado mais da redução da cárie dentária, apresentando melhor condição de saúde bucal.

Descritores: Disparidades nos Níveis de Saúde, Desigualdades em Saúde, Iniquidades, Revisão Sistemática, Epidemiologia, Saúde Pública, Cárie Dentária

ABSTRACT

INEQUALITIES AMONG BRAZILIAN ADOLESCENTS RELATED TO RACE/ETHNICITY: dental caries as oral health indicator

This thesis includes three epidemiological studies and one systematic review, which aimed to assess inequalities among Brazilian adolescents related to race/ethnicity in dental caries experience, untreated caries, missing and filled teeth, and test whether socioeconomic indicators explain the observed differences. A systematic review was conducted in PubMed and Scopus databases to evaluate the association between race/ethnicity and caries experience. Data from a Brazilian National Oral Health Survey (SBBrasil) conducted in 2003 (n=16,833) and 2010 (n=5,367) were used to prevalence analysis, chi-square test, hierarchical conceptual modelling, and mediation. Between 2003 and 2010, a decrease in the prevalence of caries experience, untreated caries, missing and filled teeth between 2003 and 2010 was observed, and a persistence of inequalities related to race/ethnicity. Whites had a significant 19.4% reduction in caries experience and only 10,2% reduction in untreated caries, while among Indigenous descents and Mixed Race there was a 17,4% and 15,5% reduction, respectively, in untreated caries. However, in 2003, African descents were 19% less likely, and in 2010, 32% more likely to have caries experience than Whites. Although in 2003, Mixed Race and Whites had similar chances of having caries experience, in 2010, Mixed Race was 69% more likely to have caries experience than Whites. Moreover, African descents, Indigenous descents, and Mixed Race were more likely to have untreated decayed teeth than whites in 2010. Missing teeth prevalence decrease between all groups and filled teeth had a reduction of 17.2% for Whites and a rise by 14.8% for

Mixed Race, being the Mixed Race in 2010, 21% more likely to have filled teeth than Whites. Hierarchical conceptual modelling analysis performed in the SBBrasil 2010 data, confirmed the association between caries experience, untreated caries, missing and filled teeth and race/ethnicity. Compared to Whites, Mixed Race and East Asian Descents were 1.44 and 1.81 times, respectively, more likely to have caries experience; Mixed Race was 1.52 times more likely to have missing teeth, and African Descents and Mixed Race were 0.67 and 0.85 times, respectively, less likely to have filled teeth. Results of mediation analysis confirmed that the observed inequalities were mediated through education and income variables. The systematic review suggested an association of racial/ethnic inequalities in caries experience, being race/ethnicity a social construct that needs to be addressed with other determinant factors to better understand and effectively address oral health inequalities. Despite the existing policies in Brazil, data analysis demonstrated a persistence in race/ethnic inequalities and that White adolescents have benefited more from the reduction of dental caries and have a better oral health condition.

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LISTA DE ABREVIATURAS E SIGLAS

ABO – Associação Brasileira de Odontologia

CEO – Centros de Especialidades Odontológicas

CFO – Conselho Federal de Odontologia

ECA – Estatuto da Criança e Adolescente

ESF – Estratégia Saúde da Família

Hb – Hebreus

HIV/AIDS – *human immunodeficiency virus/acquired immunodeficiency syndrome*

IBGE – Instituto Brasileiro de Geografia e Estatística

Is – Romanos

LRPD – Laboratórios Regionais de Prótese Dentária

MS – Ministério da Saúde

Mt – Mateus

OMS – Organização Mundial de Saúde

ONU – Organização das Nações Unidas

PIB – Produto Interno Bruto

PNAD – Pesquisa Nacional por Amostra de Domicílios

PNSB – Política Nacional de Saúde Bucal

PNSIPN – Política Nacional de Saúde Integral da População Negra

PSF – Programa de Saúde da Família

SB BRASIL – Levantamento das Condições de Saúde Bucal da População Brasileira

SI – Salmos

SUS – Sistema Único de Saúde

SVS/MS – Secretaria de Vigilância em Saúde/Ministério da Saúde

SUMÁRIO

PARTE I

1 CONSIDERAÇÕES INICIAIS

1.1 Iniquidades em saúde no Brasil

Segundo o Dicionário Houaiss da Língua Portuguesa (1) o termo iniquidade tem etimologia do latim iniquítas,átis "desigualdade, demasia, excesso, desvantagem, apuros, injustiça, iniquidade", sendo definido como "caráter daquilo ou daquele que é iníquo, que é contrário à equidade", podendo ser uma "…ação ou coisa contrária à moral e à religião, ato contrário à justiça…", ou ainda "…ato perverso; maldade...".

A palavra iniquidade aparece diversas vezes no livro da Bíblia, tanto no Antigo Testamento como no Novo Testamento, sendo traduzido pelo Dicionário da Bíblia de Almeida (2) como: "pecado que consiste em não reconhecer igualmente o direito de cada um, em não ser correto, em ser perverso (Sl 25.11; 51.5; Is 13.11; Mt 7.23; Hb 1.9)".

Além disso, a palavra iniquidade tem uma dimensão moral e ética, referindo-se às diferenças que são desnecessárias e evitáveis, mas também são consideradas abusivas e injustas. Assim, a fim de descrever uma determinada situação como injusta, a causa deve ser examinada e julgada como injusta no contexto do que está acontecendo no resto da sociedade (3).

A iniquidade em saúde é um termo utilizado para indicar diferenças sistemáticas, desnecessárias e revelantes em um país (3). No Brasil, as iniquidades são um traço marcante, pois além do país apresentar graves iniquidades na distribuição da renda, há grandes setores de sua população vivendo em condições de pobreza que não lhes permite ter acesso a mínimas condições e bens essenciais à saúde (4).

Os esforços para reduzir as diferenças de educação ou de renda entre grupos socioeconômicos são susceptíveis de ter um efeito positivo a partir de uma perspectiva de equidade em saúde, uma vez que aumentam o poder e oportunidades para grupos menos privilegiados, evitando condições de vida insalubres. A educação

também pode promover uma maior compreensão entre os diferentes grupos da sociedade e assim, ajudar a reduzir a distância entre os grupos (5). Além da renda dos 20% mais ricos ser 26 vezes maior que a renda dos 20% mais pobres, 24% da população economicamente ativa do Brasil possui rendimentos menores que dois dólares por dia (4).

1.2 Adolescência no Brasil

A adolescência é um período de transição entre a infância e a fase adulta, caracterizado pelos impulsos de desenvolvimento físico, mental, emocional, sexual e social, e pelos esforços do indivíduo em alcançar os objetivos relacionados às expectativas culturais da sociedade em que vive. Os limites cronológicos da adolescência são definidos pela Organização Mundial da Saúde (OMS) entre 10 e 19 anos (adolescents) e pela Organização das Nações Unidas (ONU) entre 15 e 24 anos (youth), critério este usado principalmente para fins estatísticos e políticos. Usa-se também o termo jovens adultos para englobar a faixa etária de 20 a 24 anos de idade (young adults) (6).

No Brasil, o Estatuto da Criança e do Adolescente (ECA) (7), considera criança a pessoa até 12 anos de idade incompletos e define a adolescência como a faixa etária de 12 a 18 anos de idade (Artigo 2), e, em casos excepcionais e quando disposto na lei, o estatuto é aplicável até os 21 anos de idade (Artigos 121 e 142). O Estatuto da Juventude (8), dispõe sobre os direitos dos jovens, os princípios e diretrizes das políticas públicas de juventude e o Sistema Nacional de Juventude e define jovens as pessoas de 15 a 29 anos de idade.

De acordo com a OMS, os adolescentes constituem uma população negligenciada e muitas vezes os dados de pesquisas são combinados com dados de infância e não é possível identificar a adolescência, ou eles estão considerados em conjunto com adultos jovens. A maioria dos adolescentes avança até a idade adulta com relativamente pouca dificuldade, outros, no entanto, assumem muitos tipos de riscos e tomam atitudes não saudáveis - em seu comportamento sexual, ao dirigir, no uso de substâncias ilícitas, em atividade criminal - ou tem experiência de sofrimento emocional ou distúrbios de saúde mental. Para um número significativo de

adolescentes, as consequências são graves e podem limitar a oportunidade de se tornar um adulto produtivo e saudável. Nas normas e políticas de saúde do Ministério de Saúde do Brasil (MS), os limites da faixa etária de interesse são as idades de 10 a 24 anos. (6)

Em 2013, crianças, adolescentes e jovens de até 29 anos de idade correspondiam a 46,6% da população brasileira total (9) e a proporção deste grupo etário na população está diminuindo, dado que em 2004 representava mais da metade da população (54,4%). Dados do Censo Brasileiro de 2010, do Instituto Brasileiro de Geografia e Estatística (IBGE) (10), indicam que mais de 20% de todas as crianças brasileiras nascem de mães adolescentes e que quatro em cada dez brasileiros (40%) que vivem na miséria são meninas e meninos de até 14 anos de idade. Depois das crianças, o segundo grupo etário com maior percentual de pessoas vivendo em famílias pobres são os adolescentes. O número de adolescentes brasileiros de 12 a 17 anos de idade que vivem em famílias com renda inferior a ½ salário mínimo per capita é de 7,9 milhões. Isso significa dizer que 38% dos adolescentes brasileiros estão em condição de pobreza.

De acordo com o Pesquisa Nacional por Amostra de Domicílios (PNAD) (11), 3,7 milhões de adolescentes de 12 a 17 anos (17,6% dos adolescentes do país) vivem em famílias extremamente pobres, ou seja, que sobrevivem com até ¼ de salário mínimo por mês. Desde a aprovação do ECA (7), em 2009, 97,9% das crianças e adolescentes de 7 a 14 anos e os da faixa etária de 15 a 17 anos, 85,2% estavam matriculados na escola. Porém, dos adolescentes de 15 a 17 anos, pouco mais da metade (50,9%) estava no nível adequado para a idade, sendo que 1,4 milhão já haviam abandonado os estudos e estavam fora da escola (11). Além disso, em 2013 (9), entre as mulheres de 15 a 17 anos de idade que não tinham filho, 88,4% estavam estudando; enquanto entre aquelas que tinham um filho ou mais, somente 28,4% estudavam.

As desigualdades regionais evidenciam-se, ainda, quando se analisam os dados sobre gravidez na adolescência. As regiões Norte e o Nordeste, por exemplo, têm os maiores percentuais de mães adolescentes de 12 a 17 anos. Enquanto a média nacional em 2009 era de 2,8% de meninas nessa faixa etária, que já tinham filhos, no

Norte, esse número era de 4,6%. As maiores taxas foram verificadas nos Estados do Acre (5,3%), Amazonas (5,2%) e Amapá (4,9%). Enquanto a média nacional de adolescentes de 12 a 17 anos não alfabetizados era de 1,6%, em 2009, no Nordeste o índice era mais que o dobro da média nacional: 4%. Enquanto no Nordeste, apenas a metade (50,3%) dos adolescentes de 16 e 17 anos tinha concluído o ensino fundamental, em 2009, na região Sudeste, a taxa de conclusão era 50% maior: 75,3%. O índice de extrema pobreza entre garotos e garotas de 12 a 17 anos na Região Nordeste é praticamente o dobro da média nacional: 32% (quando a média nacional é de 17,6%), o que representa um universo de 2,1 milhões de adolescentes que vivem na miséria (11).

O primeiro passo para desenvolver uma estratégia de redução das iniquidades em saúde, em um país, é avaliar a magnitude dos diferenciais de saúde entre os diversos grupos sociais e sua evolução ao longo do tempo. As iniquidades em saúde são em geral invisíveis, tanto para as autoridades, como para o público em geral, o que indica uma necessidade urgente de, não só melhorar os sistemas de informação em saúde, como também fazer com que seus resultados sejam mais amplamente divulgados (12).

Os determinantes das iniquidades em saúde devem ser conhecidos para que se possam formular políticas mais eficientes para combatê-las. Diderishen, Evans e Whitehead (12) identificam cinco mecanismos através dos quais os fatores e condições de risco conhecidos causam os gradientes de saúde observados entre os grupos sociais de um determinado país: 1) diferentes níveis de poder e recursos, 2) diferentes níveis de exposição a riscos para a saúde, 3) o mesmo nível de exposição pode ter diferentes impactos, 4) efeitos ao longo do ciclo de vida e 5) diferentes consequências sociais e econômicas decorrentes da doença.

Evidentemente, o volume de riqueza gerado por uma sociedade é um elemento fundamental para proporcionar melhores condições de vida e de saúde, e há inúmeros exemplos de países com Produto Interno Bruto (PIB) total ou *per capita* bem superior a outros que, possuem indicadores de saúde muito mais satisfatórios. Uma vez superado um determinado nível de PIB *per capita*, o fator mais importante para explicar a situação geral de saúde de um dado país não é sua riqueza total, mas a

maneira como ela é distribuida. A deterioração das relações de solidariedade e confiança entre pessoas e grupos é um importante mecanismo por meio do qual as iniquidades de renda têm um impacto negativo sobre a situação de saúde. Países com grandes iniquidades de renda e consequentemente, escassos níveis de coesão social e baixa participação política, são os que menos investem em capital humano e em redes de apoio social, essenciais para a promoção e proteção da saúde (4).

Em outras palavras, a desigualdade na distribuição de renda não é prejudicial à saúde somente dos grupos mais pobres, mas é também prejudicial para a saúde da sociedade em seu conjunto (5).

Nos últimos anos, o Brasil tem proposto inúmeros projetos e políticas sociais voltadas para a redução da iniquidade. Entre esses projetos, destaca-se o Programa Bolsa Família, que é um programa de transferência de renda no qual as famílias recebem um pagamento, mediante algumas condições a serem cumpridas, tais como manter os filhos em idade escolar e adolescentes matriculados na escola, seguir o calendário vacinal para crianças de 0 a 6 anos, cumprir as agendas pré e pós-natal para mulheres grávidas e mães que amamentam. Este programa, criado em 2003, a partir da unificação de programas anteriores, é o maior programa de transferência condicionada de renda do mundo, cobrindo cerca de 11 milhões de lares e atingindo 45 milhões de indivíduos (13).

Nas políticas de saúde, a Estratégia Saúde da Família (ESF), concebida em 1993 com o nome de Programa de Saúde da Família (PSF), foi proposta como uma estratégia de reorientação do modelo assistencial, com o objetivo de modificar a abordagem centrada no tratamento. É um programa preventivo e abrangente que prioriza a educação e promoção da saúde, e objetiva reorganizar o serviço de saúde e a atenção básica no País, fundamentando-se nos preceitos do Sistema Único de Saúde (SUS), na equidade, universalidade e integralidade. A proposta deste programa segue uma abordagem de cobertura populacional elevada, maior acesso ao serviço e atendimento integral para os indivíduos em seu contexto familiar (14). Em 2004, o MS lançou a Política Nacional de Saúde Bucal (PNSB), o Programa Brasil Sorridente, que se constituiu em uma série de medidas que visam garantir ações de promoção, prevenção e recuperação da saúde bucal dos brasileiros, fundamental para a saúde

geral e qualidade de vida da população. A PNSB se propôs a reorientar a assistência pela promoção da saúde como eixo do cuidado, universalizar o acesso a serviços pela inserção transversal da saúde bucal nas linhas de cuidado, e comtemplar todos os níveis de atenção (integralidade) e teve como objetivos principais a implantação de equipes de saúde bucal na ESF, a ampliação e qualificação das ações e serviços oferecidos, especialmente com a implantação dos Centros de Especialidades Odontológicas (CEO) e os Laboratórios Regionais de Prótese Dentária (LRPD), e a viabilização da adição de flúor nas estações de tratamento de águas de abastecimento público (15).

A Política Nacional de Saúde Integral da População Negra (PNSIPN) (16), instituída em 2009 pelo MS, reconheceu o racismo, as desigualdades étnico-raciais e o racismo institucional como determinantes sociais das condições de saúde da população brasileira. Com o intuito de combater as iniquidades raciais, a proposta teve como objetivos aprimorar os sistemas de informação em saúde, incluindo o quesito cor nos instrumentos de coleta; desenvolver ações para reduzir indicadores de morbimortalidade materna e infantil, doença falciforme, hipertensão arterial, diabetes mellitus, HIV/AIDS (*Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome*), tuberculose, hanseníase, cânceres de colo uterino e de mama, miomas, transtornos mentais na população negra; garantir e ampliar o acesso da população negra do campo e da floresta e, em particular, das populações quilombolas, às ações e aos serviços de saúde; e garantir o fomento à realização de estudos e pesquisas sobre racismo e saúde da população negra (17).

Ações para reduzir as iniquidades exigem uma busca de informações sobre a real extensão dos problemas e a identificação sistemática dos grupos vulneráveis da sociedade, através da coleta de dados apropriados e análise dos processos sociais que levam à deterioração da saúde, com o intuito de complementar, aperfeiçoar e viabilizar a política universal no âmbito da saúde pública.

1.3 Raça e etnia no Brasil

Há um número considerável de trabalhos descritos na literatura sobre a utilidade de raça e etnia como conceitos (18-21). Embora a categorização de indivíduos em raça

e etnia seja amplamente utilizada, seus significados são frequentemente indefinidos, inadequados, confundidos ou mesmo desconhecidos (21-23).

A ausência de descrições dos parâmetros utilizados para definir raça e etnia na grande maioria dos casos em que essas variáveis são utilizadas, bem como o uso de termos vagos e ambíguos, podem dificultar e até mesmo impedir comparações entre os grupos humanos e da utilização destes dados para determinar as desigualdades na assistência à saúde (21).

Raça e etnia são termos comumente usados, com características semelhantes, mas diferenças sutis. Raça normalmente refere-se a características físicas, como a cor da pele ou a textura do cabelo, o que pode refletir a descendência de uma pessoa; e exemplos de categorias que são comumente usados para descrever raça, incluem, Brancos, Afrodescendentes ou Asiáticos. Etnia é um termo complexo usado para descrever agrupamentos sociais baseados em um sentimento de pertencimento, de coletividade, como o local de origem e outros fatores tais como a língua, a religião, e às vezes a raça (19, 22, 24-26).

Estudos que tentam correlacionar raça e saúde devem buscar compreender a vulnerabilidade múltipla a que sujeitos de determinados segmentos da população e, em que medida o status étnico/racial se combina de forma aditiva e interativa com outras categorias de status social, restringindo ou facilitando a exposição a situação de risco a saúde (23).

Autores afirmam que raça e etnia, enquanto classificações sociais, apresentam alguns desafios para a saúde pública. Dentre eles, destacam que raça e etnia são determinantes importantes do acesso a recursos sociais e do status de saúde, portanto seu uso não é apenas uma questão de método científico, mas também de política e de ética. A validade do conceito de raça como uma medida não de característica biológica, mas uma auto percepção a qual as características fenotípicas podem ser um dentre muitos critérios, não permite um consenso na comunidade cientifica, quanto às formas de identificação racial, étnica ou por ancestralidade, dada a possibilidade dos indivíduos mudarem sua identidade étnico-racial ao longo do tempo e em decorrência de circunstâncias políticas e sociais (18, 27).

Há também uma necessidade de compreender não só as limitações da raça e etnia como variáveis epidemiológicas e os riscos que tais classificações podem implicar, mas é importante reconhecer que, ao formalizar a raça ou etnia como um dos meios para a compreensão das relações complexas nas quais fatores socioambientais e biológicos se inter-relacionam, estamos avançando tanto no conhecimento sobre as desigualdades e iniquidades em saúde quanto na formulação de políticas públicas mais justas e equânimes (28).

A categorização em grupos raciais ou étnicos para a investigação das desvantagens sociais, econômicas e ambientais, associada a um risco aumentado de doença e seu uso no monitoramento e formulação de ações para correção de tais desigualdades, exige o emprego de esquemas classificatórios e modelos explicativos que atendam a complexidade das concepções de raça e etnia, com o intuito de revelar e reverter as desigualdades em saúde dos indivíduos e, no acesso e utilização dos serviços de saúde (21, 23, 29).

No sistema de classificação por raça ou cor da população utilizado pelo IBGE (10), constam cinco categorias autodeclaráveis: branca, preta, amarela, parda e indígena. A cor autodeclarada ou auto referida, capta tanto as experiências compartilhadas/cultura de um indivíduo como a sua auto identidade (20, 24).

1.4 Inquéritos epidemiológicos nacionais em saúde bucal no Brasil

Enquanto melhorias gerais em saúde bucal foram observadas entre as pessoas dos países industrializados e em desenvolvimento, durante as últimas décadas, as doenças bucais, como por exemplo a cárie dentária e doença periodontal, continuam sendo um problema global, particularmente entre as populações desfavorecidas em ambos, os países industrializados e em desenvolvimento (30). O sistema de saúde, incluindo serviços de tratamento odontológico básico, pode ter uma importante contribuição na redução das desigualdades (31).

Apesar da disponibilidade de diversos dados oriundos dos sistemas de informação brasileiro, persiste a necessidade de inquéritos populacionais periódicos. Algumas

informações importantes para o planejamento e avaliação das ações são produzidas pelo MS, no âmbito da Secretaria de Vigilância em Saúde (SVS/MS) e pelo Instituto Brasileiro de Geografia e Estatística (IBGE) (32).

No campo da saúde bucal, o primeiro levantamento epidemiológico nacional realizado no Brasil ocorreu no ano de 1986, com o objetivo de conhecer os níveis de prevalência dos principais problemas odontológicos e fornecer subsídios para a implantação de um programa nacional de saúde bucal. Devido à escassez de recursos disponíveis, esse levantamento epidemiológico foi restrito à zona urbana de 16 capitais, com dados para as cinco macrorregiões. A pesquisa foi realizada em crianças, adolescentes, adultos e idosos, segundo as faixas de renda familiar, analisando a prevalência da carie dentária, das doenças periodontais, das necessidades e presença de prótese total e da procura por serviços odontológicos (33).

Após a promulgação da Constituição de 1988 e a implantação do SUS, decorridos 10 anos da primeira pesquisa, o MS, através da Área Técnica de Saúde Bucal e em parceria com a Associação Brasileira de Odontologia (ABO-Nacional), Conselho Federal de Odontologia (CFO) e as Secretarias Estaduais de Saúde, realizaram o segundo levantamento, buscando verificar as alterações ocorridas no perfil da população brasileira. Esse levantamento foi realizado visando um referencial para o desenvolvimento das ações preventivas do SUS, sendo a pesquisa restrita a cárie dentária, em crianças na faixa etária de 6 a 12 anos de escolas públicas e privadas das 27 capitais e do Distrito Federal.

Embora os levantamos epidemiológicos realizados em 1986 e 1996 tenham tido grande importância no seu tempo, não se estabeleceram enquanto um componente da política de saúde bucal vigente, se conformando em iniciativas isoladas, sem uma linha epidemiológica bem estabelecida (34).

No ano 2000, o MS, iniciou uma discussão sobre a realização de um amplo projeto de levantamento epidemiológico que avaliasse os principais agravos em diferentes grupos etários e que incluísse, tanto a população urbana, como a rural. Esse projeto foi identificado como "SB Brasil: Levantamento das Condições de Saúde Bucal da População Brasileira". Além do MS e Secretarias Estaduais, o projeto envolveu várias

instituições e entidades, como os Conselhos Federal e Regionais de Odontologia e a ABO, além de faculdades de Odontologia. Foram envolvidos no projeto, 250 municípios, sendo a amostra representativa para as macrorregiões do Brasil e por porte populacional das cidades envolvidas, assim como o próprio município para alguns agravos e faixas etárias. Ainda, o SB Brasil 2003 teve como objetivo, contribuir na perspectiva da estruturação de um sistema nacional de vigilância epidemiológica em saúde bucal (35).

Além de estabelecer um marco na epidemiologia em saúde bucal no Brasil, com diagnóstico aprofundado da situação de saúde bucal, evidenciando pontos nunca analisados, como as desigualdades regionais, a base metodológica do SB Brasil 2003 permitiu comparabilidade internacional, além de fornecer subsídios importantes para novas propostas políticas em saúde bucal (34).

Os levantamentos nacionais realizados em 1986, 1996 e 2003 foram de grande relevância para a construção de uma sólida base de dados relativa ao perfil epidemiológico de saúde bucal da população brasileira. Contudo, é fundamental que a realização destes estudos faça parte de uma estratégia inserida no componente de vigilância à saúde da Política de Saúde, na perspectiva da construção de uma série histórica de dados de saúde bucal com o objetivo de verificar tendências, planejar e avaliar serviços (36).

Dando continuidade ao levantamento nacional realizado em 2003 (35), foi realizado o SB Brasil 2010 (36), em moldes semelhantes e com o intuito de construir uma série história, aperfeiçoando, modernizando e consolidando um modelo metodológico (32, 37). Portanto, o objetivo do SB Brasil 2010 foi conhecer a situação de saúde bucal da população brasileira urbana em 2010, subsidiar o planejamento e a avaliação das ações e serviços junto ao SUS e manter uma base de dados eletrônica para o componente de vigilância à saúde da PNSB (36).

Apesar dos investimentos realizados em políticas públicas a partir dos levantamentos epidemiológicos realizados, o SB Brasil 2010 (36) ao avaliar a condição de saúde bucal da população brasileira, demonstrou, principalmente, entre diferentes faixas etárias e regiões, que a desigualdade persiste.

2 OBJETIVOS

Analisar as iniquidades relacionadas à saúde bucal e raça/etnia e determinantes socioeconômicos associados

2.1 Objetivos específicos

- Verificar a associação entre a experiência de cárie dentária e raça/etnia;
- Avaliar a associação entre a experiência de cárie dentária e raça/etnia em adolescentes brasileiros e a influência dos fatores socioeconômicos nas diferenças encontradas em 2010;
- Avaliar a associação entre a experiência de cárie dentária, cárie não tratada, dentes perdidos e restaurados e raça/etnia em adolescentes brasileiros em 2003 e 2010, e a influência dos fatores socioeconômicos nas diferenças encontradas.

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PARTE II

4 RESULTADOS E DISCUSSÃO

Os resultados e discussão serão apresentados sob a forma artigos científicos em número de quatro, com apresentação do resumo em língua portuguesa, periódico em que o artigo foi formatado ou publicado e o artigo completo em língua inglesa.

4.1. Artigo 1

4.1.1 Raça/etnia e experiência de cárie dentária: uma revisão sistemática – Resumo

Introdução: O objetivo deste estudo foi revisar sistematicamente a literatura e sintetizar as evidências disponíveis para uma possível associação entre raça/etnia e experiência de cárie dentária.

Métodos: As bases de dados eletrônicas *PubMed* e *Scopus* foram pesquisadas para verificar estudos publicados entre 1º de janeiro de 2005 e 1º de janeiro de 2015, que avaliaram a associação entre raça/etnia e experiência de cárie dentária em crianças, adolescentes, adultos e idosos. A estratégia de busca incluiu os termos: *"ethnic*" OR race OR racial OR skin colour" AND "dental caries OR caries OR decay",* não havendo restrição de idioma. Os estudos foram avaliados quanto a sua validade metodológica. A metanálise não foi realizada devido à heterogeneidade dos estudos.

Resultados: Foram identificados 1.288 artigos, e 56 estudos foram elegíveis para a leitura completa, sendo que 14 preencheram os critérios de inclusão. Os dados dos 14 estudos foram resumidos e analisados. Foram observados diferentes métodos de coleta de dados de raça/etnia. Os estudos selecionados mediram a associação de experiência de cárie com outros fatores que não a raça/etnia *per se*.

Conclusão: Os grupos minoritários, como aborígenes e indígenas, tiveram uma maior prevalência e são mais propensos a ter cárie dentária. Esta avaliação sugere uma associação das iniquidades raciais/étnicas na experiência de cárie dentária, sendo a raça/etnia um constructo social que precisa ser avaliado com outros fatores determinantes para melhor compreender e tratar eficazmente as iniquidades em saúde bucal.

- Artigo formatado de acordo com a revista BMC Oral Health

4.1.2 Race/ethnicity and dental caries experience: a systematic review – Artigo completo

Race/ethnicity and dental caries experience: a systematic review

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ABSTRACT

Background: The aim of this study was to systematically review the literature and synthesize the available evidence for a possible association between race / ethnicity and dental caries experience. **Methods**: The electronic databases PubMed and Scopus were screened for studies published between January 1st 2005 and January 1st 2015 that assessed the association between race/ethnicity and dental caries experience in children, adolescents, adults and elderly. The search strategy included the terms: "ethnic*" OR race OR racial OR skin colour" AND "dental caries OR caries OR decay" and there were no language restrictions. The studies were assessed for methodological quality using a scale and meta-analysis was not performed due to the heterogeneity of the studies. **Results:** We identified 1,288 records, 56 were eligible for full-text screening and 14 met the inclusion criteria. Data from these studies were abstracted, compiled as assessed. Different methods of race/ethnicity data collections were observed. The selected studies measured the association of caries experience with other factors than race/ethnicity *per se*. **Conclusions**: Minority groups such as aboriginals and indigenous have experienced a higher prevalence and are more likely to have dental caries. This review suggests an association of racial/ethnic inequalities in dental caries experience, being race/ethnicity a social construct that needs to be addressed with other determinant factors to better understand and effectively address oral health inequalities.

Key-words: Caries, Disparities, Epidemiology, Public Health, Diversity

BACKGROUND

Minority populations bear a disproportionate burden of chronic disease, due to higher disease prevalence and greater morbidity and mortality [1]. Dental caries is the most prevalent oral chronic disease, affecting billions of people worldwide [2]. The medical literature showed consistently that minority groups had a higher prevalence of dental caries experience [3-19]. It has been suggested that the race and ethnicity of a person may determine their oral health status [14, 20, 21]. There is a considerable amount of research on the utility of race and ethnicity as concepts [22-24]. 'Race' and 'ethnicity' are terms commonly used with similar characteristics but subtle differences. 'Race' typically refers to physical features, such as skin colour or hair texture, which may reflect a person's ancestry; and examples of categories that are commonly used to describe race include White, African descents, or Asian descents. 'Ethnicity' is a complex term used to describe perceived social groupings based on a sense of belonging, place of origin, and other factors such as language, religion, and sometimes race [23, 25]. Assessing ethnicity is difficult, and numerous proxy measures are used to capture its various components.

The association between experience of dental caries and race/ethnicity is not well-defined. Worldwide, White children, adolescents, adults and the elderly were consistently found to experience lower levels of dental caries than their counterparts from other racial/ethnic groups [3-19]. However, it is not clear whether these differences were due to race/ethnicity *per se* or due to confounding variables such as socio-economic position ("SEP") as both are strongly related to the experience of dental caries [3-5, 7, 8, 10, 16-19, 26-28]. Data from the United States suggested that SEP may fully explain ethnic inequalities in oral health [29, 30], while other studies

have reported the persistence of these inequalities after adjustment for confounding factors [17, 31].

The aim of this study was to systematically review the literature and synthesize the available evidence for a possible association between race / ethnicity and dental caries experience.

METHODS

A systematic literature review was conducted at the Institute of Dentistry at Queen Mary University of London, between October 2014 and February 2015, following the recommendations of the Cochrane *Handbook* [32]. We sought to answer the question if race/ethnicity is an important determinant factor of inequality in relation to dental caries experience or are there other factors that may interfere with this association.

Search Strategy

We systematically screened the electronic databases PubMed/Medline and Scopus for studies published between January 1st 2005 and January 1st 2015. Keywords and MeSH (Medical Subject Headings) searches were conducted to assess the association between race/ethnicity and dental caries experience in children, adolescents, adults and elderly. The search strategy included the terms: "ethnic*" OR race OR racial OR skin colour" AND "dental caries OR caries OR decay". There were no language restrictions.

Study screening and data extraction

Two trained reviewers performed independent searches, assessed publication validity, and extracted the data in duplicate. Differences were resolved by discussion, rereading, and consultation with the other co-authors members of the research when

necessary. Records identified through database searching were exported to the bibliographic management program EndNote® version 7.2.

Articles addressing unrelated topics were not kept in the database after the title and abstract screening. The remaining studies were assessed for methodological quality using a scale. We did not, however, use a scoring system, owing to concerns over the validity of this procedure when assessing study quality [33]. The quality and inclusion criteria used in this review were observational longitudinal (regardless of study design, prospective or retrospective, or duration of follow-up) or cross-sectional studies (1) based on random samples; (2) representing national, subnational, or community populations; (3) measuring caries experience through clinical examination and reporting prevalence or mean DMFT; (4) with a response rate >50% for prevalence surveys and an attrition rate <50% for longitudinal studies. Only studies that met all the eligibility criteria were finally included.

The selected studies were fully read and the following data of each study was extracted by one reviewer: country of the study and coverage (national or subnational), author, year of publication, final sample size, subjects age, dental caries measures and main results. Meta-analysis was not performed due to the heterogeneity of the studies and their methodology, participants' age and race/ethnic data collection differences.

RESULTS

A flowchart describing the systematic review search results is presented in Fig. 1. The search yielded a total amount of 1,288 articles in our chosen period, 657 from PubMed and 631 from Scopus. After excluding the duplicates (324 studies), 964 records remained. After screening titles and abstracts, we excluded 878 records, as they did

not address the topic of interest in this review. A total of 56 records were eligible for full-text screening, and 14 met the inclusion criteria for the review analysis.

Figure 1. Flowchart of the selection of studies for the review.
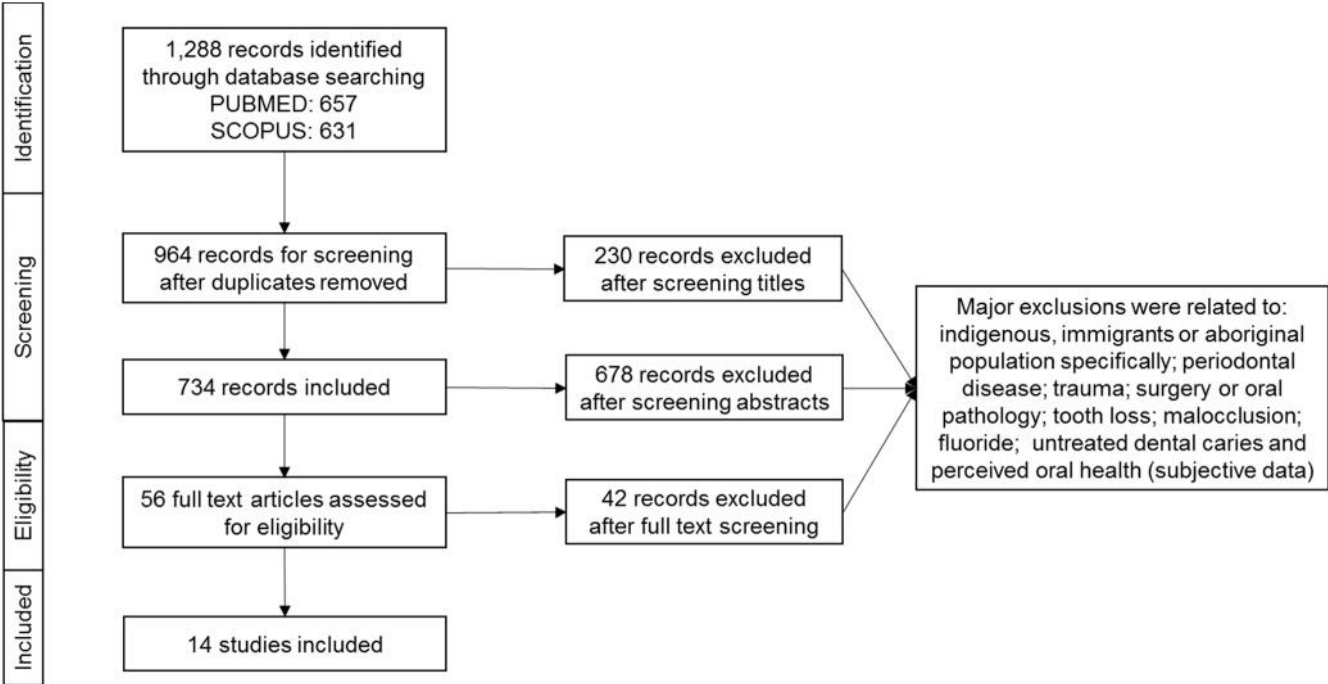
The exclusions were associated with studies that did not approach the measurements of interest, were specific and compared only indigenous, immigrants or aboriginal population and related to periodontal disease, dental trauma, surgery or oral pathology, tooth loss, malocclusion, fluoride exposure, untreated dental caries only, measurements of surface dental caries or only caries presence and subjective data on oral health such as perceived oral health.

The records included in this review are from studies from seven different countries, with four studies of national coverage [4, 5, 7, 19]. The dental literature tends to report prevalence of caries experience and the Decayed, Missing, and Filled Teeth Index for permanent or primary dentition (DMFT or dmft Indexes) are the universal measure

used in surveys for caries experience in deciduous and permanent teeth, respectively. All studies used the DMFT or dmft Indexes. Some studies combined the components of the DMFT/dmft Index to build and measure the Significant Caries Index (SiC) [5, 8, 11, 17], the Dental Care Index [3, 4], and the Unmet Need [9]. Additionally, studies used other indexes, as the Human Development Index (HDI) [4, 7], the Gini Index [7], the Oral Hygiene Index [12] and the Index of Multiple Deprivation [14]. Statistical analyses applied to the studies included quantity measurements such as average, standard deviation and prevalence, and measures of association such as odds ratio and only one study used risk ratio [17].

A total amount of 1,937,581 individuals participated in the 14 selected studies, and the sample size ranged from 455 in the smaller final sample size to 328,042 in the larger sample size. Among the 14 included records, two studies [8, 17] compared White and Non-White groups, and White presented a lower caries experience. Five studies [9-12, 15] compared indigenous/aboriginal with non-indigenous/non-aboriginal populations and, interestingly, three from Australia [9-11, 15] and one from Canada [12] showed a significantly higher prevalence and severity of caries experience in the indigenous/aboriginal population than their counterparts, while one study from Ecuador [15] showed that non-indigenous children had a significantly higher mean DMFT Index than indigenous children, depending primarily on the higher prevalence of decayed teeth. Two studies explored the association of race/ethnicity in early childhood caries (ECC) [12, 17].

The 14 selected studies measured the association of caries experience with other factors than race/ethnicity, such as age [8, 17, 19], sex [4, 5, 8, 10, 17, 19], income [3, 7, 11, 17, 19], education [7, 11, 17, 19], occupation or employment status [5, 11, 17], area of residence [4, 5, 10], socioeconomic factors [3, 4, 10], social capital [10], marital

status [19], diet measurements or results related to diet [5, 9, 15, 16], health expenditures by the public service [3], access to dental care or dental visit [7, 16], dental pain [7, 16], dental-related behaviours [16], health behaviours [19] and dental care insurance coverage [19]. In addition, the studies reported the necessity of implementation or reform of population-approach policies, such as access to fluoride [5, 9], dental service [3, 9, 13, 14, 19], disease prevention and health promotion programs [14-16] and further programs and policies to tackle the social determinants of oral health [4, 12].

Table 1. Study characteristics and results reported from the systematic search of the literature on inequalities related to race/ethnicity and dental caries experience within countries.

Country	Authors, Date	Coverage	Final sample size	Age	Race/ethnicity	%	DMFT/dmft	OR/RR	95% CI
Africa	Ayo-Yusuf, Ayo-Yusuf and van Wyk, 2007[5]	National	5,411	12 y	White		1.13	1	
					Black/African		1.02	0.97	0.94-0.99
					Coloured		2.14	3.32	3.23-3.40
					Indians		0.91	1.23	1.18-1.27
Australia	Jamieson, Armfield and Roberts-Thomson, 2007 [10]	Subnational	328,042	4-10 y	Indigenous		2.86	3.40	
					Non-indigenous		1.40	2.49	
				6-14 y	Indigenous		0.75	1.60	
					Non-indigenous		0.46	1.23	
	Jamieson, Parker and Armfield, 2007 [11]	Subnational	7,657	<10 y	Indigenous		4.00	3.43	
					Non-indigenous		2.06	2.86	
				6+ y	Indigenous		1.62	2.46	
					Non-indigenous		0.95	1.70	
	Ha, 2014 [9]	Subnational	103,387	5-6 y	Non-indigenous	48.9	2.22		2.13-2.32
					Indigenous	74.4	4.22		3.88-4.55
				12-13 y	Non-Indigenous	49.2	1.45		1.34-1.55
					Indigenous	60.2	2.42		1.76-3.09
Brazil	Antunes et al, 2003 [3]	subnational	18,718	11-12 y	Whites		3.38		
					Blacks		3.19		
	Gushi et al, 2005 [8]	Subnational	1,825	15-19 y	White		6.40*		
					Non-white		6.55*		
	Antunes et al, 2006 [4]	National	34,550	12 y	White		2.6		
					Black		2.9	1.6	1.5-1.7
	Piovesan [17]	Subnational	455	1-5 y	White	20.0	0.7	1.0[b]	
					Non-White	34.5	1.2	1.71[b]	1.14-2.98
	Guiotoku et al, 2012 [7]	National	12,811	35-44 y	White		20.4		20.2-20.6
					Blacks		19.2		20.6-21.1
					Mixed Race		20.0		19.8-20.2
Canada	Lawrence et al., 2009 [12]	Subnational	960	3-5 y	Aboriginal[a]		5.9		4.7-7.1
					Non-aboriginal[a]		1.5		1.2-1.7
Ecuador	Medina et al., 2008 [15]	Subnational	1,449	6-12 y	Indigenous		2.95*		
					Non-Indigenous		3.46		

Country	Authors, Date	Coverage	Final sample size	Age	Race/ethnicity	%	DMFT/dmft	OR/RR	95% CI
United Kingdom	Marcenes et al., [14]	Subnational	1,297	3-4 y	White British	18.21	0.60	1.0	
					White Eastern European	50.74	2.56	4.62	1.63-13.13
					White other	21.69	1.09	1.24	0.36-4.35*
					Black African	14.31	0.56	0.75	0.39-1.45*
					Black other	10.73	0.35	0.54	0.16-1.86*
					Asian Indian	25.99	0.84	1.58	0.68-3.66*
					Asian Bangladeshi	30.31	1.25	1.95	0.96-3.96*
					Asian Pakistani	31.70	1.39	2.08	1.03-3.28
					Asian other	24.05	0.66	1.42	0.62-3.28*
					Middle Eastern	24.97	1.30	1.50	0.54-4.14*
					Mixed	21.54	0.57	1.23	0.47-3.21*
					Other	42.57	1.52	3.33	0.94-1.61*
					Unclassified	11.88	0.20	0.61	0.23-1.61*
United States	Mitchell et al., 2007 [16]	Subnational	3,079	12-16 y	African American	53.7		0.8	0.7-1.1
					Hispanic	21.6		1.0	
					Others	53.8*		1.1	0.8-1.5
	Wu, 2011 [19]	National	4,355	60+ y	Non-Hispanic White		20.3		
					Non-Hispanic Black		19.8		
					Mexican American		17.7		

a Only data from 2005 and 2006; b Risk Ratio; *Statistically non-significant

DISCUSSION

The presented systematic review was performed to analyse the evidence for a possible association between race/ethnicity and dental caries experience. We identified 14 studies on racial/ethnic inequalities in dental caries experience. This is the only known systematic review of the literature on race/ethnicity inequalities over dental caries experience. The studies were not uniform in several methodological aspects and in the data collection on race/ethnicity. However, inequalities in dental caries experience were observed throughout the studies and in different countries with Whites presenting a better oral health condition than other race/ethnic groups. Health and by implication oral health, is a product of environmental, social, and economic determinants, not just biology or genetics, and reasons for the disparities are likely to be complex, but may include issues pertaining to social cohesion, poverty, historical factors, remote location and inappropriate oral health service provision especially when comparing indigenous/aboriginal with non-indigenous/aboriginal populations [9, 11].

It is accepted that dental caries is a multifactorial disease and the interaction of host, agent and environmental factors under conductive conditions leads to dental caries development. Also, Andersen's Behavioural Model of Health services [34] explain that health service utilization are associated with predisposing factors, including individuals' age, sex, and education; enabling factors, including individuals' economic, marital, and employment status, as well as availability and distance from healthcare providers, and status of the health provider; and factors related to the need for healthcare. It has been suggested in the literature that the race and ethnicity of a person may determine their oral health status [14, 20, 21]. The selected studies for this review identified an association of caries experience with other factors than race/ethnicity, such as age [8, 17, 19], sex [4, 5, 8, 10, 17, 19], income [3, 7, 11, 17, 19], education [7, 11, 17, 19],

occupation or employment status [5, 11, 17], area of residence [4, 5, 10], socioeconomic factors [3, 4, 10], social capital [10], marital status [19], diet measurements or results related to diet [5, 9, 15, 16], health expenditures by the public service [3], access to dental care or dental visit [7, 16], dental pain [7, 16], dental-related behaviours [16], health behaviours [19] and dental care insurance coverage [19], mostly to understand the role of race/ethnicity in dental caries experience.

Jamieson, Armfield and Roberts-Thomson [10] stated that indigenous children experienced higher caries prevalence and severity than non-Indigenous children, regardless of age, sex, area of residence and socioeconomic factors. Wu et al. [19] demonstrated a persistent caries inequality across racial/ethnic groups despite the fact that the differences between groups diminished when socioeconomic, health-related and behavioural factors were considered. Other authors consider that risk factors such as occupation or employment status [5, 11, 17], education, distribution of income and access to health care, are more predictors in characterizing the vulnerability of populations to oral health diseases than biological or race/ethnicity factors *per se* [3, 4, 7, 13, 17, 18].

Jamieson, Parker and Armfield (2007) noted that race/ethnicity is not as a risk factor or cause for poor oral health, but a biological and social construct only [11]. After adjusting for factors such as area of residence [10], age [10, 12, 17], sex [5, 10, 12], SEP [3, 10, 17], minority groups continued to exhibit worst oral health condition than their counterparts. Inequalities are reported between race/ethnic groups [8, 9] and authors suggest there are factors contributing to the observed oral health disparities that are not explained by SEP alone [10]. Oral health disparities are persistent across racial/ethnic groups despite the fact that the differences between groups typically

diminish when socioeconomic, health-related, and behavioural factors are considered [19].

Antunes et al. (2003) [3] relates factors such provision of public dental services, *per-capita* municipal yearly budget and health expenditure as important determinant factors of the caries experience differences between Blacks and Whites. Guiotoku et al. (2012) [7] report that contextual factors related to the human development profile, distribution of income and access to health care policies plays an important role in characterizing the vulnerability of populations to diseases in oral health.

Other studies report similar caries experience between race/ethnic groups. However, the disease burden is not evenly distributed across groups [7, 15, 16]. Interestingly, one studied conducted in Brazil [3], demonstrated that White schoolchildren presented overall poor profile of caries experience than their Black counterparts, with a higher DMFT Index, however, a better profile of dental care, and a higher proportion of children in no need of dental treatment. This corroborated with other authors [4, 7, 8] that indicated unequal access between Whites and other race/ethnic groups. Five studies [9-12, 15] compared indigenous/aboriginal with non-indigenous/non-aboriginal populations and, interestingly, three from Australia [9-11, 15] and one from Canada [12] showed a significantly higher prevalence and severity of caries experience in the indigenous/aboriginal population than their counterparts, while a study from Ecuador [15] demonstrated an overall caries prevalence almost as high among indigenous as non-indigenous children, mostly related to diet and low incorporation of dental services in the region, affecting both populations. Other race/ethnic differences were found among diet measurements or results related to diet behaviours [5, 9, 15, 16]. Authors stated that access to health care policies seem essential in characterizing the

vulnerability of populations to oral health diseases and is associated with caries status [5, 7, 16]

The studies were not based on any determined race/ethnicity concept and assessing ethnicity is complex, and numerous proxy measures are used to capture its various components. Nelson [35] emphasizes the critical need for improved data collection on race/ethnicity to understand and eliminate health disparities. The challenges of standardized data collection of race/ethnicity, patient privacy concerns, costs of collection, and resistance from providers and patients' needs to be addressed. The understanding of the race/ethnic concept also varies across respondents and for the same person on different occasions [25]. As an example, measuring race/ethnicity in Brazil is challenging [22], and the aggregation of racial categories is necessary because of the wide range of mixed races from "darker to lighter Mixed Race". This may lead to misclassification as light Mixed Race may classify themselves as Whites and dark Mixed Race as African descents. Also, there is not any clear evidence of racial or genetic variations as determining factors of dental caries experience. On the contrary, there is evidence of ethnic differences in relation to exposure to the risk factors associated with dental caries. One study [14] from the United Kingdom, included the variable race/ethnicity from school records, and 27 different ethnic groups were found and grouped, demonstrating disparities within the groups. The authors describes the necessity of cultural sensitive programmes in addition to general evidence-based preventive approaches in order to address race/ethnic dental caries inequalities.

Some limitations of this study need to be discussed. Despite the rigor in conducting the review, the meta-analysis was not performed, as there is a lack of consistency across settings or methods for collecting data on race and ethnicity and problems in

the interpretation of such data could occur. There is often some subjectivity when deciding how similar studies must be before pooling is appropriate. Besides the nonexistence of standard in the data collection on race/ethnicity, definitions of racial categories vary across countries and time [25]. Indigenous populations in Australia or Ecuador have different characteristics than the aboriginal population in Canada. Some people that refer to themselves as Whites in Brazil are not similar to Whites in the United Kingdom and the United States. However, data on race and ethnicity are necessary to measure disparities in health and health care, and the focus of the review was not to compare the populations but to better understand the role of race/ethnicity in dental caries experience. Studies published outside peer-reviewed mainstream medical or dental journals, in books or sources not abstracted by Pubmed or Scopus, were not reviewed. Hand searching for grey literature was not perform, and some relevant data may have been missed.

Since the concept and classification of race are not uniform within the studies, between countries, or over time, any comparison of study results concerning the effects of race on health and health care must take into consideration variations in racial measurement used and data quality issues [25]. Different race/ethnic groups are a concern for some regions, as Africa focus on inequalities between Whites and African descents while Australia concern is between aboriginals and non-aboriginals. A concerted effort is needed to improve the recording of individuals' race/ethnic descriptors in health information systems worldwide, to generate health information for the comparable content and quality for all racial and ethnic groups, particularly those segments at highest risk of health problems.

This review confirms an association of racial/ethnic inequalities in dental caries experience. Results showed that minority groups such as aboriginals and indigenous

have a higher prevalence and are more likely to have caries experience. In addition, race/ethnicity was shown not as determinant factor or cause for poor oral health, but a biological and social construct that needs to be addressed with other factors such as income, socioeconomic factors, education, occupation or employment status, diet measurements and access to dental care. An improvement and standardization in data collection on race/ethnicity are necessary to better understand and effectively address oral health inequalities.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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AUTHOR CONTRIBUTIONS

AMAD and VEG independently screened the list of titles and abstracts resulting from the search, created an overview of the studies selected for full text reading, performed the full text reading, made a selection of the papers that fulfilled the eligibility criteria, collected the data, worked on the interpretation of the data, drafted and designed the manuscript. WM and EFF conceived the study, created the search, assisted in the selection strategy of the papers, supervised the data extraction, participated in the design, helped in the drafting of the manuscript, and revised the manuscript critically for important intellectual content. All authors read and approved the final manuscript.

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4.2 Artigo 2

4.2.1 Iniquidades da experiência de cárie dentária entre diferentes grupos étnicos de brasileiros de 15 a 19 anos – Resumo

Introdução: O objetivo deste estudo foi avaliar a iniquidade da experiência de cárie dentária, com base em raça/etnia, entre adolescentes brasileiros com idade entre 15 a 19 anos, em 2010, e testar se os indicadores socioeconômicos explicam as diferenças étnicas para a experiência de cárie dentária.

Métodos: Foram analisados os dados do Projeto SB Brasil 2010. A raça/etnia foi autodeclarada de acordo com o IBGE (branco, negro, amarelo, pardo e indígena) e a prevalência de experiência por cárie dentária e raça/etnia em 2010 (n=5.367) foi calculada. Análises posteriores incluíram modelo conceitual hierárquico e mediação.

Resultados: A experiência de cárie foi de 76,9% em brasileiros de 15 a 19 anos de idade em 2010. Enquanto os brasileiros Negros foram 32% mais propensos a ter experiência de cárie do que os Brancos, os Pardos foram 69% mais propensos a ter experiência de cárie do que os Brancos. Análise de modelo conceitual hierárquico confirmou a associação altamente significativa entre a experiência de cárie dentária e raça/etnia. Os Pardos e Amarelos tiveram 1,44 (IC 95% 1,24-1,67) e 1,81 (IC 95% 1,02-3,20) vezes maior probabilidade de ter experiência de cárie dentária do que os Brancos após o ajuste para idade, sexo, escolaridade e renda familiar. A diferença na probabilidade de ocorrência de cárie entre Brancos e Negros não foi estatisticamente significativa após o ajuste para anos de escolaridade e renda familiar. Os resultados da análise de mediação confirmaram que a iniquidade de experiência de cárie entre Brancos e os indivíduos Pardos e Amarelos foi mediada através da educação e renda familiar. A probabilidade de indivíduos Pardos e Amarelos terem experiência de cárie em comparação com os Brancos foi atenuada, para 14,8% e 9,5%, respectivamente, após o ajuste para anos de escolaridade e renda familiar.

Conclusão: A análise dos dados demonstrou que os Brancos se beneficiaram mais da redução significativa na experiência da cárie dentária de brasileiros de 15 a 19 anos, em comparação com Negros e Pardos. A educação e a renda explicam totalmente as iniquidades étnicas na experiência de cárie dentária entre Brancos e Negros, e em grande parte das iniquidades entre Brancos e Pardos.

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5.2.1 Inequality of Experience of Dental Caries between Different Ethnic Groups of Brazilians Aged 15 to 19 Years – Artigo completo

Inequality of Experience of Dental Caries between Different Ethnic Groups of Brazilians Aged 15 to 19 Years

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Abstract

Introduction

The aim of this study was to assess inequality of experience of dental caries, based on race/ethnicity, among Brazilian adolescents aged 15 to 19 years in 2010 and test whether socioeconomic indicators fully explain ethnic differences in dental caries.

Methods

Data from a National Oral Health Survey conducted in Brazil in 2010 was analysed. Race/ethnicity was self-assigned and modified to White, African descents, East Asian descents, Mixed Race and Indigenous descents. The prevalence of caries experience by race/ethnic group in 2010(n = 5,367) was calculated. Further analysis included conceptual hierarchical modelling and mediation analysis.

Results

Caries experience was 76.9% in 15 to 19 year old Brazilians in 2010. While African descents were 32% more likely to have caries experience than Whites, Mixed Race were 69% more likely to have caries experience than Whites. Hierarchical conceptual modelling analysis confirmed the highly significant association between caries and race/ethnicity. Mixed Race and East Asian descents were 1.44 (95% CI 1.24–1.67) and 1.81 (95% CI 1.02–3.20) times more likely to experience caries than Whites after adjusting for age, sex, education and income. The difference in the likelihood of experiencing caries between Whites and African descents was not statistically significant after adjusting for years of education and family income. The results of mediation analysis confirmed that inequality of caries experience between Whites and Mixed Race and East Asian descents was mediated through education and income. The likelihood that Mixed Race and East Asian descents would experience caries compared to Whites was attenuated, by 14.8% and by 9.5% respectively, after adjusting for years of education and income.

Conclusions

Data analysis demonstrated that Whites have benefited more from the significant reduction in dental caries experience in 15 to 19 year old Brazilians, as compared to African descents and Mixed Race. Education and income fully explained ethnic inequalities in experience of dental caries between Whites and African descents, and largely explained inequalities between Whites and Mixed Race.

Introduction

The literature showed consistently that socially vulnerable groups had a higher prevalence of experience of dental caries [1–17]. It has been suggested in the literature that the race and ethnicity of a person may determine their oral health status [2, 12]. There is a considerable amount of literature on the utility of race and ethnicity as concepts [18–20]. 'Race' and 'ethnicity' are terms commonly used, with similar characteristics but subtle differences. 'Race' typically refers to physical features, such as skin colour or hair texture, which may reflect a person's ancestry; and examples of categories that are commonly used to describe race include White, African descents, or Asian descents. 'Ethnicity' is a complex term used to describe perceived social groupings based on a sense of belonging, place of origin, and other factors such as language, religion, and sometimes race [19, 21]. Assessing ethnicity is difficult, and numerous proxy measures are used to capture its various components. For the purposes of this study, 'Ethnicity' and 'Race' will be viewed as synonyms. Self-reported ethnicity captures both the shared experiences/culture of an individual and their self-identity [20, 21].

The association between experience of dental caries and race/ethnicity is not well-defined. Worldwide, White children, adolescents, adults and the elderly were consistently found to experience lower levels of dental caries than their counterparts from other racial/ethnic groups [1–17]. However, it is not clear whether these differences were due to race/ethnicity *per se* or due to confounding variables such as socio-economic position ("SEP") as both are strongly related to experience of dental caries [1–3, 5, 6, 8, 14–17, 22–24]. Data from the United States suggested that SEP may fully explain ethnic inequalities in oral health [25, 26], while other studies have reported the persistence of these inequalities after adjustment for confounding factors [15, 27].

The aim of this study was to assess inequality of experience of dental caries as between different ethnic groups of Brazilian adolescents (aged 15 to 19 years) in 2010. In addition, the study sought to test whether socioeconomic indicators fully explain ethnic differences in dental caries in 2010.

Methods

This article analyses data from a National Oral Health Survey conducted in Brazil in 2010 (SBBrasil 2010) [28]. The survey adopted a cross-sectional survey design and included a representative sample of young adults aged 15 to 19 years. Participants were selected using multi-stage random sampling stratified approach by the five Brazilian macro-regions. Proportional representation was adopted. Trained and calibrated dentists conducted the oral examinations using the WHO protocol [29]. The DMFT index was used to assess experience of dental caries. Following the clinical examination, participants answered a supervised structured questionnaire, designed especially for the research. A handheld Personal Digital Assistant (PDA model

P550) was used for data collection. The questionnaire included questions on socio-demographic factors (age, sex, race/ethnicity, years of education, family income and household characteristics). Age was assessed in complete years. Race/ethnicity was self-assigned into the five Brazilian census classification [30] and modified to White, African descent, East Asian descent, Mixed Race (those with mixed racial ancestry, known as "*pardos*") and Indigenous descent. The participant's 'years of education' were assessed in terms of the number of successfully completed school years; and 'family income' was reported by the head of the family, considering the total income of the household in the month prior to the interview. Detailed information on the sampling procedure can be found elsewhere [31]. The SBBrasil 2010 (*Conselho Nacional de Etica em Pesquisa*—approval ref. 15,498/2010) followed the requirements of the Declaration of Helsinki and was approved by the Brazilian Ethics Committee.

Statistical analysis

Data was analyzed using IBM SPSS Statistics 18.0. The prevalence of experience of dental caries was calculated by reference to race/ethnic group. The SBBrasil 2010 included a sample of 5,445 participants, aged 15 to 19 years. Seventy-eight individuals (1.43%) were excluded from this data analysis due to missing information on the outcome variable (n = 5,367).

Further data analysis were carried out to assess race/ethnicity inequalities of experience of dental caries. In addition, to test the estimation of precision, we also performed post hoc power analysis. The post-hoc sample calculation demonstrated that the minimum sample size needed to provide 80% statistical power to enable the identification of an odds ratio of 1.5 was estimated to be 822 [32]. The calculation assumed 50% of the unexposed population and 60% of the exposed population to have the outcome of interest: α equal to 0.05, and β equal to 0.20. Therefore, the sample size (n = 5,367) provides sufficient statistical power to test the hypothesis.

Data manipulation was minimal. The participants' 'years of education' were categorized into 'four or less years of education', 'five to eight years of education' and 'nine or more years of education'. Family income' was converted into U.S. dollars (US$1.00 = R$1.76 in 2010) and categorized into 'equal to or less than US$142.00', 'US$143.00 to US$284.00', 'US$285.00 to US$852.00', 'US$853.00 to US$1,420.00' and 'US$1,421.00 or above'.

Simple logistic regression analyses were carried out to assess the unadjusted association between each of the explanatory variables (race/ethnicity, sex, age, years of education and family income) and experience of dental caries. In accordance with the lax criterion [33], explanatory variables that were not statistically significantly related to the outcome at the level of 0.20 or more were excluded at this stage. Following this, conceptual hierarchical modelling [34] was carried out. The remaining variables were sequentially included as follows: (1) race/ethnicity, sex and age (2) race/ethnicity, sex, age plus years of education; (3) race/ethnicity, sex, age, years of education, plus family income. Odds Ratios (OR) were reported and the 95% confidence interval was considered. Attenuation of the OR was calculated using the formula (ORU-ORA)÷(ORU-1) [35], where ORU represents the odds ratio before including the family income and ORA reflects the odds ratio after including years of education and family income in the model. Mediation analysis included the four steps proposed by Baron and Kenny [36].

Results

Frequency distribution of demographic characteristics in the SBBrasil 2010 study sample are shown in Table 1. Experience of dental caries was 76.9% in 15 to 19 year old Brazilians in 2010. A significant difference in the distribution of experience of dental caries among race/ethnic groups was observed. African descents (77.1%), East Asian descents (83.5%), Mixed Race

Table 1. Sample characteristics by race/ethnicity in 15 to 19 years old Brazilians in 2010.

Characteristics		Sample (n = 5367)	White (n = 2177; 40.6%)	African descents (n = 586; 10.9%)	East Asian descents (n = 103; 1.9%)	Mixed Race (n = 2453; 45.7%)	Indigenous descents (n = 48; 0.9%)
Age							
	15 years	1438 (26.8%)	552 (25.4%)	167 (28.5%)	29 (28.1%)	672 (27.4%)	18 (37.5%)
	16 years	973 (18.1%)	404 (18.6%)	85 (14.5%)	18 (17.5%)	458 (18.7%)	8 (16.7%)
	17 years	977 (18.2%)	392 (18.0%)	100 (17.1%)	25 (24.3%)	451 (18.4%)	9 (18.7%)
	18 years	995 (18.6%)	419 (19.2%)	110 (18.8%)	14 (13.6%)	444 (18.1%)	8 (16.7%)
	19 years	984 (18.3%)	410 (18.8%)	124 (21.1%)	17 (16.5%)	428 (17.4%)	5 (10.4%)
Gender							
	Male	2452 (45.7%)	1014 (46.6%)	265 (45.2%)	43 (41.7%)	1101 (44.9%)	29 (60.4%)
	Female	2915 (54.3%)	1163 (53.4%)	321 (54.8%)	60 (58.3%)	1352 (55.1%)	19 (59.6%)
Education							
	≤ 4 years	200 (3.7%)	56 (2.6%)	34 (5.8%)	4 (3.9%)	103 (4.2%)	3 (6.2%)
	5–8 years	1798 (33.5%)	618 (28.4%)	236 (40.3%)	24 (23.3%)	901 (36.7%)	19 (39.6%)
	≥ 9 years	3357 (62.6%)	1498 (68.8%)	313 (53.4%)	75 (72.8%)	1445 (58.9%)	26 (54.2%)
	Missing information	*12 (0.2%)*	*5 (0.2%)*	*3 (0.5%)*	*0 (0%)*	*4 (0.2%)*	*0 (0%)*
Family Income							
	≤ US$142	160 (3.0%)	36 (1.7%)	26 (4.4%)	4 (3.9%)	91 (3.7%)	3 (6.2%)
	US$143–284	686 (12.8%)	203 (9.3%)	104 (17.8%)	14 (13.6%)	359 (14.6%)	6 (12.5%)
	US$285–852	2621 (48.8%)	943 (43.3%)	307 (52.4%)	46 (44.7%)	1302 (53.1%)	23 (47.9%)
	US$853–1420	920 (17.1%)	456 (20.9%)	87 (14.8%)	16 (15.5%)	352 (14.3%)	9 (18.8%)
	≥ US$1421	665 (12.4%)	406 (18.7%)	37 (6.3%)	10 (9.7%)	210 (8.6%)	2 (4.2%)
	Missing information	*315 (5.9%)*	*133 (6.10%)*	*25 (4.3%)*	*13 (12.6%)*	*139 (5.7%)*	*5 (10.4%)*
DMFT							
	= 0 (free of caries)	1240 (23.1%)	611 (28.1%)	134 (22.9%)	17 (16.5%)	466 (19.0%)	12 (25.0%)
	≥ 1	4127 (76.9%)	1566 (71.9%)	452 (77.1%)	86 (83.5%)	1987 (81.0%)	36 (75.0%)

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(81.0%) experienced significantly more dental caries than Whites (71.9%) while experience of dental caries among Indigenous descents (75.0%) was not significantly different than among Whites (Table 2). In addition, there were statistically significant differences in the distribution of experience of dental caries by age, sex, years of education and family income. As expected, experience of dental caries increased with ageing. Participants with less than four years of education were 2.67 (95% CI 1.72–4.15) times more likely to have experience of dental caries than those with nine or more years of education. Participants with family income of US$142.00 or less were 3.52 (95% CI 2.20–5.63) times more likely to have experience of dental caries than those with a family income of US$ 1,421.00 or above (Table 2).

Hierarchical conceptual modelling analysis (Table 3) confirmed the highly significant association between dental caries and race/ethnicity. Adjusted odds ratios confirmed that Mixed Race and East Asian descents were 1.44 (95% CI 1.24–1.67) and 1.81 (95% CI 1.02–3.20) times more likely to experience dental caries than Whites respectively. The difference in the likelihood of experiencing dental caries between Whites and African descents was not statistically significant after adjusting for years of education and family income.

Table 2. Caries experience (DMFT>0) by demographic and socioeconomic characteristics in the total sample, Brazil, 2010.

Characteristics		N DMFT>0 (%)	OR[a] [95%CI]	P value
Self-reported race/ethnicity				
	White	1566 (71.9)	1 [reference]	
	African descents	452 (77.1)	1.32 [1.06–1.63]	0.012
	East Asian descents	86 (83.5)	1.97 [1.16–3.35]	0.012
	Mixed Race	1987(81.0)	1.66 [1.45–1.91]	<0.001
	Indigenous descents	36 (75.0)	1.17 [0.60–2.26]	0.640
Sex				
	Male	1854 (75.6)	1 [reference]	
	Female	2273 (78.0)	1.14 [1.01–1.30]	0.041
Age				
	15 years	1029 (71.6)	1 [reference]	
	16 years	735 (75.5)	1.23 [1.01–1.48]	0.031
	17 years	771 (78.9)	1.49 [1.23–1.80]	<0.001
	18 years	793 (79.7)	1.56 [1.29–1.89]	<0.001
	19 years	799 (81.2)	1.72 [1.41–2.09]	<0.001
Education				
	≤ 4 years	177 (88.5)	2.67 [1.72–4.15]	<0.001
	5–8 years	1448 (80.5)	1.44 [1.25–1.65]	<0.001
	≥ 9 years	2492 (74.3)	1 [reference]	
	Missing information	10 (83.3)		
Family Income				
	≤ US$142	137 (85.6)	3.52 [2.20–5.63]	<0.001
	US$143–284	571 (83.2)	2.93 [2.27–3.79]	<0.001
	US$285–852	2090 (79.7)	2.33 [1.94–2.78]	<0.001
	US$853–1420	678 (73.7)	1.66 [1.34–2.05]	<0.001
	≥ US$1421	418 (62.9)	1 [reference]	
	Missing information	233 (74.0)		

[a]Unadjusted logistic regression models and odds ratios (OR) reported with a 95% confidence interval

The results of mediation analysis, using the four steps proposed by Baron and Kenny [36] confirmed that race/ethnic inequalities of experience of dental caries between Whites and Mixed Race and East Asian descents was mediated through education and income. Race/Ethnicity was significantly associated with experience of dental caries, education and income.

Table 3. Models for race/ethnic differences in caries experience (DMFT) among the total sample, Brazil, 2010.

Self-reported race/ethnic groups	Model 1[a] OR[b] (95% CI)	P value	Model 2[a] OR[b] (95% CI)	P value	Model 3[a] OR[b] (95% CI)	P value
White	1.00 [Reference]		1.00 [Reference]		1.00 [Reference]	
African descents	1.32 [1.07–1.64]	0.011	1.21 [0.97–1.51]	0.086	1.04 [0.83–1.30]	0.762
East Asian descents	2.00 [1.18–3.41]	0.010	2.04 [1.20–3.46]	0.009	1.81 [1.02–3.20]	0.042
Mixed Race	1.69 [1.47–1.94]	<0.001	1.61 [1.40–1.86]	<0.001	1.44 [1.24–1.67]	<0.001

[a] Model 1 was adjusted for sex and age; Model 2 was adjusted for sex, age plus years of education; Model 3 was adjusted for sex, age, years of education plus family income.
[b] Logistic regression models were fitted and odds ratios (OR) reported.

Also, the likelihood that Mixed Race and East Asian descents would experience dental caries compared to Whites was attenuated by 14.8% and by 9.5% respectively after adjusting for years of education and income. Table 3 shows all models compared to the unadjusted model and, interestingly, education and income fully explained the difference in experience of dental caries between Whites and African descents.

Discussion

The unadjusted results of this study corroborated previous studies worldwide that postulated that Whites experience significantly less dental caries than other race/ethnic groups [1–17]. Wu et al. [17] also conducted a hierarchical analysis and their results corroborated our findings. The findings also confirmed the well-established association between experience of dental caries and income and education worldwide [23] and in the Brazilian population [24]. To our knowledge, this is the only study that has conducted mediation analysis.

Mediation analysis demonstrated that higher education and income may explain inequality of experience of dental caries between race/ethnic groups in Brazil. While education and income fully accounted for the difference in experience of dental caries between Whites and African descents, the likelihood that Mixed Race and East Asian descents would experience dental caries compared to Whites was significantly attenuated.

Although experience of dental caries has reduced significantly among all race/ethnic groups in 15 to 19 year old Brazilians between 2003 and 2010, inequality of experience of dental caries between these groups has increased. Experience of dental caries has reduced significantly from 89.2% to 76.9% in 15 to 19 year old Brazilians between 2003 [37] and 2010 [28]. Comparison of the results of the national studies carried out in Brazil in 2003 and 2010 showed a larger reduction in prevalence of experience of dental caries in Whites (19.4%) than in Indigenous descents (13.8%), African descents (11.2%), Mixed Race (9.7%) and East Asian descents (7.2%). Furthermore, while in 2003 African descents were 19% less likely to have experience of dental caries than Whites, in 2010 African descents were 32% more likely to have experience of dental caries than Whites. Also, while in 2003 Mixed Race and Whites had similar likelihood of experiencing caries, in 2010 Mixed Race were 69% more likely to have experience of dental caries than Whites (results not presented).

In the past 10 years, the Brazilian government have been investing in health, education and income policies to reduce inequality. A Family Health Programme (FHP), which aimed to broaden access to public health services, especially in deprived areas, was introduced in Brazil in 1994. The FHP covered 94.3% of Brazilian municipalities and 50.8% of the population in 2010. The FHP offers free community based primary care, and follows the principles of decentralisation, universality and equity [38]. In 2003, the "*Bolsa Família*" (Family Allowance) programme was introduced, which is a major cash transfer programme targeting those in poverty. It aimed to promote an immediate relief of poverty, improving access to education and health care, and offering complementary social programmes to enable families to end their condition of vulnerability. Enrolment in the "*Bolsa Família*" programme is conditional on school attendance up to 17 years and meeting primary health care conditions such as vaccination and nutritional surveillance [39].

In 2004, positive discrimination or social inclusion policies established racial quotas reserving 20% of available admissions in universities for students who self-identified as African descents [40]. However, Whites may have benefited more from the Brazilian economic development and social programmes than other groups or the programmes were still insufficient to reduce inequalities between the race/ethnic groups in Brazil.

Some limitations of this study need to be discussed. Measuring race/ethnicity in Brazil is challenging [18]. The aggregation of racial categories is necessary because of the wide range of

mixed races from "darker to lighter Mixed Race". This may lead to misclassification as light Mixed Race may classify themselves as Whites and dark Mixed Race as African descents. Brazilian government policies to reduce ethnic inequality includes positive discrimination, i.e. university entry quotas for African descents and Mixed Race [40]. This may have shifted the way Brazilians have self-assessed their race/ethnicity [41]. East Asian descents and Indigenous populations are minority groups in the Brazilian population leading to a smaller sample than Whites, African descents and Mixed Race, which led to larger confidence intervals. While classifying participants into Whites and non-Whites may reduce misclassification it obscures the relevant differences. The cross-sectional design precludes establishing a cause-effect relationship. However, it is more logical to assume that race/ethnicity determines experience of dental caries than the reverse. Race/ethnicity is established at birth; and caries in the permanent dentition starts at age of 6 years. In addition, there is not any clear evidence of racial or genetic variations as determining factors of experience of dental caries. On the contrary, there is strong evidence of ethnic differences in relation to exposure to the risk factors associated with experience of dental caries.

In conclusion, data analysis of the SBBrasil 2010 demonstrated that Whites have benefited more from the significant reduction in experience of dental caries in 15 to 19 year old Brazilians, as compared with African descents and Mixed Race. Education and income fully explained ethnic inequalities in experience of dental caries between Whites and African descents, and largely explained inequalities between Whites and Mixed Race.

Author Contributions

Conceived and designed the experiments: AMAD EFF VEG WM. Performed the experiments: AMAD EFF VEG WM. Analyzed the data: AMAD WM. Contributed reagents/materials/analysis tools: AMAD WM. Wrote the paper: AMAD EFF VEG WM.

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4.3   Artigo 3

4.3.1 Iniquidade da cárie dentária entre diferentes grupos étnicos de adolescentes no Brasil no período de 2003 e 2010 – Resumo

Introdução: Este estudo teve como objetivo avaliar a iniquidade de raça/etnia na experiência de cárie dentária, cárie não tratada, dentes perdidos e restaurados entre adolescentes brasileiros com idade entre 15 a 19 anos, em 2003 e 2010.

Métodos: Dados de experiência de cárie dentária (Índice CPOD) do Projeto SB Brasil 2003 (n=16.833) e 2010 (n=5.367) foram analisados incluindo a prevalência, regressão logística e teste qui-quadrado.

Resultados: Em 2003, os Negros tiveram 19% menos chance, e em 2010, 32% mais chance de ter experiência de cárie do que os Brancos. Enquanto em 2003, os Pardos e Brancos tiveram chance similar de ter experiência de cárie, em 2010, os Pardos tiveram 69% mais chance de ter experiência de cárie que os Brancos. Uma redução significativa na prevalência de cárie não tratada foi observada, porém, os Negros, Pardos e Indígenas tiveram, significantemente, mais chance de ter cárie não tratada que os Brancos, em 2010. Houve uma redução na prevalência de dentes perdidos, porém, em 2003, os Negros tiveram 21% e os Pardos 59% mais chance de terem dentes perdidos que os Brancos, enquanto em 2010, os Negros tiveram 54% e os Pardos 76% mais chance de terem dentes perdidos que os Brancos. A redução da prevalência foi observada para dentes restaurados entre os Brancos (17,2%) e um aumento entre os Pardos (14,8%), sendo que os Pardos tiveram 21% mais chance de ter dentes restaurados que os Brancos. A experiência de cárie entre os Brancos reduziu, significantemente, em 19,4% entre 2003 e 2010, e cárie não tratada reduziu, significativamente, em 17,4% para os Indígenas e 15,5% para os Pardos, enquanto reduziu apenas 10,2% para os Brancos. Houve uma redução significativa para dentes perdidos entre todos os grupos, e uma redução para dentes restaurados de 17,2% para os Brancos e um aumento significativo de 14,8% para os Pardos.

Conclusão: Apesar da existência de políticas públicas de inclusão racial, programas sociais e em saúde, iniquidades raciais/étnicas na experiência de cárie, cárie não tratada, dentes perdidos e restaurados persistiu entre 2003 e 2010.

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4.3.2 Inequality of dental caries between different ethnic groups of adolescents in Brazil between 2003 and 2010 – Artigo completo.

Inequality of dental caries between different ethnic groups of adolescents in Brazil between 2003 and 2010

Dental caries between 2003 and 2010 in Brazil

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ABSTRACT

Introduction: This study aimed to assess race/ethnic inequalities in dental caries experience, untreated caries, missing and filled teeth among Brazilian aged 15 to 19 years in 2003 and 2010. **Methods:** Data from a National Oral Health Survey conducted in Brazil in 2003 (n=16,833) and 2010 (n=5,367) were analysed through prevalence, logistic regression, and chi-square tests. **Results:** In 2003, African descents were 19% less likely, and in 2010, 32% more likely to have caries experience than Whites. While in 2003 Mixed Race and Whites had similar likelihood of experiencing caries, in 2010 Mixed Race were 69% more likely to have caries experience than Whites. A larger reduction in the prevalence of untreated caries was observed, but African descents, Mixed Race and Indigenous descents were significantly more likely to have untreated caries than Whites in 2010. Missing teeth prevalence has reduced but in 2003, African descents were 21% and Mixed Race 59% more likely to have missing teeth than Whites, while in 2010, African descents were 54% and Mixed Race 76% more likely to have missing teeth than Whites. A prevalence reduction was observed in filled teeth in Whites (17.2%) and an increase in Mixed Race (14.8%), being the Mixed Race 21% more likely to have filled teeth than Whites. Whites experience of caries has significantly decreased by 19.4% between 2003 and 2010, and untreated dental caries reduced significantly by 17.4% for Indigenous descents and 15.5% for Mixed Race, while decreased only 10.2% for Whites. Missing teeth significantly decrease between all groups and filled teeth had a reduction of 17.2% for Whites and a significant rise by 14.8% for Mixed Race. **Conclusions:** Despite the existing public policies for racial inclusion, health, and social programmes, race/ethnic inequalities in caries experience, untreated dental caries, missing and filled teeth persisted between 2003 and 2010.

Key-words: Caries, Disparities, Epidemiology, Public Health, Diversity

INTRODUCTION

Inequalities in the use of health services are found worldwide [1, 2]. Regardless of the financing and delivery mechanisms for health care in each country, inequalities in access are found in developed and developing countries [3-6], according to age, gender, ethnicity and socioeconomic position such as family income and education [7-9]. The approach to health inequalities is needed so the health service can meet the population needs [2, 6].

It has been suggested in the literature that the race and ethnicity of a person may determine their oral health status [10-12]. There is a considerable amount of literature on the utility of race and ethnicity as concepts [13-15]. 'Race' and 'ethnicity' are terms commonly used, with similar characteristics but subtle differences. 'Race' typically refers to physical features, such as skin colour or hair texture, which may reflect a person's ancestry; and examples of categories that are commonly used to describe race include White, African descents, or Asian descents. 'Ethnicity' is a complex term used to describe perceived social groupings based on a sense of belonging, place of origin, and other factors such as language, religion, and sometimes race [14, 16]. Assessing ethnicity is difficult, and numerous proxy measures are used to capture its various components. For the purposes of this study, 'Ethnicity' and 'Race' will be viewed as synonyms. Self-reported ethnicity captures both the shared experiences/culture of an individual and their self-identity [15, 16].

Dental caries is the most prevalent oral chronic disease, affecting billions of people worldwide [17]. The association between race/ethnicity, dental caries experience, untreated dental caries and missing and filled teeth is not well-defined. The coverage of the health care service has an effect over health inequalities [3, 18]. However, individuals from disadvantaged groups are more likely to have unmet needs and less

likely to receive dental care than those in better social conditions [6, 19]. The literature showed consistently that minority groups had a higher prevalence of dental caries experience [12, 20-35]. Race/ethnic inequalities in health care access were found in United States, Mexico, Chile, Brazil, Australia and across European Countries [18, 36-40]. In the United States, trends in access to dental services show higher use for White most value income groups since the 1930s [8]. The association between race/ethnicity and oral health relates to multiple points from developing the disease to possible entry into the health care system to treatment receipt, to treatment outcome [41].

Studies have confirmed the inequality of dental caries and access to dental treatment in Brazil [21, 33, 42, 43]. Equity must be a priority in the planning of health actions [21], and race/ethnic inequalities in oral health may be used to assess ongoing public policies, actions and/or to inform new oral health interventions [21, 42]. Health programmes demand selective information for exploring inequalities in the experience of disease so that their proposals do not inadvertently damage health or reinforce inequalities. A continuous monitoring of oral health may contribute to improved initiatives aimed at reducing levels of caries without enlarging the gap in the burden of disease [21].

This study aimed to assess race/ethnicity inequalities in dental caries experience, untreated dental caries, missing and filled teeth among Brazilian adolescents aged 15 to 19 years in 2003 and 2010.

METHODS

This article analyzes comparable data from two National Oral Health Survey conducted in Brazil in 2003 (SBBrasil 2003) [44] and 2010 (SBBrasil 2010) [45]. Both studies adopted a cross-sectional survey design and included a representative sample of

young adults aged 15 to 19 years. Participants were selected using multi-stage random sampling stratified approach by the five Brazilian macro-regions. Proportional representation was adopted. Trained and calibrated dentists conducted the oral examinations using the WHO Protocol [46]. The DMFT index components (untreated dental caries, filled and missing teeth) were used to assess dental caries and unmet needs. Following the clinical examination, participants answered a supervised structured questionnaire, designed especially for the research. A handheld Personal Digital Assistant (PDA model P550) was used for data collection. The questionnaire included questions on socio-demographic factors (age, sex, race/ethnicity, years of education and family income) and oral health status. Age was assessed in complete years. Race/ethnicity was self-assigned into the five Brazilian census classification as White, Black, Yellow, Brown, and Indigenous [47] and modified to White, African Descent, East Asian descent, Mixed Race (those with mixed racial ancestry, known as *"pardos"*) and Indigenous descent.

Detailed information on the sampling procedure can be found elsewhere [48]. The SBBrasil 2003 (*Conselho Nacional de Etica em Pesquisa* - approval ref. 581/2000) and 2010 (*Conselho Nacional de Etica em Pesquisa* - approval ref. 15,498/2010) followed the requirements of the Declaration of Helsinki and was approved by the Brazilian Ethics Committee.

Statistical analysis

Data was analyzed using IBM SPSS Statistics 18.0. The prevalence of dental caries experience, untreated dental caries, filled and missed teeth were calculated by reference to ethnic group and chi-square tests performed to verify whether there was a significant difference between the frequencies observed in 2003 and 2010. The SBBrasil 2003 included a sample of 16,833 participants and the SBBrasil 2010

included a sample of 5,445 participants aged 15 to 19 years. Thirty-seven individuals were excluded from data analysis of the SBBrasil 2003 (n=37; 0.22%) and 78 (1.43%) individuals were excluded from the SBBrasil 2010 analysis due to missing information on the outcome variable.

The *post-hoc* sample calculation demonstrated that the minimum sample size needed to provide 80% statistical power to enable the identification of an odds ratio of 1.5 was estimated to be 822 [44, 45, 48]. The calculation assumed 50% of the unexposed population and 60% of the exposed population to have the outcome of interest: equal to 0.05, and   equal to 0.20. Therefore, the sample size of both databases provides sufficient statistical power to test the hypothesis.

Further data analysis were carried out to assess race/ethnicity inequalities of dental caries experience, untreated dental caries, filled and missing teeth. Simple logistic regression analyses were carried out to assess the unadjusted association between each of the explanatory variables (race/ethnicity, sex and age), and the Decayed, Missing, and Filled Teeth Index for permanent dentition (DMFT Index), used to measure dental caries experience, and the components of the index used to measure untreated dental caries, missing and filled teeth. In accordance with the lax criterion [49], explanatory variables that were not statistically significantly related to the outcome at the level of 0.20 were excluded at this stage. Following this, hierarchical modelling [50] was carried out and the variables were sequentially included as follows: race/ethnicity, sex, and age. Odds Ratios (OR) were reported and the 95% confidence interval was considered.

RESULTS

Frequency distribution of demographic characteristics of the SBBrasil 2003 and 2010 samples are shown in Table 1. Female adolescents aged 15 years were more prevalent in 2003 and 2010 samples. The experience of dental caries, untreated dental caries, and missing teeth has reduced significantly from 89.2% to 76.9%, 65.7% to 54.0%, and 38.9% to 20.5%, respectively. Filled teeth slightly reduce from 51.8% to 49.8% in the total sample of 15 to 19 year old Brazilians between 2003 and 2010. A significant difference in the distribution of dental caries experience, untreated dental caries, missing and filled teeth among race/ethnic groups was observed. Among the ethnic groups, dental caries experience and missing teeth reduced in prevalence between all race/ethnic groups. African descents and Mixed Race had significantly more missing teeth than Whites in 2003 and 2010; and African descents, Mixed Race, and Indigenous descents had significantly less filled teeth than Whites in 2003 and 2010.

African descents were 19% less likely to have experience of dental caries than Whites in 2003 while in 2010, African descents were 32% more likely to have experience of dental caries than Whites. Also, while in 2003 Browns and Whites had similar likelihood of experiencing caries, in 2010 Browns were 69% more likely to have experience of dental caries than Whites. Prevalence of untreated dental caries decrease between Whites from 2003 to 2010, however, in 2003, African descents were 38% and Mixed Race 93% more likely to have untreated dental caries than Whites, and in 2010, African descents were 90% and Mixed Race 111% more likely to have untreated dental caries than Whites. In 2003 African descents were 21% and Mixed Race 59% more likely to have missing teeth than Whites, while in 2010 African descents were 54% and Mixed Race 76% more likely to have missing teeth than Whites. In 2003 African descents and

Mixed Race were 58% and Indigenous descents were 81% less likely to have filled teeth than Whites, while in 2010, African descents were 33%, Mixed Race 15% and Indigenous descents 65% less likely to have filled teeth than Whites.

Furthermore, Whites experience of dental caries has significantly decreased by 19.4% between 2003 and 2010, while for African descents, Mixed Race, and Indigenous descents decreased by 11.2%, 9.7%, and 13.8%, respectively. Concerning 2003 and 2010, untreated dental caries reduced significantly by 17.4% for Indigenous descents and 15.5% for Mixed Race, while decreased only 10.2% for Whites. Missing teeth had more than 50% significantly decrease between Whites, East Asian descents, and Indigenous descents, while among African descents and Mixed Race decrease by 39.8% and 44.7%, respectively. Filled teeth had a reduction by 17.2% for Whites between 2003 and 2010, and a significant rise by 14.8% for Mixed Race (Table 2).

Table 1. Sample characteristics by race/ethnicity in 15 to 19 years old Brazilians in 2003 and 2010.

Characteristics		Sample	White	African descents	East Asian descents	Mixed Race	Indigenous descents
SB BRASIL 2003		16796 (100%)	7071 (42.1%)	1686 (10.0%)	501 (3.0%)	7369 (43.9%)	169 (1.0%)
Age	15 years	4785 (28.5%)	1987 (28.1%)	492 (29.2%)	145 (28.9%)	2127 (28.9%)	34 (20.1%)
	16 years	3312 (19.7%)	1428 (20.2%)	330 (19.6%)	100 (20.0%)	1416 (19.2%)	38 (22.5%)
	17 years	2962 (17.6%)	1248 (17.6%)	306 (18.1%)	102 (20.4%)	1260 (17.1%)	46 (27.2%)
	18 years	2686 (16.0%)	1123 (15.9%)	262 (15.5%)	72 (14.4%)	1209 (16.4%)	20 (11.8%)
	19 years	3051 (18.2%)	1285 (18.2%)	296 (17.6%)	82 (16.4%)	1357 (18.4%)	31 (18.3%)
Sex	Male	6995 (41.6%)	2888 (40.8%)	768 (45.6%)	196 (39.1%)	3080 (41.8%)	63 (37.3%)
	Female	9801 (58.4%)	4183 (59.2%)	918 (54.4%)	305 (60.9%)	4289 (58.2%)	106 (62.7%)
Dental caries experience	= 0 (free of caries)	1813 (10.8%)	762 (10.8%)	223 (13.2%)	50 (10.0%)	756 (10.3%)	22 (13.0%)
	1	14983 (89.2%)	6309 (89.2%)	1463 (86.8%)	451 (90.0%)	6613 (89.7%)	147 (87.0%)
Untreated dental caries	= 0 (free of caries)	5765 (34.3%)	2948 (41.7%)	575 (34.1%)	204 (40.7%)	1997 (27.1%)	41 (24.3%)
	1	11031 (65.7%)	4123 (58.3%)	1111 (65.9%)	297 (59.3%)	5372 (72.9%)	128 (75.7%)
Missing teeth	= 0 (no missing tooth)	10262 (61.1%)	4697 (66.4%)	1056 (62.6%)	292 (58.3%)	4120 (55.9%)	97 (57.4%)
	1	6534 (38.9%)	2374 (33.6%)	630 (37.4%)	209 (41.7%)	3249 (44.1%)	72 (42.6%)
Filled teeth	= 0 (no fillings)	8094 (48.2%)	2577 (36.4%)	970 (57.5%)	185 (36.9%)	4236 (57.5%)	126 (74.6%)
	1	8702 (51.8%)	4494 (63.6%)	716 (42.5%)	316 (63.1%)	3133 (42.5%)	43 (25.4%)
SB BRASIL 2010		5367 (100%)	2177 (40.6%)	586 (10.9%)	103 (1.9%)	2453 (45.7%)	48 (0.9%)
Age	15 years	1438 (26.8%)	552 (25.4%)	167 (28.5%)	29 (28.1%)	672 (27.4%)	18 (37.5%)
	16 years	973 (18.1%)	404 (18.6%)	85 (14.5%)	18 (17.5%)	458 (18.7%)	8 (16.7%)
	17 years	977 (18.2%)	392 (18.0%)	100 (17.1%)	25 (24.3%)	451 (18.4%)	9 (18.7%)
	18 years	995 (18.6%)	419 (19.2%)	110 (18.8%)	14 (13.6%)	444 (18.1%)	8 (16.7%)
	19 years	984 (18.3%)	410 (18.8%)	124 (21.1%)	17 (16.5%)	428 (17.4%)	5 (10.4%)

Sex	Male	2452 (45.7%)	1014 (46.6%)	265 (45.2%)	43 (41.7%)	1101 (44.9%)	29 (60.4%)
	Female	2915 (54.3%)	1163 (53.4%)	321 (54.8%)	60 (58.3%)	1352 (55.1%)	19 (59.6%)
Dental caries experience	= 0 (free of caries)	1240 (23.1%)	611 (28.1%)	134 (22.9%)	17 (16.5%)	466 (19.0%)	12 (25.0%)
	1	4127 (76.9%)	1566 (71.9%)	452 (77.1%)	86 (83.5%)	1987 (81.0%)	36 (75.0%)
Untreated dental caries	= 0 (free of caries)	2471 (46.0%)	1233 (56.6%)	239 (40.8%)	40 (38.8%)	941 (38.4%)	18 (37.5%)
	1	2896 (54.0%)	944 (43.4%)	347 (59.2%)	63 (61.2%)	1512 (61.6%)	30 (62.5%)
Missing teeth	= 0 (no missing tooth)	4265 (79.5%)	1832 (84.2%)	454 (77.5%)	83 (80.6%)	1855 (75.6%)	41 (85.4%)
	1	1102 (20.5%)	343 (15.8%)	132 (22.5%)	20 (19.4%)	598 (24.4%)	7 (14.6%)
Filled teeth	= 0 (no fillings)	2696 (50.2%)	1026 (47.1%)	334 (57.0%)	44 (42.7%)	1257 (51.2%)	35 (72.9%)
	1	2671 (49.8%)	1151 (52.9%)	252 (43.0%)	59 (57.3%)	1196 (48.8%)	13 (27.1%)

Table 2. Prevalence, odds ratios and variation of prevalence of dental caries experience, untreated dental caries, missing and filled teeth by race/ethnicity on 15 to 19 years old Brazilians in 2003 and 2010.

Outcome	Self-reported race/ethnic groups	SB Brasil 2003		SB Brasil 2010		%[b]
		N (%)	OR[a] (95% CI)	N (%)	OR[a] (95% CI)	
Dental caries experience	White	6309 (89.2)	1.00 [Reference]	1566 (71.9)	1.00 [Reference]	- 19.4***
	African descents	1463 (86.8)	0.81 [0.69-0.95]*	452 (77.1)	1.32 [1.07-1.64]*	- 11.2***
	East Asian descents	451 (90.0)	1.10 [0.81-1.49]	86 (83.5)	2.00 [1.18-3.41]*	- 7.2
	Mixed Race	6613 (89.7)	1.06 [0.95-1.18]	1987 (81.0)	1.69 [1.47-1.94]*	- 9.7***
	Indigenous descents	147 (87.0)	0.76 [0.48-1.21]	36 (75.0)	1.27 [0.65-2.48]	- 13.8*
Untreated dental caries	White	4123 (58.3)	1.00 [Reference]	944 (43.4)	1.00 [Reference]	-25.6*
	African descents	1111 (65.9)	1.38 [1.24-1.55]***	347 (59.2)	1.90 [1.58-2.30]***	-10.2**
	East Asian descents	297 (59.3)	1.05 [0.87-1.26]	63 (61.2)	2.07 [1.38-3.11]***	3.2
	Mixed Race	5372 (72.9)	1.93 [1.80-2.06]***	1512 (61.6)	2.11 [1.87-2.37]***	-15.5***
	Indigenous descents	128 (75.7)	2.23 [1.56-3.18]***	30 (62.5)	2.24 [1.24-4.04]**	-17.4*
Missing Teeth	White	2374 (33.6)	1.00 [Reference]	345 (15.8)	1.00 [Reference]	-53.0***
	African descents	630 (37.4)	1.21 [1.08-1.35]***	132 (22.5)	1.54 [1.22-1.93]***	-39.8***
	East Asian descents	209 (41.7)	1.45 [1.20-1.75]***	20 (19.4)	1.31 [0.79-2.18]	-53.5***
	Mixed Race	3249 (44.1)	1.59 [1.48-1.70]***	598 (24.4)	1.76 [1.52-2.05]***	-44.7***
	Indigenous descents	72 (42.6)	1.44 [1.05-1.97]*	7 (14.6)	1.05 [0.46-2.38]	-65.7***
Filled Teeth	White	4494 (63.9)	1.00 [Reference]	1151 (52.9)	1.00 [Reference]	-17.2***
	African descents	716 (42.5)	0.42 [0.38-0.47]***	252 (43.0)	0.67 [0.56-0.80]***	1.9
	East Asian descents	316 (63.1)	0.98 [0.81-1.19]	59 (57.3)	1.21 [0.81-1.81]	-9.2
	Mixed Race	3133 (42.5)	0.42 [0.39-0.45]***	1196 (48.8)	0.85 [0.76-0.96]**	14.8***
	Indigenous descents	43 (25.4)	0.19 [0.13-0.27]***	13 (27.1)	0.35 [0.19-0.67]**	6.7

[a] Logistic regression models were adjusted for sex and age, and odds ratios (OR) reported.

[b] Chi-square test

* $p < 0.05$

** $p < 0.01$

***$p < 0.001$

DISCUSSION

The results of this study corroborated previous studies worldwide that postulated that Whites have significantly better oral health than other race/ethnic groups [12, 33, 42, 43, 51]. Experience of dental caries has reduced significantly from 89.2% to 76.9% in 15 to 19 year old Brazilians between 2003 and 2010 and between all race/ethnic groups. Comparison of the results of the national studies carried out in Brazil in 2003 and 2010 showed a larger reduction in prevalence of experience of dental caries in Whites (19.4%) than in Indigenous descents (13.8%), African descents (11.2%), Mixed Race (9.7%) and East Asian descents (7.2%). Furthermore, while in 2003 African descents were 19% less likely to have experience of dental caries than Whites, in 2010 African descents were 32% more likely to have experience of dental caries than Whites. Also, while in 2003 Mixed Race and Whites had similar likelihood of experiencing caries, in 2010 Mixed Race were 69% more likely to have experience of dental caries than Whites.

Untreated caries in permanent teeth is the most prevalent health condition, affecting 2.4 billion people worldwide [52] and represents a major biological, social and financial burden on individuals and health care systems [53]. Although untreated dental caries has reduced significantly among Whites, African descents, Mixed Race and Indigenous Descents in Brazilians adolescents between 2003 and 2010, inequality between these groups has increased. A larger reduction in the prevalence of untreated dental caries was observed in Whites (25.6%) than in Indigenous descents (17.4%), Mixed Race (15.5%) and African Descents (10.2%). In addition, missing and filled teeth have reduced significantly from 38.9% and 51.8% to 20.5% and 50.2%, respectively and a larger reduction was observed in the prevalence of missing teeth in East Asian descents (53.5%) and Whites (53.0%) than in Mixed Race (44.7%) and African

Descents (39.8%). Interestingly, a reduction was observed in the prevalence of filled teeth in Whites (17.2%) and an increase in Mixed Race (14.8%).

A health system is equitable, by definition, if the utilization of health services is based on need, regardless of individual or social differences [54]. However, the coverage of the heath care service and the design of interventions may wide, unintendedly, the inequalities due to the multiple factors related to oral health [3, 18]. In the past ten years, the Brazilian government has invested in health, education and income policies to reduce inequality. The Family Health Programme (FHP), which aimed to broaden access to public health services, especially in deprived areas, was introduced in Brazil in 1994, covering 94.3% of Brazilian municipalities and 50.8% of the population in 2010. The FHP offers a free community-based primary care and follows the principles of decentralisation, universality, and equity [55]. The Family Health Strategy (FHS), designed with the FHP, was proposed as a strategy for reorienting the care model, aiming to modify the approach focused on treatment. It is a preventive and comprehensive program that gives priority to health education and promotion and intended to reorganize the health service and primary care, based on the Brazilian Unified Health System (*Sistema Único de Saúde/SUS*) principles, universality and integrality. The purpose of the FHS program follows a high population coverage approach, greater access to service and comprehensive care to individuals in their family context [56]. In 2004, the Brazilian Ministry of Health launched the National Oral Health Policy (NOHP), the Smiling Brazil project, which consisted of a series of measures designed to ensure promotion, prevention and recovery of Brazilians oral health, fundamental to overall health and the quality of life of the population. The NOHP was projected to reorient assistance for health promotion and care, universalizing access to services by the transversal integration of oral health in the lines of care, and

contemplate all levels of care (integrality) and had as main objectives the implementation of oral health teams in the FHS, expansion and qualification of the activities and services offered, especially with the implementation of Specialized Dental Clinics and Dental Prosthesis Laboratories; and the feasibility of adding fluoride in public water supply [57].

Another national policy was established in 2009, the National Policy of Integral Health of the Black Population (*Política Nacional de Saúde Integral da População Negra*) [58], which recognized racism, ethnic-racial inequality, and institutional racism as social determinants of health conditions of the population. In order to fight racial inequities, this policy aimed to improve health information systems including the question of colour in the data collection instruments, develop actions to reduce indicators of maternal and child morbidity and mortality, and other important diseases and disorders in the black population; ensure and expand access of the black population to the actions and health services; and ensure the promotion of studies and research on racism and health of the black population [59, 60]. However, probably due to the short time of the implementation of this policy, impacts were not observed in our analysis, being race/ethnic inequalities present in the oral health of Brazilian adolescents between 15 to 19 years of age.

A study that conducted mediation analysis demonstrated that education and income may explain inequality of experience of dental caries between race/ethnic groups in Brazilian adolescents [11]. In 2003, the "*Bolsa Família*" (Family Allowance) programme was introduced, which is a major cash transfer programme targeting those in poverty. It aimed to promote an immediate relief of poverty, improving access to education and health care, and offering complementary social programmes to enable families to end their condition of vulnerability. Enrolment in the "Bolsa Família" programme is

conditional on school attendance up to 17 years and meeting primary health care conditions such as vaccination and nutritional surveillance [61]. In 2004, positive discrimination or social inclusion policies established racial quotas reserving 20% of available admissions in universities for students who self-identified as African descents [62]. However, Whites may have benefited more from the Brazilian economic development, social and health programmes than other groups or the programmes were still insufficient to reduce inequalities between the race/ethnic groups in Brazil.

Some limitations of this study need to be discussed. Measuring race/ethnicity in Brazil is challenging [13]. The aggregation of racial categories is necessary because of the wide range of mixed races from "darker to lighter Mixed Race". This may lead to misclassification as light Mixed Race may classify themselves as Whites and dark Mixed Race as African descents. Brazilian government policies to reduce ethnic inequality includes positive discrimination, i.e. university entry quotas for African Descents and Mixed Race [63] and the National Policy of Integral Health of the Black Population [58]. This may have shifted the way Brazilians have self-assessed their race/ethnicity [64]. East Asian descents and Indigenous are minority groups in the Brazilian population leading to a smaller sample than Whites, African descents and Mixed Race, which led to larger confidence intervals. While classifying participants into Whites and non-Whites may reduce misclassification, it obscures the relevant differences, and focusing on the groups allows the comprehension of the race/ethnicity inequality in Brazil in a historical and cultural context [65]. The cross-sectional design precludes establishing a cause-effect relationship. However, it is more plausible to assume that race/ethnicity determines dental caries experience, untreated dental caries, missing and filled teeth, than the reverse. Race/ethnicity is established at birth, and caries in the permanent dentition starts at the age of 6 years. In addition, there is

not any clear evidence of racial or genetic variations as determining factors of dental caries. On the contrary, there is strong evidence of ethnic differences in exposure to the risk factors associated with dental caries.

In conclusion, data analysis of the SBBrasil 2003 and 2010 confirmed the persistence of race/ethnic inequalities in dental caries experience, untreated dental caries, missing and filled teeth between 15 to 19 years old Brazilians. Despite the existing policies for racial inclusion, health, and social programmes, Whites have benefited more in the access of oral health services and from the significant reduction in dental caries.

AUTHOR CONTRIBUTIONS

Conceived and designed the experiments: AMAD EFF VEG WM. Performed the experiments: AMAD EFF VEG WM. Analyzed the data: AMAD WM. Contributed reagents/materials/analysis tools: AMAD WM. Wrote the paper: AMAD EFF VEG WM.

DATA AVAILABILITY STATEMENT

All data are public available from the Brazilian National Oral Health Survey (SBBrasil 2003 and 2010).

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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4.4 Artigo 4

4.4.1 Iniquidades entre diferentes grupos étnicos de adolescentes no Brasil relacionadas a cárie dentária não tratada, dentes perdidos e restaurados – Resumo

Introdução: Este estudo teve como objetivo avaliar as iniquidades de raça/etnia relacionadas a cárie dentária não tratada, dentes perdidos e restaurados entre adolescentes brasileiros com idade entre 15 a 19 anos em 2010. Além disso, testar se os indicadores socioeconômicos explicam as diferenças raciais/étnicas encontradas.

Métodos: Os dados do Projeto SB Brasil 2003 (n = 16.833) e 2010 (n = 5.367) foram analisados. A raça/etnia foi autodeclarada de acordo com o IBGE (Branco, Negro, Amarelo, Pardo e Indígena). A análise dos dados incluiu a prevalência, modelo conceitual hierárquico e mediação.

Resultados: Houve uma diminuição no número de cáries não tratadas, dentes perdidos e restaurados. No entanto, entre os grupos raciais/étnicos os Brancos tiveram um menor número de dentes cariados não tratados e os Pardos mais dentes perdidos. Análise de modelo conceitual hierárquico confirmou a associação entre cárie não tratada, dentes perdidos e restaurados, e raça/etnia. A razão de chance ajustada confirmou que em comparação com os Brancos, os Pardos foram 1,52 (95% CI: 1,30-1,77) vezes mais propensos a ter dentes perdidos e os Negros e Pardos tiveram 0,72 (95% CI: 0,59-0,86) e 0,89 (IC 95%: 0,79-1,01) vezes menos chance de ter dentes restaurados. Os resultados da análise de mediação confirmaram que educação e renda explicaram as iniquidades raciais/étnicas na cárie não tratada, dentes perdidos e restaurados entre Brancos, Negros e Pardos.

Conclusão: Apesar da existência de políticas públicas em saúde, educação e renda, há uma persistência nas iniquidades raciais/étnicas para cárie não tratada, dentes perdidos e restaurados entre adolescentes brasileiros. Os Brancos se beneficiaram

mais e apresentaram melhor condição de saúde bucal do que os outros grupos raciais/étnicos brasileiros.

- Artigo formatado de acordo com as normas da revista *PlosOne*

4.4.2. Inequality between ethnic groups of adolescents in Brazil related to untreated dental caries, missing and filled teeth – Artigo completo

Inequality between ethnic groups of adolescents in Brazil related to untreated dental caries, missing and filled teeth

Ethnic inequality of untreated dental caries in Brazil

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ABSTRACT

Introduction: This study aimed to assess race/ethnic inequalities in untreated dental caries, missing and filled teeth among Brazilian adolescents aged 15 to 19 years in 2010. Also, to test whether socioeconomic indicators explain ethnic differences in untreated dental caries, filled and missed teeth. **Methods:** Data from a National Oral Health Survey conducted in Brazil in 2010 (n=5,367) was analysed. Race/ethnicity was self-assigned and modified to White, African descents, East Asian descents, Mixed Race and Indigenous descents. Data analysis included prevalence, conceptual hierarchical modelling, and mediation. **Results:** There was a decrease in the number of untreated caries, missing and filled teeth. However, between the race/ethnic groups, Whites had less untreated caries and Mixed Race more missing teeth. Hierarchical conceptual modelling analysis confirmed the association between untreated caries, missing and filled teeth and race/ethnicity. Adjusted odds ratios confirmed that compared to Whites, Mixed Race were 1.52 (95% CI:1.30–1.77) times more likely to have missing teeth and African descents and Mixed Race were 0.72 (95% CI:0.59–0.86) and 0.89 (95% CI:0.79–1.01) times less likely to have filled teeth. Mediation analysis confirmed that education and income explained the race/ethnic inequalities in untreated caries, missing and filled between Whites, African descents and Mixed Race. **Conclusions:** Despite the existing health, education and income public policies, there is a persistence of race/ethnic inequalities in untreated caries, missing and filled teeth between Brazilian adolescents. Whites have benefited more and presented a better oral health condition than other Brazilian race/ethnic groups.

Key-words: Caries, Disparities, Epidemiology, Public Health, Diversity

INTRODUCTION

Inequalities in the use of health services are found worldwide [1, 2]. Regardless of the financing and delivery mechanisms for health care in each country, inequalities in access are found in developed and developing countries [3-6], according to age, gender, ethnicity and socioeconomic position such as family income and education [7-9]. The approach to health inequalities is needed so the health service can meet the population needs [2, 6].

It has been suggested in the literature that the race and ethnicity of a person may determine their oral health status [10-12]. There is a considerable amount of literature on the utility of race and ethnicity as concepts [13-15]. 'Race' and 'ethnicity' are terms commonly used, with similar characteristics but subtle differences. 'Race' typically refers to physical features, such as skin colour or hair texture, which may reflect a person's ancestry; and examples of categories that are commonly used to describe race include White, African descents, or Asian descents. 'Ethnicity' is a complex term used to describe perceived social groupings based on a sense of belonging, place of origin, and other factors such as language, religion, and sometimes race [14, 16]. Assessing ethnicity is challenging, and numerous proxy measures are used to capture its various components. For the purposes of this study, 'Ethnicity' and 'Race' will be viewed as synonyms. Self-reported ethnicity captures both the shared experiences/culture of an individual and their self-identity [15, 16].

The association between race/ethnicity, untreated dental caries and access to dental care is not well-defined. The coverage of the health care service has an effect over health inequalities [3, 17]. However, individuals from disadvantaged groups are more likely to have unmet needs and less likely to receive dental care than those in better social conditions [6, 18]. The association between race/ethnicity and oral health relates

to multiple points from developing the disease to possible entry into the health care system to treatment receipt to treatment outcome [19]. Moreover, minority racial/ethnic groups experience persistent disparities over time in oral health status and access and it is not clear whether these differences were due to race/ethnicity *per se* or due to confounding variables such as socioeconomic position ("SEP") as both are strongly related to dental caries and access to dental care [11, 20-28]. Data from other studies suggested that SEP may fully explain ethnic inequalities in oral health [11, 28-30] while other studies have reported the persistence of these inequalities after adjustment for confounding factors [24, 31].

This study aimed to assess race/ethnicity inequalities in untreated dental caries and use of oral health service among Brazilian adolescents aged 15 to 19 years in 2010. In addition, the study sought to test whether socioeconomic indicators fully explain ethnic differences in untreated dental caries, filled and missed teeth.

METHODS

This article analyses data from a National Oral Health Survey conducted in Brazil in 2010 (SBBrasil 2010) [32]. The SBBrasil 2010 study adopted a cross-sectional survey design and included a representative sample of young adults aged 15 to 19 years. Participants were selected using multi-stage random sampling stratified approach by the five Brazilian macro-regions. Proportional representation was adopted. Trained and calibrated dentists conducted the oral examinations using the WHO Protocol [33]. The DMFT index components (untreated dental caries, filled and missing teeth) were used to assess dental caries and access to dental care. Following the clinical examination, participants answered a supervised structured questionnaire, designed especially for the research. A handheld Personal Digital Assistant (PDA model P550)

was used for data collection. The questionnaire included questions on socio-demographic factors (age, sex, race/ethnicity, years of education and family income) and oral health perception. Age was assessed in complete years. Race/ethnicity was self-assigned into the five Brazilian census classification as White, Black, Yellow, Brown, and Indigenous [34] and modified to White, African Descent, East Asian descent, Mixed Race (those with mixed racial ancestry, known as "*pardos*") and Indigenous descent. The participant's 'years of education' was assessed regarding the number of successfully completed school years; and 'family income' was reported by the head of the family, considering the total income of the household in the month before the interview. Detailed information on the sampling procedure can be found elsewhere [35]. The SBBrasil 2010 (*Conselho Nacional de Ética em Pesquisa* - approval ref. 15,498/2010) followed the requirements of the Declaration of Helsinki and was approved by the Brazilian Ethics Committee.

Statistical analysis

Data was analyzed using IBM SPSS Statistics 18.0. The prevalence of untreated dental caries, filled and missed teeth were calculated by reference to the ethnic group. The SBBrasil 2010 included a sample of 5,445 participants aged 15 to 19 years. Seventy-eight (1.43%) individuals were excluded from the analysis due to missing information on the outcome variable.

Further data analysis were carried out on the SBBrasil 2010 data to assess race/ethnicity inequalities of untreated dental caries, filled and missing teeth. The *post-hoc* sample calculation demonstrated that the minimum sample size needed to provide 80% statistical power to enable the identification of an odds ratio of 1.5 was estimated to be 822 [36]. The calculation assumed 50% of the unexposed population and 60% of the exposed population to have the outcome of interest: equal to 0.05, and   equal

to 0.20. Therefore, the sample size (n=5,367) provides sufficient statistical power to test the hypothesis.

Data manipulation was minimal. The participants' 'years of education' were categorized into 'four or less years of education', 'five to eight years of education' and 'nine or more years of education'. Family income' was converted into U.S. dollars (US$1.00=R$1.76 in 2010) and categorized into 'equal to or less than US$142.00', 'US$143.00 to US$284.00', 'US$285.00 to US$852.00', 'US$853.00 to US$1,420.00' and 'US$1,421.00 or above'. For the mediation analysis, education was dichotomized in the median into 'eight or less years of education' and 'nine or more years of education', representing primary and higher education. Family income was categorized into 'equal to or less than US$284.00' and 'US$285.00 or above', representative of family income of at least one and more than one Brazilian minimum wage (Brazilian minimum wage in 2010 was R$510.00=US$289,77)

Simple logistic regression analyses were carried out to assess the unadjusted association between each of the explanatory variables (race/ethnicity, sex, age, years of education and family income) and untreated dental caries, missing and filled teeth. In accordance with the lax criterion [37], explanatory variables that were not statistically significantly related to the outcome at the level of 0.20 were excluded at this stage. Following this, conceptual hierarchical modelling [38] was carried out. The remaining variables were sequentially included as follows: (1) race/ethnicity, sex and age (2) race/ethnicity, sex, age plus years of education; (3) race/ethnicity, sex, age, years of education, plus family income. Odds Ratios (OR) were reported and the 95% confidence interval was considered. Attenuation of the OR was calculated using the formula (ORU-ORA)÷(ORU-1) [39], where ORU represents the odds ratio before

including the family income and ORA reflects the odds ratio after including years of education and family income in the model.

Mediation analysis included the four steps proposed by Baron and Kenny [40] to determine a mediator: (1) the predictor variable must be related to the outcome; (2) the predicted variable must be related to the potential mediator; (3) the mediator must be related to the outcome variable after controlling for the predictor variable; (4) if there is mediation, the relation of the predictor variable to the outcome variable will show reduced significance or effect size once the mediator is controlled. The mediation analysis was not performed for Indigenous descents due to the small sample size of this group (less than 1% of the total sample).

RESULTS

Frequency distribution of demographic and socioeconomic characteristics of the SBBrasil 2010 sample is shown in Table 1. From the total sample of 5,367 adolescents, 2,896 (54.0%) had untreated dental caries, 1,102 (20.5%) had missing teeth and 2,671 (49.8%) had filled teeth. The majority of the ethnic groups were female, had 15 years of age, nine or more years of education and family income of US$285 to US$852 monthly. Between the ethnic groups, the Whites had less untreated caries, and the Mixed Race individuals had more missing and filled teeth.

Table 1. Sample characteristics by race/ethnicity in 15 to 19 years old Brazilians in 2010.

Characteristics		Sample	White	African descents	East Asian descents	Mixed Race	Indigenous descents
SB BRASIL 2010		5367 (100%)	2177 (40.6%)	586 (10.9%)	103 (1.9%)	2453 (45.7%)	48 (0.9%)
Age	15 years	1438 (26.8%)	552 (25.4%)	167 (28.5%)	29 (28.1%)	672 (27.4%)	18 (37.5%)
	16 years	973 (18.1%)	404 (18.6%)	85 (14.5%)	18 (17.5%)	458 (18.7%)	8 (16.7%)
	17 years	977 (18.2%)	392 (18.0%)	100 (17.1%)	25 (24.3%)	451 (18.4%)	9 (18.7%)
	18 years	995 (18.6%)	419 (19.2%)	110 (18.8%)	14 (13.6%)	444 (18.1%)	8 (16.7%)
	19 years	984 (18.3%)	410 (18.8%)	124 (21.1%)	17 (16.5%)	428 (17.4%)	5 (10.4%)
Sex	Male	2452 (45.7%)	1014 (46.6%)	265 (45.2%)	43 (41.7%)	1101 (44.9%)	29 (60.4%)
	Female	2915 (54.3%)	1163 (53.4%)	321 (54.8%)	60 (58.3%)	1352 (55.1%)	19 (59.6%)
Education	4 years	200 (3.7%)	56 (2.6%)	34 (5.8%)	4 (3.9%)	103 (4.2%)	3 (6.2%)
	5-8 years	1798 (33.5%)	618 (28.4%)	236 (40.3%)	24 (23.3%)	901 (36.7%)	19 (39.6%)
	9 years	3357 (62.6%)	1498 (68.8%)	313 (53.4%)	75 (72.8%)	1445 (58.9%)	26 (54.2%)
	Missing information	*12* (0.2%)	*5* (0.2%)	*3* (0.5%)	*0* (0%)	*4* (0.2%)	*0* (0%)
Family Income	US$142	160 (3.0%)	36 (1.7%)	26 (4.4%)	4 (3.9%)	91 (3.7%)	3 (6.2%)
	US$143 - 284	686 (12.8%)	203 (9.3%)	104 (17.8%)	14 (13.6%)	359 (14.6%)	6 (12.5%)
	US$285 - 852	2621 (48.8%)	943 (43.3%)	307 (52.4%)	46 (44.7%)	1302 (53.1%)	23 (47.9%)
	US$853 - 1420	920 (17.1%)	456 (20.9%)	87 (14.8%)	16 (15.5%)	352 (14.3%)	9 (18.8%)
	US$1421	665 (12.4%)	406 (18.7%)	37 (6.3%)	10 (9.7%)	210 (8.6%)	2 (4.2%)
	Missing information	*315* (5.9%)	*133* (6.10%)	*25* (4.3%)	*13* (12.6%)	*139* (5.7%)	*5* (10.4%)
Untreated dental caries	= 0 (free of caries)	2471 (46.0%)	1233 (56.6%)	239 (40.8%)	40 (38.8%)	941 (38.4%)	18 (37.5%)
	1	2896 (54.0%)	944 (43.4%)	347 (59.2%)	63 (61.2%)	1512 (61.6%)	30 (62.5%)
Missing teeth	= 0 (no missing tooth)	4265 (79.5%)	1832 (84.2%)	454 (77.5%)	83 (80.6%)	1855 (75.6%)	41 (85.4%)
	1	1102 (20.5%)	343 (15.8%)	132 (22.5%)	20 (19.4%)	598 (24.4%)	7 (14.6%)
Filled teeth	= 0 (no fillings)	2696 (50.2%)	1026 (47.1%)	334 (57.0%)	44 (42.7%)	1257 (51.2%)	35 (72.9%)
	1	2671 (49.8%)	1151 (52.9%)	252 (43.0%)	59 (57.3%)	1196 (48.8%)	13 (27.1%)

There were statistically significant differences in the distribution of untreated dental caries, missing and filled teeth by age, sex, years of education and family income in the SBBrasil 2010 (Table 2). As expected, females were more likely to have missing and filled teeth. Participants with less than four years of education were 4.23 (95% CI 2.97-6.01) times and 2.02 (95% CI 1.47-2.79) times more likely to have untreated dental caries and missing teeth, respectively, than those with nine or more years of education. In addition, participants with less than four years of education were 51% less likely to have filled teeth than those with nine or more years of education. Participants with a family income of US$142.00 or less were 7.68 (95% CI 5.15-11.47) times and 5.88 (95% CI 3.82-9.06) times more likely to have untreated dental caries and missing teeth, respectively, than those with a family income of US$ 1,421.00 or above. Participants with a family income of US$142.00 or less were 36% less likely to have filled teeth than those with a family income of US$ 1,421.00 or above.

Table 2. Untreated dental caries, filled and missing teeth by demographic and socioeconomic characteristics among the sample of 15 to 19 years old Brazilians in 2010.

Characteristics	Untreated dental caries>0 (N=2896)		Missing teeth>0 (N=2671)		Filled teeth>0 (N=1102)	
	N(%)	OR[a] [95%CI]	N(%)	OR[a] [95%CI]	N(%)	OR[a] [95%CI]
Self-reported race/ethnicity						
White	944 (32.6%)	1	345 (31.3%)	1	1151 (43.1%)	1
African descents	347 (12%)	1.90 [1.58-2.28]***	132 (12.0%)	1.54 [1.23-1.93]***	252 (9.4%)	0.67 [0.56-0.80]***
East Asian descents	63 (2.2%)	2.06 [1.37-3.09]***	20 (1.8%)	1.28 [0.78-2.11]	59 (2.2%)	1.20 [0.80-1.78]
Mixed Race	1512 (61.6%)	2.10 [1.87-2.36]***	598 (54.3%)	1.71 [1.48-1.98]***	1196 (44.8%)	0.85 [0.76-0.95]**
Indigenous descents	30 (1.0%)	2.18 [1.21-3.93]**	7 (0.6%)	0.91 [0.40-2.04]	13 (0.5%)	0.33 [0.17-0.63]***
Sex						
Male	1302 (53.1%)	1	436 (39.6%)	1	1173 (43.9%)	1
Female	1594 (54.7%)	1.06 [0.96-1.19]	666 (60.4%)	1.37 [1.20-1.57]***	1498 (56.1%)	1.15 [1.04-1.28]**
Age						
15 years	746 (25.8%)	1 [reference]	197 (17.9%)	1 [reference]	616 (23.1%)	1 [reference]
16 years	530 (18.3%)	0.89 [0.75-1.04]	148 (13.3%)	0.37 [0.30-0.46]***	461 (17.3%)	0.57 [0.49-0.68]***
17 years	525 (18.1%)	0.98 [0.82-1.18]	215 (19.5%)	0.42 [0.34-0.53]***	508 (19.0%)	0.69 [0.58-0.83]***
18 years	555 (19.2%)	0.96 [0.80-1.14]	248 (22.5%)	0.66 [0.54-0.81]***	529 (19.8%)	0.83 [0.70-0.99]*
19 years	540 (18.6%)	1.04 [0.87-1.24]	294 (26.7%)	0.78 [0.64-0.95]*	557 (56.6%)	0.87 [0.73-1.04]
Education						
4 years	149 (5.1%)	4.23 [2.97-6.01]***	58 (5.3%)	2.02 [1.47-2.79]***	69 (2.6%)	0.49 [0.36-0.66]***
5-8 years	1181 (40.7%)	2.23 [1.98-2.51]***	440 (39.9%)	1.49 [1.30-1.72]***	789 (29.5%)	0.67 [0.60-0.75]***
9 years	1552 (53.6%)	1 [reference]	599 (54.4%)	1 [reference]	1807 (67.7%)	1 [reference]
Missing information	14 (0.5%)		5(0.4%)		6 (0.2%)	
Family Income						
US$142	122 (4.2%)	7.68 [5.15-11.47]***	54 (4.9%)	5.88 [3.82-9.06]***	63 (2.4%)	0.64 [0.45-0.90]*
US$143 – 284	471 (16.3%)	5.24 [4.16-6.61]***	169 (15.3%)	3.78 [2.71-5.25]***	304 (11.4%)	0.78 [0.63-0.97]*
US$285 – 852	1532 (52.9%)	3.37 [2.80-4.05]***	615 (55.8%)	3.54 [2.64-4.76]***	1317 (49.3%)	0.99 [0.83-1.17]
US$853 – 1420	416 (14.4%)	1.98 [1.60-2.44]***	157 (14.2%)	2.38 [1.71-3.30]***	493 (18.5%)	1.13 [0.93-1.38]
US$1421	196 (6.8%)	1 [reference]	53 (4.8%)	1 [reference]	336 (12.6%)	1 [reference]
Missing information	159 (5.5%)		54 (4.9%)		158 (5.9%)	

[a] Unadjusted logistic regression models and odds ratios (OR) reported with a 95% confidence interval
* p<0.05; ** p<0.01; ***p<0.001

Hierarchical conceptual modelling analysis (Table 3) confirmed the association between untreated dental caries, missing and filled teeth, and race/ethnicity. Adjusted odds ratios confirmed that African descents, East Asian descents, and Mixed Race were 1.44 (95% CI 1.19–1.75), 1.99 (95% CI 1.31–3.03) and 1.76 (95% CI 1.56–2.00) times more likely to have untreated dental caries than Whites, respectively. The difference in the likelihood of having untreated dental caries between Whites and Indigenous descents was not statistically significant after adjusting for years of education and family income. In addition, adjusted odds ratios confirmed that Mixed Race was 1.52 (95% CI 1.30–1.77) times more likely to have missing teeth than Whites, and African descents and Mixed Race were 0.72 (95% CI 0.59–0.86) and 0.89 (95% CI 0.79–1.01) times less likely to have filled teeth than Whites, respectively. The difference in the likelihood of having missing teeth between Whites and African, East Asian and Indigenous descents were not statistically significant after adjusting for years of education and family income. Similarly, the difference in the likelihood of having filled teeth between East Asian and Indigenous descents were not statistically significant.

The results of mediation analysis (Fig. 1), using the four steps proposed by Baron and Kenny [40] confirmed that race/ethnic inequalities of untreated caries, missing and filled teeth between Whites, African descents and Mixed Race were mediated through education and income. Since education as mediator was not associated with East Asian descents (independent variable), the mediation analysis was not possible to this group. Interestingly, race/ethnic inequalities of filled teeth between Whites and Mixed Race were fully mediated by education and income.

Table 3. Models for race/ethnic differences in untreated dental caries, filled and missing teeth among the sample of 15 to 19 years old Brazilians in 2010.

Outcome	Self-reported race/ethnic groups	Model 1[a] OR[b] (95% CI)	P value	Model 2[a] OR[b] (95% CI)	P value	Model 3[a] OR[b] (95% CI)	P value
Untreated dental caries	White	1.00 [Reference]		1.00 [Reference]		1.00 [Reference]	
	African descents	1.90 [1.58-2.30]	<0.001	1.68 [1.34-2.03]	<0.001	1.44 [1.19-1.75]	<0.001
	East Asian descents	2.07 [1.38-3.11]	<0.001	2.18 [1.44-3.29]	<0.001	1.99 [1.31-3.03]	0.001
	Mixed Race	2.11 [1.87-2.37]	<0.001	1.98 [1.76-2.23]	<0.001	1.76 [1.56-2.00]	<0.001
	Indigenous descents	2.24 [1.24-4.04]	0.008	2.06 [1.12-3.76]	0.019	1.76 [0.96-3.22]	0.067
Missing Teeth	White	1.00 [Reference]		1.00 [Reference]		1.00 [Reference]	
	African descents	1.54 [1.22-1.93]	<0.001	1.41 [1.12-1.78]	0.004	1.25 [0.99-1.58]	0.064
	East Asian descents	1.31 [0.79-2.18]	0.295	1.41 [0.84-2.34]	0.192	1.30 [0.78-2.18]	0.317
	Mixed Race	1.76 [1.52-2.05]	<0.001	1.67 [1.44-1.94]	<0.001	1.52 [1.30-1.77]	<0.001
	Indigenous descents	1.05 [0.46-2.38]	0.911	0.99 [0.43-2.24]	0.975	0.89 [0.39-2.02]	0.771
Filled Teeth	White	1.00 [Reference]		1.00 [Reference]		1.00 [Reference]	
	African descents	0.67 [0.56-0.80]	<0.001	0.71 [0.59-0.85]	<0.001	0.72 [0.59-0.86]	<0.001
	East Asian descents	1.21 [0.81-1.81]	0.357	1.22 [0.81-1.83]	0.335	1.24 [0.82-1.86]	0.310
	Mixed Race	0.85 [0.76-0.96]	0.008	0.88 [0.78-0.99]	0.035	0.89 [0.79-1.01]	0.051
	Indigenous descents	0.35 [0.19-0.67]	0.002	0.37 [0.19-0.70]	0.002	0.38 [0.19-0.70]	0.002

[a] Model 1 was adjusted for sex and age; Model 2 was adjusted for sex, age plus years of education; Model 3 was adjusted for sex, age, years of education plus family income.
[b] Logistic regression models were fitted and odds ratios (OR) reported.

Figure 1. Representation of the mediation analysis of race/ethnicity, education, income and untreated dental caries, missing and filled teeth using the four steps proposed by Baron and Kenny [40].
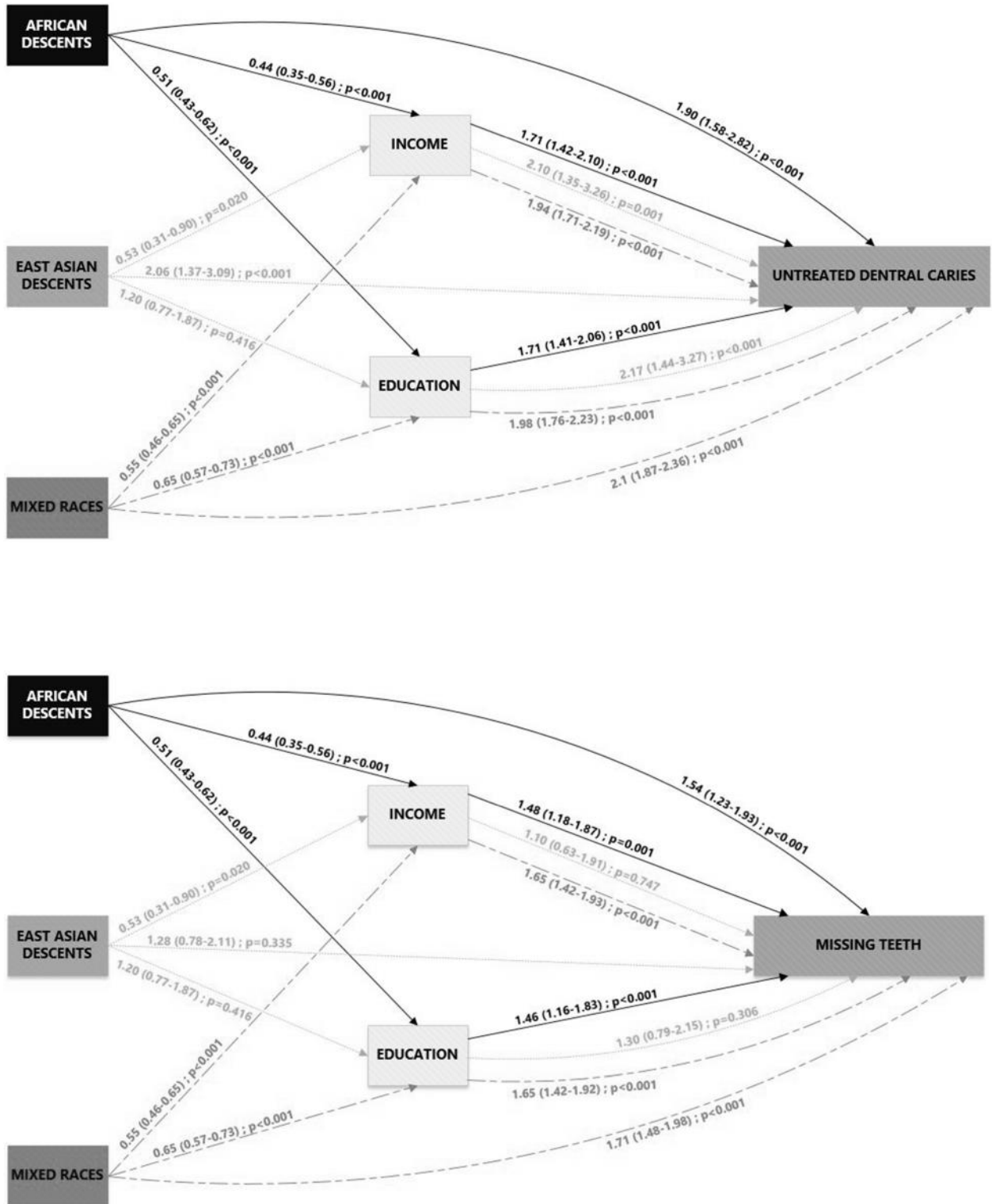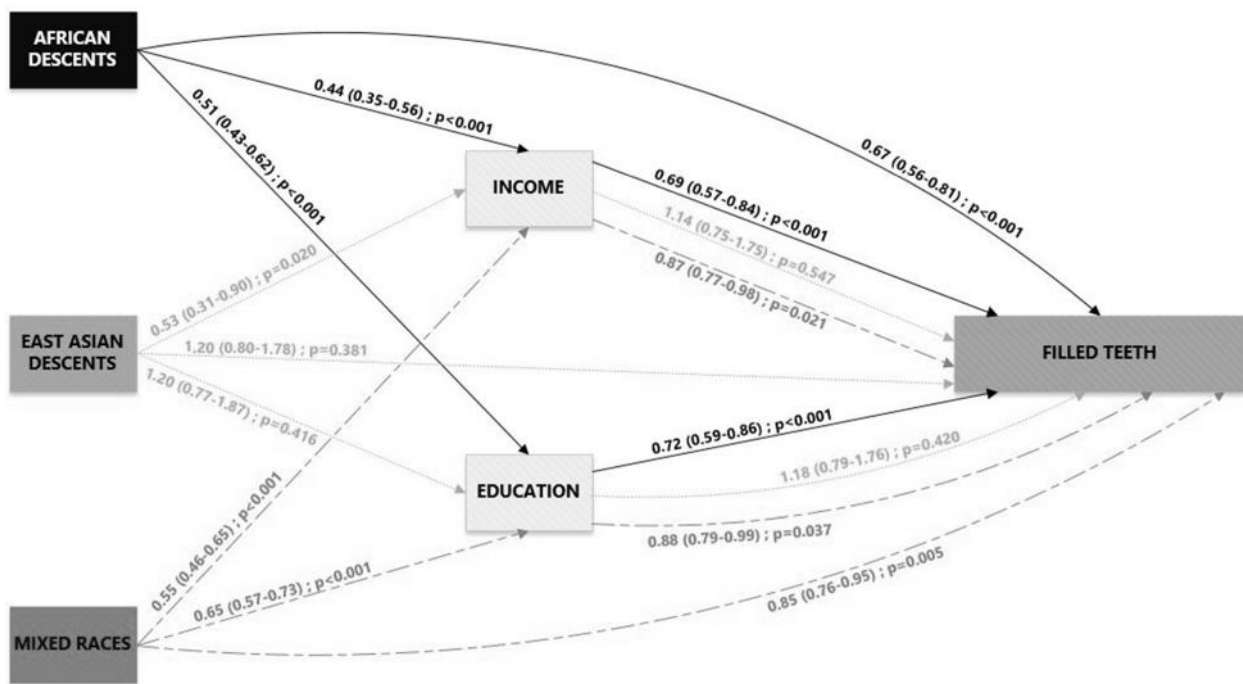
DISCUSSION

The unadjusted results of this study corroborated previous studies worldwide that postulated that Whites have significantly less untreated dental caries than other race/ethnic groups [12, 24, 41-43]. Wu et al. [26] also conducted a hierarchical analysis and their results supported our findings. Mediation analysis with dental caries experience conducted in a previous study [11] stated that income and education fully explained ethnic inequalities between Whites and African descents and largely explained inequalities between Whites and Mixed Race. Our results confirmed the well-established association between untreated dental caries, missing and filled teeth, and income and education worldwide [28] and in the Brazilian population [44].

Untreated caries in permanent teeth is the most prevalent health condition, affecting 2.4 billion people worldwide [45] and represents a major biological, social and financial burden on individuals and health care systems [46]. Although untreated dental caries

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has reduced significantly among Whites, African descents, Mixed Race and Indigenous Descents in 15 to 19-year-old Brazilians between 2003 and 2010, inequality between these groups has increased. Untreated dental caries has reduced significantly from 65.7% to 54.0% in 15 to 19-year-old Brazilians between 2003 and 2010. Comparison of the results of the national studies carried out in Brazil in 2003 and 2010 showed a larger reduction in the prevalence of untreated dental caries in Whites (25.6%) than in Indigenous descents (17.4%), Mixed Race (15.5%) and African Descents (10.2%). Also, missing and filled teeth have reduced significantly from 38.9% and 51.8% to 20.5% and 50.2%, respectively, in 15 to 19-year-old Brazilians between 2003 and 2010. Comparison of the results showed a larger reduction in the prevalence of missing teeth in East Asian descents (53.5%) and Whites (53.0%) than in Mixed Race (44.7%) and African Descents (39.8%). Interestingly, a reduction was observed in the prevalence of filled teeth in Whites (17.2%) and an increase in Mixed Race (14.8%).

Mediation analysis demonstrated that education and family income might partially explain inequality of untreated caries and missing teeth between Whites and African descents, and Mixed Race. Also, income and education partially mediated inequality of filled teeth between Whites and African descents and fully explained inequalities between Whites and Mixed Race. Education and income significantly attenuated the likelihood that African descents, East Asian Descent, and Mixed Race would have untreated dental caries when compared to Whites.

In a systematic review, authors [47] found inconsistent effects of income inequality in Brazil, with some supportive evidence in studies from Chile, Russia, and Taiwan. However, among wealthy nations, the evidence suggests that income inequality is not associated with population health differences.

In the past ten years, the Brazilian government has invested in education, income health policies to reduce inequality. In 2003, the "*Bolsa Família*" (Family Allowance) programme was introduced, a major cash transfer programme aiming to promote an immediate relief of poverty, improving access to education and health care, and offering complementary social programmes to enable families to end their condition of vulnerability. Enrolment in the "Bolsa Família" programme is conditional on school attendance up to 17 years and meeting primary health care conditions such as vaccination and nutritional surveillance [48]. In 2004, positive discrimination or social inclusion policies established racial quotas reserving 20% of available admissions in universities for students who self-identified as African descents [49]. Another national policy was established in 2009, the National Policy of Integral Health of the Black Population (*Política Nacional de Saúde Integral da População Negra*) [50], which recognized racism, ethnic-racial inequality, and institutional racism as social determinants of health conditions of the population. In order to fight racial inequities, this policy aimed to improve health information systems including the question of colour in the data collection instruments, develop actions to reduce indicators of maternal and child morbidity and mortality, and other important diseases and disorders in the black population; ensure and expand access to the black population to the actions and health services; and guarantee the promotion of studies and research on racism and health of the black population [51, 52].

Is important to recognize that income inequality is a characteristic of a social system, whereas income is a characteristic of an individual person. As social system characteristic, the determinants of income inequality are different from those of individual income [47]. Social and economic policies that affect income distribution may have important consequences for the health of the population, and reducing income

inequality by raising the incomes of more disadvantaged people could improve the health of poor individuals, contribute to reducing health inequalities and increase average population health [47, 53]. Our results confirm the necessity of continuous investments of the Brazilian government in health, education and income policies to reduce inequalities since for oral health race/ethnic inequalities persisted between 2003 and 2010.

In 1994, the Family Health Programme (FHP) was introduced in Brazil and aimed to broaden access to public health services, especially in deprived areas, offering a free community-based primary care and follows the principles of decentralisation, universality, and equity [54], and in 2010, it covered 94.3% of Brazilian municipalities and 50.8% of the population. The Family Health Strategy (FHS), designed with the FHP, was proposed as a strategy for reorienting the care model, aiming to modify the approach focused on treatment. It is a preventive and comprehensive program that gives priority to health education and promotion and intended to restructure the health service and primary care, based on the Brazilian Unified Health System (*Sistema Único de Saúde/SUS*) principles [55]. In 2004, the Brazilian Ministry of Health launched the National Oral Health Policy (NOHP), the Smiling Brazil project, which consisted of a series of measures designed to ensure promotion, prevention, and recovery of Brazilians oral health, fundamental to overall health and the quality of life of the population. The NOHP was projected to reorient assistance for health promotion and care, universalizing access to services by the transversal integration of oral health in the lines of care, and contemplate all levels of care (integrality) and had as main objectives the implementation of oral health teams in the FHS, expansion and qualification of the activities and services offered, especially with the implementation of Specialized Dental Clinics and Dental Prosthesis Laboratories; and the feasibility of

adding fluoride in public water supply [56]. Despite the health policies ongoing in Brazil, ou results demonstrated a persistent race/ethnic inequality in oral health, in which Whites have a better oral health condition than other race/ethnic groups.

Some limitations of this study need to be discussed. Measuring race/ethnicity in Brazil is challenging [13]. The aggregation of racial categories is necessary because of the wide range of mixed races from "darker to lighter Mixed Race". This may lead to misclassification as light Mixed Race may classify themselves as Whites and dark Mixed Race as African descents. Brazilian government policies to reduce ethnic inequality includes positive discrimination, i.e. university entry quotas for African Descents and Mixed Race [49] and the National Policy of Integral Health of the Black Population [50]. This may be shifting the way Brazilians self-assessed their race/ethnicity [57]. East Asian descents and Indigenous populations are minority groups in the Brazilian population leading to a smaller sample than Whites, African descents, and Mixed Race, which resulted in larger confidence intervals. While classifying participants into Whites and non-Whites may reduce misclassification, it obscures the relevant differences, and focusing on the groups allows the comprehension of the race/ethnicity inequalities in Brazil in a historical and cultural context [58]. The cross-sectional design precludes establishing a cause-effect relationship. However, it is more logical to assume that race/ethnicity determines untreated dental caries, missing and filled teeth, than the reverse. Race/ethnicity is established at birth, and caries in the permanent dentition starts at the age of 6 years. Also, there is not any clear evidence of racial or genetic variations as determining factors of dental caries. On the contrary, there is strong evidence of ethnic differences in exposure to the risk factors associated with dental caries.

In conclusion, data analysis of the SBBrasil 2010 confirmed the persistence of race/ethnic inequalities in untreated dental caries, missing and filled teeth between 15 to 19 years old Brazilians. Education and family income explained the inequalities in untreated dental caries, missing and filled teeth between Whites, African descents, and Mixed Race. Despite the existing health, education and income policies targeting to overcome inequalities, Whites have benefited more, and present a better oral health condition than other Brazilian race/ethnic groups.

AUTHOR CONTRIBUTIONS

Conceived and designed the experiments: AMAD EFF VEG WM. Performed the experiments: AMAD EFF VEG WM. Analyzed the data: AMAD WM. Contributed reagents/materials/analysis tools: AMAD WM. Wrote the paper: AMAD EFF VEG WM.

DATA AVAILABILITY STATEMENT

All data are public available from the Brazilian National Oral Health Survey (SBBrasil 2003 and 2010).

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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PARTE III

5 CONSIDERAÇÕES FINAIS

O caminho percorrido nesta etapa de minha vida acadêmica como aluna de um programa de doutorado foi desafiador e instigante, principalmente na escolha do tema. A ideia inicial seria trabalhar com iniquidades relacionadas a cárie dentária em uma amostra de adolescentes escolares de Belo Horizonte. No entanto, devido à possibilidade de analisar dados nacionais, gerando uma maior expectativa de retorno da pesquisa, optamos por utilizar dados do Levantamento das Condições de Saúde Bucal da População Brasileira (Projeto SB Brasil).

Com o intuito de uma maior possibilidade de divulgação dos estudos realizados e seus resultados, optamos pelo resumo em língua portuguesa dos artigos desenvolvidos.
As metodologias escolhidas para desenvolver esse trabalho, possibilitou-me refletir sobre o tema, com liberdade, embora tenha se constituído em um desafio constante. Discutir o tema raça/etnia é de natureza complexa, considerando-se que raça e muitas vezes a etnia são estabelecidas ao nascer, não se constituindo em características biológicas determinantes.

Ações para reduzir as iniquidades exigem identificação e avaliação dos grupos vulneráveis, a vontade e a viabilização de políticas públicas por parte do Estado, além do seu monitoramento. A existência de programas ou políticas na saúde pública, por si só, não evitam as iniquidades se os indivíduos envolvidos no processo não compreenderem a magnitude do problema e a proposta para combate-las. Confirmamos a existência e persistência de iniquidades em saúde bucal no Brasil, relacionadas à raça/etnia e, identificamos políticas que enfrentam as iniquidades em saúde, porém com pouca inserção e impacto na saúde bucal. Além disso, observamos a necessidade de desenvolver uma melhor categorização dos grupos raciais e étnicos, e inserir a variável raça/etnia nas pesquisas em saúde bucal em desenvolvimento no Brasil.

Durante o período do doutorado sanduiche, como aluna do *Barts and The London School of Medicine and Dentistry* da *Queen Mary, University of London*, sob a

supervisão do Prof. Dr. Wagner Marcenes, constatamos na literatura consultada que a raça/etnia como um determinante social em saúde, é pouco explorado no território brasileiro. Em face disso, e, após desenvolver uma revisão sistemática sobre o tema iniquidades raciais/étnicas e experiência de cárie dentária, resolvemos realizar os demais estudos aqui descritos.

Essa oportunidade de conhecer outros campos dos saberes, constituiu-se em uma experiência enriquecedora que instiga as minhas reflexões sobre o tema e me desafiam a buscar novos caminhos. Dessa experiência, tivemos como um dos resultados a publicação de um dos artigos que compõe essa tese.

Ao retornar à FO/UFMG, motivada pelo estudo do tema, desenvolvemos uma pesquisa de iniciação cientifica junto a uma estudante de graduação em Odontologia (FO/UFMG), por meio de uma revisão sistemática intitulada "Iniquidades raciais/étnicas em saúde entre Brasileiros" (*Ethnic/race inequalities in health among Brazilians: a systematic review*).

Embora a pesquisa ainda esteja em andamento, observamos pelos estudos realizados, a raça/etnia no Brasil compõe um determinante histórico e cultural, que direta ou indiretamente, afeta a saúde da população e dos indivíduos, sendo um tema pouco discutido, quando comparado a outros determinantes de saúde.

Ainda me foi dada a oportunidade, a convite da Profa. Dra. Ana Valéria M. Mendonça, coordenadora do Núcleo de Estudos em Saúde Pública (NESP) e do Laboratório de Informação e Comunicação em Saúde Coletiva da Universidade de Brasília (UnB), de ministrar uma oficina sobre Revisão Sistemática Mediada por Tecnologia. Durante essa oficina, conheci o Observatório de Saúde Indígena, coordenado pelo colega de doutorado Roberto Carlos de Oliveira e o Observatório de Saúde LGBT, coordenado pelo Dr. Edu Turte Cavadinha. Esta vivencia me propiciou novas indagações, confirmando a necessidade da continuidade de pesquisas objetivando combater as iniquidades em saúde relacionadas à raça/etnia e de populações vulneráveis ou minorias.

Portanto, considero este estudo realizado e apresentado como requisito parcial para conclusão do doutorado finalizado nos seus aspectos formais. Entretanto, ressalto que o principal resultado é a possibilidade de realizar novos estudos para analisar iniquidades em saúde presentes na população brasileira, ampliando o escopo dessa linha de pesquisa, objetivando minorar os efeitos das iniquidades nos indivíduos.

6 ATIVIDADES DESENVOLVIDAS

Descrição das atividades desenvolvidas durante o período de agosto de 2013 à abril de 2016:

- Julho de 2014: Introdução à Estatística, curso com carga horária de 30 horas
- Setembro de 2014 a Abril de 2015: Período de doutorado sanduíche em *Barts and The London School of Medicine and Dentistry da Queen Mary, University of London*, sob a supervisão do Prof. Dr. Wagner Marcenes, com bolsa CAPES/PDSE (ANEXO A);
- Novembro de 2014: Endnote for Medicine and Dentistry, curso com carga horaria de 4 horas
- Dezembro de 2014: Critical Thinking, curso com carga horaria de 3 horas
- Janeiro e fevereiro de 2015: Pronunciation & spoken skills for researchers, curso com carga horaria de 12 horas
- Janeiro de 2015: NOT All in the Mind, curso com carga horaria de 1 hora
- Junho de 2015: A importância da utilização do ART em adolescentes, curso com carga horaria de 3 horas

6.1 Atuação Profissional

- Março de 2014 a junho de 2014: Professora do Instituto de Educação Continuada da Pontifícia Universidade Católica de Minas Gerais, ministrando as disciplinas de Epidemiologia e Políticas de Atenção à Saúde para os cursos de pós-graduação *lato senso* em Enfermagem; e a disciplina de Fundamentos teóricos em Saúde Coletiva para o curso de pós-graduação *lato senso* Interdisciplinar em Saúde Coletiva;
- Fevereiro a agosto de 2014: Professora das disciplinas de "Administração do Consultório" e "Ética na prática Odontológica", do Curso de Auxiliar em Saúde Bucal, do Departamento de Odontologia Social e Preventiva, da Faculdade de Odontologia da Universidade Federal de Minas Gerais, com carga horária de cada disciplina de 4 horas semestrais;

- Abril de 2015 a janeiro de 2016: Bolsista de Apoio Técnico em Pesquisa, Projeto PPSUS/ FAPEMIG - Programa de pesquisa para o SUS: gestão compartilhada em saúde. Projeto de Pesquisa intitulado: Percepção das mães e dos profissionais de saúde sobre a atenção à saúde das crianças na rede pública de saúde. Departamento de Odontologia Social Preventiva. Projeto com financiamento do Edital 14/2012/ PPSUS;

- Abril de 2015 a dezembro de 2015: Monitora de pós-graduação do Departamento de Odontologia Social e Preventiva, da Faculdade de Odontologia da Universidade Federal de Minas Gerais, exercendo as atividades de ensino nas disciplinas de graduação em Odontologia: Integralidade e Ações Coletivas III, totalizando 180 horas;

- Agosto a novembro de 2015: Professora das disciplinas de "Administração do Consultório" e "Ética na prática Odontológica", do Curso de Auxiliar em Saúde Bucal, do Departamento de Odontologia Social e Preventiva, da Faculdade de Odontologia da Universidade Federal de Minas Gerais, com carga horária de cada disciplina de 4 horas semestrais;

- Setembro de 2015 à atual: Pesquisadora do grupo de pesquisa do Núcleo de Estudos de Saúde Pública – NESP, no âmbito da Unidade de Tecnologias da Informação e Comunicação em Saúde da Faculdade de Ciências da Saúde da Universidade de Brasília (UnB), apoiando estudos e pesquisas desde a graduação ao pós-doutoramento, nas áreas que compreendem estudos qualitativos, revisões sistemáticas, estudos mistos e outros processos facilitadores da pesquisa mediados por tecnologias.

6.2 Revisor de periódicos

2014 – Atual: Journal of Dentistry and Oral Hygiene

2014 – Atual: Ciência & Saúde Coletiva (Online)

2015 – Atual: World Journal of Agricultural Sciences (Print)

2015 – Atual: Journal of Dentistry

2015 – Atual: International Research Journal of Public and Environmental Health

6.3 Artigos completos publicados em periódicos

1. DRUMMOND, AMAD; FERREIRA, EF; GOMES, VE; MARCENES, W. *Inequality of Experience of Dental Caries between Different Ethnic Groups of Brazilians Aged 15 to 19 Years*. Plos One, v. 10, p. e0145553, 2015.

2. SANTA-ROSA, TT; FERREIRA, RC; DRUMMOND, AMA; DE MAGALHÃES, CS; VARGAS, AMD ; FERREIRA, EF. *Impact of aesthetic restorative treatment on anterior teeth with fluorosis among residents of an endemic area in Brazil: intervention study*. BMC Oral Health (Online), v. 14, p. 52, 2014.

3. DRUMMOND, AMA; Cury, JA; FERREIRA, RC; Vargas, AMD; FERREIRA, EF. *A Domestic Water Filter System to Defluoridation: Experience in Rural Brazilian Community*. OHDM - Oral Health and Dental Management, v. 13, p. 1060-1066, 2014.

6.4 Artigos completos submetidos em periódicos

1. TRAVASSOS DV, DRUMMOND AMA, FERREIRA RC, MOURA RNV, VARGAS AMD, FERREIRA EF. *Demands required in lawsuits against the Brazilian National Health System in three State Courts.* Em apreciação no periódico Ciência & Saúde Coletiva

2. OLIVEIRA FPSL, FERREIRA EF, DRUMMOND AMA, VARGAS AMD, DIAS S, HARTZ Z. Economic Evaluation of school health programmes: a literature review (2005-2015). Em apreciação no periódico *International Journal of Public Health*.

6.5 Resumos publicados em anais de congressos

1. DRUMMOND AMA, MARTINS-OLIVEIRA JG, PAIVA PCP, PAIVA HN, FERREIRA RC, FERREIRA EF, ZARZAR PM. Consumo de bebidas alcoólicas em 'binge' entre adolescentes e fatores associados: um estudo transversal. In: 32ª Reunião Anual da Sociedade Brasileira de Pesquisa Odontológica, 2015, Campinas. Brazilian Oral Research, 2015. v. 29. p. 1-640.

2. DRUMMOND AMA, FREIRE-MAIA FB, AUAD SM, ABREU MHNG, MARTINS MATS, SARDENBERG F, PORDEUS IA, VALE MP. Associação entre variáveis

individuais e ecológicas na Qualidade de Vida relacionada ao Traumatismo Dentário de crianças. In: 31ª Reunião Anual da Sociedade Brasileira de Pesquisa Odontológica, 2014, Águas de Lindoia. Brazilian Oral Research, 2014. v. 28. p. 325.

6.6 Apresentações de Trabalho

1. DRUMMOND AMA, GOMES VE, FERREIRA RC, BELLA M, GIGENA P, VERDUCCI P, MONCUNILL IA, HILAS E, CORNEJO LS, ZARZAR PM, PORDEUS IA, Vargas AMD, FERREIRA EF. Cárie Dentária na América do Sul: Realidade Entre Escolares do Brasil e Argentina. 2015. (Apresentação de Trabalho/Congresso).

2. DRUMMOND AMA, MARTINS-OLIVEIRA JG, PAIVA PCP, PAIVA HN, FERREIRA RC, FERREIRA EF, ZARZAR PM. Consumo de bebidas em 'binge' entre adolescentes e fatores associados: um estudo transversal. 2015. (Apresentação de Trabalho/Congresso).

3. DRUMMOND AMA, FREIRE-MAIA FB, AUAD SM, ABREU MHNG, MARTINS MATS, SARDENBERG F, PORDEUS IA, VALE MP. Associação entre variáveis individuais e ecológicas na Qualidade de Vida relacionada ao Traumatismo Dentário de crianças. 2014. (Apresentação de Trabalho/Congresso).

6.7 Demais tipos de produção técnica

1. COSTA MS, RIMULO ALM, GONCALVES JR, ENDEZ ER, DRUMMOND AMA, FERREIRA EFE. INQUÉRITO EPIDEMIOLÓGICO EM SAÚDE BUCAL DA GUINE EQUATORIAL, 2015. 2016 (Relatório de pesquisa).

6.8 Participação em eventos, congressos, exposições e feiras

1. IX Congressos Latino-Americano Interdisciplinar Orientado ao Adolescente (CLIOA). Cárie Dentária na América do Sul: Realidade Entre Escolares do Brasil e Argentina. 2015. (Congresso).

2. Compromisso Social da Pesquisa. 2015. (Seminário – Profa. Cecília Minayo).

3. I Seminário Internacional de Prática em Saúde Baseada em Evidencia: integra
ção ensino-cuidado. 2015. (Seminário).

4. 32ª Reunião Anual da Sociedade Brasileira de Pesquisa Odontológica.
Consumo de bebidas alcoólicas em "binge" entre adolescentes e fatores
associados: um estudo transversal. 2015. (Congresso).

5. A importância da utilização do Tratamento Restaurador Atraumático (ART) em
adolescentes. 2015. (Oficina).

6. Atenção à Saúde Bucal de SUS-BH: gestantes e crianças de 0 a 5 anos
(Oficina).

7. XII Encontro Científico da Faculdade de Odontologia da Universidade Federal
de Minas Gerais e X Encontro Mineiro das Faculdades de Odontologia. 2014.
(Encontro).

6.9 Trabalhos enviados para Congressos e Seminários

1. LOPES FAF, DRUMMOND AMA, MARCENES W, GOMES VE, FERREIRA EF.
Iniquidades em saúde entre diferentes grupos étnicos brasileiros: uma revisão
sistemática. Resumo enviado para a 33ª Reunião da Sociedade Brasileira de
Pesquisa Odontológica (SBPqO).

2. SOARES ARS, DRUMMOND AMA, CARDOSO AVL, MACHADO KM, AMORIM
LP, PAIVA PCP, SILVA CJP, AMARAL JHL, GOMES VE, FERREIRA RC.
Resolutividade dos serviços públicos na atenção à saúde bucal de crianças em
dois municípios mineiros. Resumo enviado para a 33ª Reunião da Sociedade
Brasileira de Pesquisa Odontológica (SBPqO).

3. DRUMMOND AMA, MARCENES W, GOMES VE, FERREIRA EF. Iniquidade de
cárie dentária não tratada e acesso ao serviço de saúde bucal entre diferentes
grupos étnicos de adolescentes brasileiros. Resumo enviado para a 33ª
Reunião da Sociedade Brasileira de Pesquisa Odontológica (SBPqO).

7 ANEXOS

7.1. Anexo A – Relatório Final do Doutorado Sanduíche

Barts and The London School of Medicine and Dentistry - Queen Mary University of London
Doctorate "*Sandwich*" Report – Andreia Maria Araújo Drummond
Process BEX 5156/14-9
Period: September 2014 to March 2015

This Report covers the seven-month period of the *"Doctorate Sandwich"* of the student **Andreia Maria Araújo Drummond**, funded by CAPES Foundation, Ministry of Education of Brazil at the Barts and The London School of Medicine and Dentistry – Queen Mary University of London. The aim of her project "Adolescents Oral Health Inequalities in Brazil" was to assess oral health inequalities as between different ethnic groups of Brazilian adolescents (aged 15 to 19 years) in 2010 and compare the results with the findings of a similar study conducted in 2003 (SBBrasil Project data from 2003 and 2010). In addition, the study sought to test whether socioeconomic indicators fully explain ethnic differences in dental caries in Brasil in 2010.

Activity descriptions

During the first four months, the research activity was mainly focused on understanding current concepts of social inequalities in health and research methodology. The student attended few relevant Undergraduate lectures, entire MSc modules and Doctorate seminars. The latter included workshops on Continuing Professional Development. Further training was provided on a one-to-one weekly tutorials and meetings. The MSc module "Health, Illness and Society" was of particular relevance to the training.

The student carried out a systematic review ethnic inequalities in health. She had one-to-one tutorials on "how to conduct a systematic review" with several experts in this field and the main supervisor to develop the research question for the systematic review (PICO question), data extraction and analysis, and wrote a draft manuscript.. Also, the student attended meetings with the supervisor on a weekly basis to clarify concepts, further develop the methodology of the study and develop her skills on data analysis.

Detailed list of activates include:

- 23/09/14 (1 hour): Undergraduate class "Social determinants of health, inequalities and oral health and the common risk factor approach"- Tutor: Professor Wagner Marcenes;
- 01/10/14 (3 hours): Workshop – Crowd funding for Healthcare Innovations, Whitechapel Campus - Queen Mary's Innovation Centre – Clark - Kennedy LT;
- 02/10/14 (8 hours): Ph.D. Student Induction – Mile End Campus - Professor Jon May;

- 07/10/14 (3 hours): Quantitative Research Methods, Cohort Studies - Professor Wagner Marcenes
- 08/10/14 (3 hours): Quantitative Research Methods, Case-control Studies - Professor Wagner Marcenes;
- 15/10/14 (2 hours): Library Information skills session in systematic review of the literature – Tutor Ms Paula Funnell;
- 20/10/14 (2 hours): "Lost in Translation?" The challenges of crossing borders;
- 21/10/14 (8 hours): William Harvey Day (annual research day) - Morris Lecture Theatre, Robin Brook Centre, St Bartholomew's Hospital, West Smithfield;
- 11/11/14 (2 hours): Endnote for Medicine and Dentistry – Tutor Ms Paula Funnell;
- 02/12/14 (4 hours): Critical Thinking – Tutor Dr. Graham Davis.

During the last three months, the student activity was mainly focused on the consolidation of inequity and inequalities concepts, attending Master degree lectures on a weekly basis and meetings with the supervisor with one-to-one training on statistical analysis using IBM SPSS Statistics software, writing scientific manuscripts and submission to a peer review journal. Additionally, the student participated in courses of Continuing Professional Development, workshops and meetings.

Detailed list of activates include:

- 20/01/15 (3 hours): Concepts and Measures of Oral Health – Lecturer Professor Wagner Marcenes;
- 26/01/15 (1 hour): Not all in the Mind – Lecturer Professor Ania Korszun;
- 27/01/15 (3 hours): Pronunciation and spoken delivery skills for researchers – Lecturer Ms S Withers;
- 27/01/15 (3 hours): Global Burden of Oral Diseases – Lecturer Professor Wagner Marcenes;
- 03/02/15 (3 hours): Oral health inequalities – Lecturer Professor Wagner Marcenes;
- 04/02/15 (3 hours): Pronunciation and spoken delivery skills for researchers – Lecturer Ms S Withers
- 05/02/15 (2 hours): Life course - Professors Cesar Victora and Daiana Kich – London School of Hygiene & Tropical Medicine
- 10/02/15 (3 hours): Pronunciation and spoken delivery skills for researchers – Lecturer Ms S Withers;
- 10/02/15 (3 hours): Social Determinants of Oral Health – Lecturer Professor Wagner Marcenes;
- 17/02/15 (3 hours): Behavioral Determinants of Oral Health – Lecturer Professor Wagner Marcenes;
- 03/03/15 (3 hours): Psychosocial Determinants of Oral Health – Lecturer Professor Wagner Marcenes

- 05/03/15 (3 hours): Life course approach to Oral Health – Lecturer Professor Wagner Marcenes;
- 10/03/15 (3 hours): Review and Integration – Lecturer Professor Wagner Marcenes.

Production

- **Race/ethnic inequalities in health: a systematic review;**

- **Inequality of experience of dental caries as between different ethnic groups of Brazilians Aged 15 to 19 years** – This manuscript has been submitted to the journal Community Dentistry and Oral Epidemiology on March 17th, 2015;

- **Inequality of untreated dental caries as between different race/ethnic groups of Brazilians aged 15 to 19 years.**

Professor Wagner Marcenes

Supervisor