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Examining Women's Dental Disorders through Multi-Level Sex and Gender Analysis: With Implications for Korean Women's Oral Health

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Abstract

Sex/gender differences in oral health have been recognized, but not yet actively investigated by dental academia. This article reviews preexisting research on sex/gender differences in two dental disorders with exceptionally high prevalence among women: Sjögren's syndrome and dental fear. These disorders have existed in the blind spot of both traditional male-centered medical academia and Gendered Innovation. We adopted Gendered Innovation's overarching themes and devised an analytical method of pattern/cause/cure, which follows a medical research narrative. Using our pattern/cause/cure analysis, we investigated what has been established and what remains to be investigated in women's oral health. Furthermore, the intersectional nature of South Korean women's oral health not only involves sex differences in dental disorders but also deepens our understanding of inter-female differences.

Key words

women's oral health, women's dental disorder, sex differences, gender differences, Gendered Innovation

Introduction

The World Health Organization (Petersen, Bourgeois, Estupinan-Day, & Ndiaye, 2005) reported that oral diseases are the most common noncommunicable

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diseases. Aside from its overwhelming prevalence, dentistry has an important role to play in speech, diet, and facial esthetics. It is not just a question of toothache or missing teeth; dental esthetics significantly influence a patient's confidence, hence her/his social interactions. Furthermore, oral infections serve as a gateway to serious conditions in other parts of the body, such as endocarditis, heart infections, cardiovascular diseases, pregnancy and birth complications (such as premature birth), exacerbation of pre-existing diabetes, and pneumonia. Oral diseases cause significant changes in patients' lives. Without quality dental care, patients cannot talk, eat, or smile with confidence. Oral health should not be limited to biomedical discourse; its inverse relationship with socioeconomic status illustrates how socioeconomic, cultural, and gender discourses are critical to painting the full picture of dental health.

Sex and gender differences translate into disparities in health experience (Hamberg, 2008; Krieger, 2003). Certain conditions may mostly affect women. Other diseases may have an equal female/male patient ratio, but present different sets of symptoms for each gender. Nonetheless, "women's diseases" or "women's symptoms" have long been relegated to the bottom of traditional medical academia's hierarchy. Marginalizing women's bodies as "the other," doctors enshrined Caucasian male adult bodies as a stable standard (Keane, 2014). Only male suffering received scholarly attention, resources, and funding, while illnesses inflicting women were dismissed as whining or unexplainable. Such a neglect of women's health could be attributed to the fact that "women's diseases" often exhibit a diffuse spectrum of symptoms in multiple body parts and have multifactorial causes, compared to male-dominant diseases with distinct symptoms and evident causal relations; women's suffering was too difficult for a male-biased medical academia to comprehend (Barsky, Peekna, & Borus, 2001).

Even for conditions that can affect both men and women, male symptoms are labeled "typical," while symptoms reported more often in women are shoved under the "atypical" category (Ricci, Cenko, Varotti, Puddu, & Manfrini, 2016). The resultant diagnostic and therapeutic strategies have been tailored to men's bodies, which may inflict harm on women (Schiebinger, 2012). Disastrous aftermaths have been observed; for example, 80% of the drugs withdrawn from the market between 1997 and 2001 were proven to cause more harm in women than in men (Gahart, Rowe, & Bradley, 2001).

Although the issue of sex and gender differences in biomedicine has slowly been gaining interest over the past few decades, the amount of evidence available is still in its infancy, and some areas are still very far from providing evi-

dence-based guidelines for practicing clinicians (Holdcroft, 2007; Tingen, Kim, Wu, & Woodruff, 2010). Much medical research omits women (Lempert, 1986; Sugimoto, Ahn, Smith, Macaluso, & Larivière, 2019) and until 2007 clinical studies had more male participants than female participants (Sugimoto et al., 2019). Beyond the issue of numbers, research often fails to factor in the concepts of sex and gender in research design and data analysis.

Oral health is not impervious to sex and gender differences (Zitzmann, Schilling, Weiger, Pastoret, & Loretan, 2007) but these issues have received limited attention within dental academia (Doyal & Naidoo, 2010). That these gender gaps need to be filled serves not only as a means for achieving social equity but also as a prerequisite for dental care that is optimized for the marginalized gender (Doyal & Naidoo, 2010). Due to the lack of gendered research in dentistry, articles on sex/gender differences in common dental illnesses—such as dental caries or periodontitis (WHO, 2003)—have been insufficient or conflicting, failing to reach a consensus (Martinez-Mier & Zandona, 2013; Shaffer et al., 2015). It is important to note that despite this insufficiency, caries and periodontitis are relatively well researched from sex/gender-specific perspectives when compared to other rarer dental disorders. There are many less common dental diseases with a significantly higher prevalence among women than for caries and periodontitis. However, despite their higher female patient ratios, these dental disorders lack sex/gender-specific research. The skewed sex ratio itself implies the influence of sex and gender on disease presentation.

One approach to overcoming the abovementioned limitations is "Gendered Innovation" (Schiebinger & Klinge, 2015). Gendered Innovation emphasizes sex and gender analysis for the advancement of scientific innovation and discovery. Sex and gender have been used interchangeably by several biomedical scholars, many baffled by the conceptual distinction between them (Doyal & Naidoo, 2010). Clarification of terms As used in this article, the terms follow the definitions given on the Gendered Innovations website (Schiebinger et al., 2011–2021). "Sex" refers to the biological characteristics of sexually reproducing organisms. Categories include, but are not limited to, female, male, and/or intersex. When determining sex factors in biomedicine, genetic components, hormones, and reproductive organs can be considered. "Gender" is a sociocultural construct. Cultural norms, societal hierarchy, and the economy interact with individual attitudes and behaviors to engender gender concepts. One's gender may or may not match their sex. Sex and gender factors interact, generating differences in symptom patterns between the sexes, even under identical diagnoses (Clayton & Davis, 2015) and treatment mo-

dalities can result in different prognoses for women and men (Rossi et al., 2013). Differences between genders in terms of access to and interactions with health care providers contribute to higher morbidity and mortality among women (Doyal, 2000; Hamberg, 2008) while disparities in health care experience often culminate in women suffering from health inequalities (Marshall-Catlin, Bushnik, & Tjepkema, 2019).

While Gendered Innovation has forced the male gaze of medical academia to examine sex/gender health aspects, efforts so far have focused on dissecting common disorders with even sex ratios. Gendered Innovation has yet to thoroughly examine "women's diseases," which many recognize as reproductive health issues. Expanding women's health beyond reproductive health should be the next step, signifying that the healthcare community recognizes women as beings other than just as mothers and wives. In doing so, Gendered Innovation has concentrated on uncovering sex/gender differences in disease with even sex ratios, unwittingly forsaking diseases unrelated to reproductive organs but with a high ratio of female sufferers.

Through the lens of Gendered Innovation, we focused on oral disorders with an overwhelming female prevalence—Sjögren's syndrome (SS) and dental fear (DF)—and which therefore have a significant impact on the oral health of South Korean women. The two disease entities were selected because each is unique in its interplay of factors, including hormones, immune system, pain during treatment, and dentist-patient interaction. Although the chosen disorders have low prevalence rates in the general population, they epitomize overarching themes in women's health. The discourse surrounding these disorders in South Korean women illustrates the absence of sex/gender analysis in South Korean oral health data and the importance of intersectionality in portraying the health of Asian women. In this article, existing studies and reviews are examined, and links between articles are explored to identify what has been established and what remains unknown about women's oral health. In focusing on these two uncommon dental disorders, we devised an analytical process to investigate the sex and gender aspects of these diseases. The results from our application of sex/gender analysis point to possible paths for future research, serving as groundwork for better women's oral health.

This article is in line with the Gendered Innovations approach in that we emphasize the significance of capturing both the biological and sociocultural aspects of women's health in all research steps. However, we diverted from Gendered Innovation's usual case selection, choosing oral disorders with a high ratio of

women: Sjogren's syndrome (SS) and dental fear (DF). We chose these "women's diseases" in dentistry for two reasons: 1) A high female prevalence in itself implies the significance of sex/gender factors in the disease. The interplay of sex/gender components in female-prevalent diseases may be even more representative of women's health than for other disorders; 2) Non-reproductive disorders with high female ratios fall into blind spots in both traditional medical academia and Gendered Innovation. Although these diseases have a greater impact on women's health than diseases with lower female ratios or reproductive disorders, a thorough examination of their sex/gender mechanisms is lacking. Available explanations for the causes of these diseases are often reductive, restricted to vague hormonal factors or psychological causes. Discovering the interplay mechanism between female biology, gender, socioeconomic factors, and culture that culminates in high female ratios for SS and DF will deepen our understanding of women's health.

Gendered Innovation suggests implementing overarching themes at the incipient stages of research design. Our study aimed to critically review past dental research, the bulk of which did not apply methods for Gendered Innovation. Analysis of past research data required a new method that carried overarching themes of Gendered Innovation and was appropriate to biomedical discourse. We devised an analytical method to review earlier research to reconstruct past knowledge regarding gendered insight into women's bodies. Our analysis method follows the biomedical narrative of the disease's pattern, cause, and cure to pursue a comprehensive, multi-level understanding of sex, gender, and the disease. We hope that our analytical method can be applied to other oral health topics and contribute to correcting the male bias in dental academia. Another major aim of our research is to shed light on the oral health of Asian women, with a particular focus on South Korea's oral health database.

Background: SS and DF as Women's Diseases

Sjögren's Syndrome (SS)

Autoimmune diseases in general have more female than male patients and Sjögren's syndrome (SS) is an autoimmune disease that primarily affects women (Hammitt, Naegeli, van den Broek, & Birt, 2017). SS destroys salivary and lacrimal glands and drying up saliva and tears. Studies report an overwhelming prevalence of the disorder in women, with some recording up to 90% of the disease's patient pool (Hammitt et al., 2017). South Korea's National Health Insurance Service database reported a 1:2.41 male to female ratio, which is much higher than that re-

ported in other countries. For patients, SS means more than dry eyes and mouth. Even with excellent oral hygiene habits, Sjögren's patients have more tooth decay (caries), causing frequent visits to dentists. Since SS is without a definitive cure, patients only have recourse to chronic medication to manage their symptoms at a tolerable level (Hammitt et al., 2017). Long-term use of anti-inflammatory agents results in side effects, such as stomach ulcers and kidney damage (Aabakken, 1992). Drugs, along with other treatment modalities for symptom control, result in added medical costs: two in three SS patients said that living with the illness adds a significant financial burden to their lives. Deteriorating health and finances inevitably lead to emotional burden, reported by 75% of SS patients (Trocchio, 2017).

Dental Fear (DF)

Dental fear (DF) is an aversive emotional state in anticipation of a visit to the dentist (Appukuttan, 2016). If exacerbated, it develops into dental phobia, an extreme psychological condition resulting in avoidance of dental treatment which can set off a vicious cycle. Long-term absence from dental clinic check-ups worsens incipient dental disease and as dental health deteriorates, drastic treatment, often more painful, is required. Traumatic dental experiences are thought to increase the likelihood of phobic patients avoiding visits to dental clinics. Although dental phobia is a treatable psychological condition, many instances remain undiagnosed as patients are not seen in clinics. The classic literature confirms that women have a higher incidence of DF (Carrillo-Diaz, Crego, Armfield, & Romero-Maroto, 2012; Katanec et al., 2018; Pohjola, Rekola, Kunttu, & Virtanen, 2016). Katanac et al. (2018) recorded who answered "afraid a lot" at the thought of a visit to the dentist.

Methods: Multi-Level Sex and Gender Analysis

In this study, a methodological approach was incorporated into qualitative analysis to review past literature on sex/gender differences in two selected dental disorders. We decided to categorize the studies according to phases of medical research, which is in line with the narrative course of cause, disease pattern, and cure of the disease. According to Röhrig, du Prel, Wachtlin, and Blettner (2009), medical research typically follows three main domains: epidemiology (disease pattern), basic medical research (cause), and clinical trials (cure). Basic medical research includes studies that investigate the underlying causes and mechanisms of the disease, examining cellular, biochemical, genetic, and physiological factors.

Epidemiological research has focused on the distribution and chronology of the disease in the population, and clinical studies have demonstrated or observed the effects of the disease or treatment.

These main medical study types can be reorganized into the following analytical method, creating a medical research flow narrative.

Pattern Level

First, epidemiological research identifies who is sick and how sick they are. Epidemiological data include demographic profiles, the timeline of disease experience, and symptom patterns. Gendered medical research, however, requires more than just reporting the sex ratio of the cell line, animal subjects, or patient pool, which is a standard protocol for all medical research. The resultant data should be analyzed according to sex to identify the patterns of conditions prevalent in women. Furthermore, to clarify sociological factors, epidemiological studies should complete a demographic portrayal of female patients. To achieve this, each demographic category, such as income, age, race, and family status, should be disaggregated according to gender.

Cause Level

A set of causes of the disease, medically termed "etiology," has been explored in basic medical research. Without knowing why women are sick, talking about prevention or cure is impossible. Etiology can often be unclear because causes can be multifactorial; the human body is not governed by a single universal equation but is influenced by a myriad of biological and social factors. Even diseases with a proportionate patient sex ratio can have different etiologies for male and female patients. With societal and biological factors intertwined, identifying the etiology of diseases presenting in women's bodies can be challenging.

Cure Level

Clinical trials establish a prevention and treatment protocol specialized for women. With pattern and cause analyses completed, knowing how and why women are sick will ultimately lead to pertinent prevention and treatment options. Providing a systematic decision-making process from diagnosis to treatment regimen will standardize the quality of treatment. This analysis examines not only remedies for the already ill but also prevention guidelines for healthy and at-risk

populations.

We searched online academic journal databases using the criteria listed in Table 1. A summary of articles selected for each dental disease entity can be found in separate tables in the appendix. The results section provides a qualitative analysis of the articles that met the criteria in Table 1.

Table 1
Search method, inclusion criteria, and resultant number of articles

	SS	DF
Search engine	Pubmed, Taylor and Francis, Google Scholar	
Time range	Jan. 1, 2010 – Jan 1, 2020 *one exception was made for Carpenter et al., (1994).	
Title had to include	Sjögren's syndrome	Dental fear OR dental anxiety OR dental phobia
Search keywords	Sex OR gender OR sex difference OR gender difference	
Inclusion criteria	1. Included abovementioned phrases in title and searched with abovementioned keywords 2. Studies with sections specifically focusing on sex/gender differences of the disease /or studies providing extensive analysis on sex/gender differences, although the entirety of the article may not exclusively concern sex/gender differences /or studies with subgroup analysis according to sex /or considers sex/gender as a major contributing factor to the disease 1. Discussed symptoms in the oral cavity 2. Full text available in English ** abstracts were read by a single researcher, and articles that did not meet the abovementioned inclusion criteria were excluded.	
Number of articles that met inclusion criteria	7	10

We chose to review articles published after the introduction of Gendered Innovation in 2009. Other databases, such as Cochrane or Embase, were considered, but were not included in this study as most results overlapped.

Results: Pattern, Cause, and Cure Levels of SS and DF

Although dentists are quite aware of the fact that all two disorders have a significantly higher female prevalence, research in all three abovementioned levels is lacking, illustrating the absence of a gendered approach in dental academia.

Multi-Level Sex and Gender Analysis of Sjögren's Syndrome

Pattern Level: Sex Ratio Is Reported Without Analysis

Research on the disease pattern of SS only reports sex ratio, rarely extending to re-analysis of results or other significant variables according to sex. Basic SS research that has investigated cell-level or animal models has often failed to indicate the sex of the cell lines or subject animals used (Brandt, Priori, Valesini, & Fairweather, 2015). Most clinical studies mention the sex ratio of the patient pool (Qin et al., 2015; Ramirez et al., 2017; Vivino, 2017) and, especially when control groups were present, sex-matching of groups was ensured (Qin et al., 2015; Vivino, 2017). This is a standard research protocol, indicating that research guidelines are aware that sex differences can yield different results. Despite this knowledge, however, researchers seldom consider sex differences in results sections, rarely analyzing data according to sex (Jonsson, Brokstad, Jonsson, Delaleu, & Skarstein, 2018; Qin et al., 2015; Vivino, 2017).

Cause Level: Sex Hormones or X-chromosomes, or Is That Really All We Have Got?

When asked why autoimmune diseases, including SS, mostly affect women, most researchers would be quick to blame either sex hormones or X-chromosomes. Knowing what causes SS begins by exploring the mechanism of autoimmune disease in general. The reasons for the higher female ratio in autoimmune diseases have not yet been fully determined (Brandt et al., 2015). The causes of SS have been rigorously investigated, totaling as many as 1,739 articles in PubMed with the keywords "Sjogren syndrome pathogenesis" but, unfortunately, studies seldom focus on sex differences.

Studies on the role of sex hormones in the prevalence of SS in women are rare. Researchers postulate that estrogen, in particular, has an especially intense effect on the immune system, resulting in increased risk of developing autoimmune diseases (Brandt et al., 2015). However, far less research has been conducted on the effects of other sex hormones, such as androgens and testosterone (Brandt et al.,

2015) and the few studies available often contradict one another (Brandt et al., 2015). While one study cited the success of androgen (one type of sex hormone) replacement therapy in a mouse model as evidence (Mostafavi et al., 2005), a survey among postmenopausal women revealed that when placed on a synthetic hormone regimen, inflammation increased (Schaumberg, 2001).

Studies on the function of the X chromosome in the prevalence of SS in women are in the incipient stage. One study focused on male patients, highlighting an unusually high proportion of cases of Klinefelter syndrome in male patients with Sjögren's syndrome (Harris et al., 2016). Klinefelter syndrome patients have a XXY karyotype with an extra X chromosome. A similar study confirmed that a very rare X chromosome anomaly was present among SS patients at a significantly higher frequency than in the general population (Sharma et al., 2017). This suggests that genes located on the X chromosome may increase the risk of SS. Nonetheless, the exact mechanisms remain unclear.

Cure Level: Disease Is Not Cured but Treated by Risk Factor Management

Scholars listed pregnancy and menopause as risk factors for SS, two conditions that are too broad for practical female-geared prevention protocols. Although often confused by lay people, risk factors are different from etiology; "risk factor" is a medical term that groups a set of elements that increase the chances of the development of a disease (National Cancer Institute Dictionary of Cancer Terms, n.d.). Risk factors are often manageable and hence critical in determining targets for prevention programs (Savitz, Poole, & Miller, 1999). Identifying risk factors is key for prevention and, with incurable diseases such as SS in particular, prevention is the only definitive method to eradicate the disease. Only two retrospective case-controlled studies have investigated the overall risk factors for SS (Brandt et al., 2015; Mostafavi et al., 2005; Priori et al., 2007). However, neither of the articles met the 10-year publication time limit of our search criteria. Of the two, only one identified risk factors pertaining to female patients (Priori et al., 2007). The listed risk factors supposedly pertaining to female SS patients listed items such as pregnancy or menopause, which are conditions present in almost all women. With these broad risk factors, specific groups of women could not be targeted for prevention or management protocols. Instead of calling out all pregnant and menopausal women to watch out for SS, a rare disease, researchers need to update more specific risk factors addressing which distinct groups of women are more prone to SS.

Multi-level Sex and Gender Analysis of Dental Fear

Pattern Level: Gendered Innovation Has Yet to Take Shape

Some researchers had a sound understanding of gender concepts as a collective social force, though some variables and results still require gendered disaggregation. Epidemiological studies of DF not only discussed socioeconomic elements but also recorded patterns of oral health behaviors. These are correlated with dental phobia, as poor oral health conditions can cause or exacerbate DF.

One epidemiological study collected information on the association between DF and oral health habits, gathering data from more than 8,000 Finnish college students (Pohjola et al., 2016). The article regrouped each oral health behavior component according to gender. Nonetheless, a gendered analysis of the dental phobic population was not conducted. According to the disaggregated data of the general population, although women brushed their teeth more religiously and had better teeth than men, they were more afraid of dental appointments, and healthier dental conditions usually signify a lower chance of the radical treatments dreaded by many fearful patients. It is still too early to propose any theories to explain this counterintuitive finding because the study neglected gender differences in oral habits and health among the dental phobic population.

Cause Level: Are Girls Born Afraid of Dentists, or Do Dentists Make Them Afraid?

The causes of the female prevalence in DF are not fully understood. Understanding the causes of DF itself could explain this prevalence, but the etiology of DF is still a matter of debate with scholars arguing for either acquired or inbred origins. Those supporting an acquired origin highlight certain traumatic dental experiences that can inculcate DF in patients, while other researchers suggest that populations born with certain temperaments are more prone to DF. Unlike the previously discussed epidemiological studies, the relevant research here often lacks a gender-sensitive view but the key thing to note is the lack of any consensus regarding the mechanism of DF in general (Armfield & Heaton, 2013). In addition, any gendered approach to DF is still in its infancy.

Negative dental experiences ranging from pain to maltreatment can cause aversive conditioning and precipitate the onset of DF (Berge, Veerkamp, & Hoogstraten, 2002). After a traumatic dental episode, the likelihood of DF increases when patients "catastrophize" the experience, developing an exaggerated obsession with unlikely failures. Carrillo-Diaz et al.'s (2012) study on children's

dental fear confirmed that girls had higher DF and catastrophized more than boys. However, this study did not include a gendered analysis of the correlation between DF and the patient's dental history. Though women are distinctly more prone to catastrophization and DF, a correlation between these tendencies and a negative dental history has not been presented.

Endogenous factors also play a role in the development of DF among women. Several researchers suggest that general psychological traits, such as general apprehensive tendencies, are more instrumental than distressing dental experiences in new incidences of DF (e.g., Thomson, Locker, & Poulton, 2000). General anxiety disorder has skewed the patient gender ratio, with women twice as likely to be afflicted as men, a trend reflected in DF (Donner & Lowry, 2013). However, the association between the prevalence of general anxiety disorder among women and DF has only occasionally been suggested in the discussion sections of articles, with no direct evidence investigated in journals. Recently, scholars have shifted their attention from psychological etiology to neurological explanations.

Sex differences in brain function can account for why women are born more afraid of dental visits. Two studies shed neurological light on sex differences in endogenous factors related to DF (Schienle, Scharmüller, Leutgeb, Schäfer, & Stark, 2013; Wabnegger, Scharmüller, & Schienle, 2014). The articles investigated gender differences in the size and activity of specific brain regions in dental phobic patients. Brain activity in female patients was both more active and more widespread in sections of the brain overseeing memory and associative learning. This implies that women can be more retentive in relation to dental pain memory. Hence, when pain-associated sensory information, such as the sound of a dental drill, is presented, women are faster to associate it with their traumatic experience, and respond more intensely.

Cure Level: Cure for Women Might Be Social

Behavioral intervention is one of the many effective methods for alleviating DF. One study verified gender differences in the effectiveness of videotaped behavioral therapy for DF (Carpenter, Gatchel, & Hasegawa, 1994). In the study, one group was shown a therapeutic videotape instructing participants to engage in anxiolytic behaviors, such as breathing exercises. The other group watched a placebo video that claimed to have calming effects but only provided informative content, such as a history of dentistry. Women showed a greater response to the placebo videotape than actual behavioral therapy, while men had a greater response to behavioral intervention. The authors suggested that women are more likely to use so-

cial support and contextual information. Informative placebo videos may have created a perception that some attention was being paid to the patients. Furthermore, placebo videos provided a better understanding of their dental treatments, serving as contextual information for alleviating their stress.

Discussion

As the results demonstrate, much remains to be studied to understand women's oral health. The implications of sex/gender variables in health research go beyond existing research protocols and merely acknowledging the existence of non-male patients. Understanding the nature of women's oral health would reveal how biological and social sex/gender factors shape our bodies. Accurate perceptions of health issues will lead to more effective treatment and prevention regimens tailored to the specific health needs of persons of all genders.

We employed Gendered Innovation's overarching themes to create a new analytical flow for medical/dental research. Our analytical structure focuses on each disorder, ultimately pushing for better care for women. In this section, we compare our analytical structure with Gendered Innovation's method and review the literature discussed in our research in line with that method. In particular, the crosssectionality of Korean women's oral health is described using multilevel sex/gender analysis.

Women's Health and Gendered Innovation

Gendered Innovation has focused on marginalized female patients suffering from diseases with an even sex ratio or primarily affecting males. SS and DF do not belong to the areas conventionally dealt with by Gendered Innovation. Nonetheless, these two disorders are optimal subjects for sex and gender analysis, SS and DF cause quality of life to deteriorate but are also influenced by patients' suboptimal social environment. The investigation of SS and DF in a Gendered Innovation context signifies not only a novel implementation of Gendered Innovation in dentistry, but also its expansion to systematically explore the interaction between health and quality of life.

In this article, dental literature was reorganized into three analytical levels of pattern, cause, and cure, a narrative flow often witnessed in medical discourse. Our analytical methods deviated from the Gendered Innovation approach that separates sex, gender, interaction between sex and gender, and intersectionality.

Instead, factors were integrated to adopt a more holistic view of the interplay between sex, gender, and diseases. Adopting a pattern/cause/cure structure to introduce themes of gendered innovation would make the analysis more approachable for dental academia. Furthermore, pattern/cause/cure structures culminate in treatment and prevention, ultimately seeking to utilize Gendered Innovation to cure people of all genders. A key component of our approach, as is also the case with Gendered Innovation, is to urge dental academia to engage in research in an appropriate fashion. Merely eliminating bias as a token gesture toward sex-adjusted research is not enough. Active research on sex and gender factors in health is important not only for health equity but also for a better understanding of health sciences, and ultimately the discovery of better and more effective treatments and cures.

Analyzing Sex and Sex-Gender Interaction: Detailed Knowledge of both Reproductive and Non-Reproductive Features of Women Is Needed

Analyzing sex considers the biological differences between the binary sexes, which can be explained in terms of hormones, chromosomes, genetic expression, reproductive organs, and secondary sexual characteristics (Verdonk, Benschop, De Haes, & Lagro-Janssen, 2008). However, a more detailed understanding of women's biological sexual characteristics is needed; current answers are not specific enough, as scientists lump women with different biological female features into the same groups. The rare literature on sex differences in dental diseases examined by our researchers often relies on reproductive biology for explanation. Although the double X chromosome, estrogen, and ovaries are important biological features unique to women, a larger portion of women's bodies exists beyond reproduction and its related organs. Reproduction-related features may influence other systems, resulting in sex differences in the somatic regions. Such relationships still lack adequate research.

The grand irony in assuming reproductive features as the only answer for sex differences is that the features are shared by the majority of women. This makes targeting risk groups for patient management impossible. To date, researchers have refused to approach reproductive features in a more detailed manner than the current bulk approach. In the case of SS, pregnancy and menopause, during which hormone levels fluctuate, contribute to the development of SS. Therefore, we need to know the specific group of pregnant or menopausal women unusually prone to SS.

Analyzing Gender and Sex-Gender Interaction: Gender Needs to Be Considered as Personal Identity, Interpersonal Interaction, and Social Structure

Analyzing gender delves into socio-economic-cultural dimensions in data collection and interpretation. Gendered Innovation accentuates researchers' gender attitudes and patients' gender behaviors (Schiebinger et al., 2011–2021). We maintain that the focus should be placed not only on the patient's gender behaviors but also on the social structures that shape gender. Researchers' gender attitudes were more difficult to fathom because of the lack of information about this; most dental studies were gender blind and unaware that gender could be a viable variable.

The studies reviewed in this paper mostly employed a binary gender classification but the transgender population merits further research, especially as the social, biological, and other pressures it experiences could be much more intense than those experienced by the cisgender population. Those undergoing gender reassignment undergo medical procedures, including hormone injections and consequent systemic changes could be possible sources of change in oral health, but this has yet to be investigated in detail. Heima, Heaton, Ng, and Roccoforte's (2017) cross-sectional study revealed that traumatic discrimination was significantly correlated with DF among transgender individuals. In general, there was a higher prevalence of DF among transgender individuals had among the general population. General discrimination from dental staff, along with past experiences and anticipation of maltreatment at dental clinics, raises the risk of DF. Discriminatory gender attitudes and behaviors among clinicians need to be examined by researchers.

Analyzing Intersectionality: Asian Women's Oral Health Needs More Academic Attention

Intersectionality will provide information on the oral health differences between women, stepping beyond differences between men and women. The first step in analyzing sex as guided by Gendered Innovation involves disaggregating data according to sex. After research policy reforms requiring the reporting of the gender distribution of study subjects, publications within the past decade have diligently reported data separately for each gender and adjusted results according to sex. Nonetheless, our study clearly recommends further stratification to provide a more diverse profile of female patients. To fully understand the role of sex/gender in diseases, researchers need to go beyond the recommended guidelines of disaggregation and stratify each relevant factor according to gender. Simply reporting that women have higher rates of SS or DF is not significant. Instead, knowing

what kind of women—e.g. elder women, low-income women, immigrant women—suffer from these diseases contributes to generating a better understanding of the causes, prevention, and treatment of the disease. A more thorough analysis of sex should be conducted to establish the demographic, socioeconomic, and clinical profiles of female patients.

Factors such as age, geographic location, nationality, culture, and race interact with sex and gender. Intersectionality can enrich sex- and gender-specific narratives of women's health (Hankivsky et al., 2010). Aside from having the highest population density worldwide, Asia's economic disparities and cultural diversity provide further merit for dental research on intracontinental differences in oral health. The economic scale of Asia ranges from G2 players to countries long blighted by poverty (Shorrocks, Davies, & Lluberas, 2019) and the incidence of caries is significantly lower in developed nations, while developing countries have much higher rates (Marcenes et al., 2013). Cultural aspects also shape oral health behaviors. The persistence of "son preference/daughter neglect" in many Asian countries may be a reason for the higher rates of caries in girls than in boys, as parental attention is critical in pediatric dental health (Lukacs, 2011a). Repetitive fasting, as part of religious practice, also contributes to tooth decay (Lukacs, 2011b). As women are the main victims of health-threatening cultural factors, the oral health of Asian women deserves academic attention.

Multi-Level Sex and Gender Analysis and Korean Women's Oral Health

As a research area, the oral health of the Asian population is often overlooked or is clustered with its Western counterparts, and few studies are available on Asian immigrant populations in English-speaking countries (Arora, Mackay, Conway, & Pell, 2016; Nguyen, Smallidge, Boyd, & Rainchuso, 2017). National and subnational reports on the Asian continent can be found, although the number of scientific papers is significantly fewer than for European or North American populations (Chung, Song, Lee, & Choi, 2011). Some global studies are available to provide a comparative picture of Asia's current oral health status (Kassebaum et al., 2014; Kassebaum et al., 2015; Marcenes et al., 2013) but, to the best of our knowledge, systematic analysis covering the entire span of the Asian continent is lacking.

Studies have verified the existence of gender bias in major oral disorders in Asia (Lee, Choi, Park, & Lee, 2012; Lukacs, 2011a). Lee et al. (2012) in South Korea found that neighborhood advantages, such as the degree of urbanization, financial

soundness of local government, and access to health care facilities, had a greater impact on the oral health of men than women. This contradicts conventional health theories that social context has a greater influence on women than on men (Kavanagh, Bentley, Turrell, Broom, & Subramanian, 2006; Skrabski, Kopp, & Kawachi, 2003; Stafford, Cummins, Macintyre, Ellaway, & Marmot, 2005). South Korean women's oral health stands at a crossroads of urbanization, culture, gender discrimination, and financial accessibility. The intersectionality of South Korean women's oral health makes it a prime target for a complex research plan formulated under the Gendered Innovation

South Korea's National Health Insurance Service (KNHIS) has accumulated thorough data on oral health for the past decade, ranging from the prevalence rates of common dental disorders (caries, periodontitis) to oral health behaviors such as how often teeth are brushed each day. These data were sorted according to sex and disaggregated according to region and age, but the available statistics do not include rare disorders with higher female ratios, such as SS and DF. Furthermore, researchers have yet to investigate the link between South Korea's unique gender structure and the underlying causes of sex differences in oral health patterns. The KNHIS database provides a retrospective analysis of risk factors for SS, comparing the relationships of each factor between patients and the control group. It did not, however, gather data directly on dental fear, and while the identified risk factors were detailed, including biological and socioeconomic elements, each category was not disaggregated according to sex.

The KNHIS provides a general picture of women's oral health, as an adequate number of questions relating to dental health were all sorted by gender. However, KNHIS only provides raw data, and this itself has not been properly utilized for gendered research. Among the categories surveyed by KNHIS, oral health was assessed using pathological indicators, such as the number of teeth missing or decayed, and in healthcare behaviors, such as the number of recent dental clinic visits and tooth-brushing sessions conducted per day. All categories separated responses according to sex. Furthermore, sex-differentiated responses were disaggregated according to age, urbanization, and income level. Hence, we know not only whether women are more likely to have fewer teeth, but also what kind of women—women with lower income levels, women residing in rural regions, and younger women—are exposed to oral health risks. However, no study has utilized the national database to provide a comprehensive profile of South Korean women's oral health, though some studies aimed to capture limited aspects of women's oral health, and sex differences were noted while discussing broader oral health topics.

Conclusion

Our paper provides an account of how dental academia has investigated two oral disorders with high female ratios. Although SS and DF impact the quality of women's lives beyond the reproductive realm, the two illnesses are neglected in medical academia. As scholars overlooked the high female ratio, sex/gender explanations at all levels of the research domains—patient population profile, cause, and cure—are lacking. Aside from sex/gender factors, research on SS and DF in general falls far short of satisfactory; theories on the causes of DF are not far from speculation, and proposed cures for SS only temporarily reduce symptoms.

SS and DF are poorly understood dental disorders with high female ratios. By examining the medical discourse on the two diseases, we reorganized the academic narrative by implementing multi-level analytical methods. The multi-level tool served as a form of reconnaissance to identify missing links in women's oral health studies, and we determined what particular kinds of knowledge need to be excavated to paint a more comprehensive, detailed picture of women's oral health. These blank spaces in oral health research are to be filled through Gendered Innovation, which spans multi-level domains including pattern, cause, and cure of diseases. This paper is one of the first attempts to introduce Gendered Innovation or sex and gender analysis into oral health and dental medicine on a full-scale level.

This study also focuses on the social aspects of women's health. Analysis of sex and gender, their interaction, and intersecting factors forces academia to face the mistreatment of research into women's health. A multi-level sex and gender analysis can find the solution beginning with women's diseases and, by encompassing intersectionality, build up public health programs accommodating diverse communities. Intersectionality requires an interdisciplinary approach that combines medicine and social sciences, including studies on gender and women (Schiebinger & Schraudner, 2011). In our study, we call for an active collaboration between dentists and social scientists with the common goal of attaining a fuller grasp of women's oral health, ultimately expanding to women's general health.

Gendered Innovation is an unfamiliar yet much needed area in dentistry. Dentistry is a field prime for Gendered Innovation, as oral health can have a major impact on women's quality of life, hence completing Gendered Innovation's mission of enhancing women's health as a whole. Furthermore, recent years have shown a significant increase in the numbers of female dentists, who should work alongside female patients to incorporate women's perceptions and observations of health into research.

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References

Aabakken, L. (1992). Non-steroidal, anti-inflammatory drugs—the extending scope of gastrointestinal side effects. *Alimentary Pharmacology & Therapeutics*, *6*(2), 143–162. doi: https://doi.org/10.1111/j.1365-2036.1992.tb00258

Appukuttan, D. P. (2016). Strategies to manage patients with dental anxiety and dental phobia: Literature review. *Clinical, Cosmetic and Investigational Dentistry*, *8*, 35–50. doi: https://doi.org/10.2147/CCIDE.S6362.

Armfield, J., & Heaton, L. (2013). Management of fear and anxiety in the dental clinic: A review. *Australian Dental Journal*, *58*(4), 390–407. doi: https://doi.org/ 10.1111/adj.12118.

Arora, G., Mackay, D., Conway, D., & Pell, J. (2016). Ethnic differences in oral health and use of dental services: Cross-sectional study using the 2009 Adult Dental Health Survey. *BMC Oral Health*, *17*(1), 1. doi: https://doi.org/10.1186/s12903-016-0228-6

Barsky, A. J., Peekna, H. M., & Borus, J. F. (2001). Somatic symptom reporting in women and men. *Journal of General Internal Medicine*, *16*(4), 266–275.

Berge, M., Veerkamp, J., & Hoogstraten, J. (2002). The etiology of childhood dental fear: The role of dental and conditioning experiences. *Journal of Anxiety Disorders*, *16*(3), 321–329. doi: https://doi.org/10.1046/j.1525-1497.2001.00229

Brandt, J. E., Priori, R., Valesini, G., & Fairweather, D. (2015). Sex differences in Sjögren's syndrome: A comprehensive review of immune mechanisms. *Biology of Sex Differences*, *6*(19). doi: https://doi.org/10.1186/s13293-015-0037-7

Carpenter, D., Gatchel, R., & Hasegawa, T. (1994). Effectiveness of a videotaped behavioral intervention for dental anxiety: The role of gender and the need for information. *Behavioral Medicine*, *20*(3), 123–132. doi: https://doi.org/10.1080/08964289.1994.9934627

Carrillo-Diaz, M., Crego, A., Armfield, J. M., & Romero-Maroto, M. (2012). Treatment experience, frequency of dental visits, and children's dental fear: A cognitive approach. *European Journal of Oral Sciences*, *120*, 75–81. doi: https://doi.org/10.1111/j.1600-0722.2011.00921

Chung, S. Y., Song, K. B., Lee, S. G., & Choi, Y. H. (2011). The strength of age effect on tooth loss and periodontal condition in Korean elderly. *Archives of Gerontology and Geriatrics*, *53*, e243–e248. doi: https://doi.org/10.1016/j.archger.2011.04.021

Clayton, J. A., & Davis, A. F. (2015). Sex/gender disparities and women's eye health. *Current Eye Research*, *40*(2), 102–109. doi: https://doi.org/10.3109/02713683.2014.

986333

Donner, N., & Lowry, C. (2013). Sex differences in anxiety and emotional behavior. *Pflügers Archiv - European Journal of Physiology*, *465*(5), 601–626. doi: https://doi.org/10.1007/s00424-013-1271-7

Doyal, L. (2000). Gender equity in health: Debates and dilemmas. *Social Science & Medicine*, *51*(6), 931–939. doi: https://doi.org/10.1016/s0277-9536(00)00072-1

Doyal, L., & Naidoo, S. (2010). Why dentists should take a greater interest in sex and gender. *British Dental Journal*, *209*(7), 335–337. doi: https://doi.org/10.1038/sj.bdj.2010.883.

Gahart, M., Rowe, E., & Bradley, L. (2001). *Drug safety: Most drugs withdrawn in recent years had greater health risks for women.* Washington, D.C.: The United States General Accounting Office. Retrieved January 21, 2020, from https://www.gao.gov/assets/gao-01-286r.pdf

Hamberg, K. (2008). Gender bias in medicine. *Women's Health*, *4*(3), 237–243. doi: https://doi.org/10.2217/17455057.4.3.237

Hammitt, K. M., Naegeli, A. N., van den Broek, R., & Birt, J. A. (2017). Patient burden of Sjögren's: A comprehensive literature review revealing the range and heterogeneity of measures used in assessments of severity. *RMD Open*, *3*(2), e000443. doi: https://doi.org/10.1136/rmdopen-2017-000443

Hankivsky, O., Reid, C., Cormier, R., Varcoe, C., Clark, N., Benoit, C., & Brotman, S. (2010). Exploring the promises of intersectionality for advancing women's health research. *International Journal for Equity in Health*, *9*(5). doi: https://doi.org/10.1186/1475-9276-9-5

Harris, V. M., Sharma, R., Cavett, J., Kurien, B. T., Liu, K., Koelsch, K. A., . . . Scofield, R. H. (2016). Klinefelter's syndrome (47, XXY) is in excess among men with Sjögren's syndrome. *Clinical Immunology*, *168*, 25–29. doi: https://doi.org/10.1016/j.clim.2016.04.002

Heima, M., Heaton, L. J., Ng, H. H., & Roccoforte, E. C. (2017). Dental fear among transgender individuals. *Academy of Dentistry for the Handicapped*, and the *American Society for Geriatric Dentistry*, *37*(5), 212–222. doi: https://doi.org/10.1111/scd.12245

Holdcroft, A. (2007). Gender bias in research: How does it affect evidence based medicine? *Journal of the Royal Society of Medicine*, *100*(1), 2–3. doi: https://doi.org/10.1177/014107680710000102

Jonsson, R., Brokstad, K. A., Jonsson, M. V., Delaleu, N., & Skarstein, K. (2018). Current concepts on Sjögren's syndrome—classification criteria and biomarkers. *European Journal of Oral Sciences*, *126*(S1), 37–48. doi: https://doi.org/10.1111/eos.12536

Kassebaum, N., Bernabé, E., Dahiya, M., Bhandari, B., Murray, C., & Marcenes, W. (2014). Global burden of severe tooth loss: A systemic review and meta-analysis. *Journal of Dental Research*, *93*(7, suppl.), 20S–28S. doi: https://doi.org/10.1177/0022034514537828

Kassebaum, N., Bernabé, E., Dahiya, M., Bhandari, B., Murray, C., & Marcenes, W. (2015). Global burden of untreated caries: A systematic review and metaregression. *Journal of Dental Research*, *94*(5), 650–658. doi: https://doi.org/10.1177/0022034515573272

Katanec, T., Singh, S., Majstorovic, M., Klaric, I., Herman, N., & Mourshi, A. (2018). Gender differences in dental fear and medical fear in Croatian adolescents. *The Journal of Clinical Pediatric Dentistry*, *42*(3), 182–187. doi: https://doi.org/10.17796/1053-4628-42.3.3

Kavanagh, A., Bentley, R., Turrell, G., Broom, D., & Subramanian, S. (2006). Does gender modify associations between self rated health and the social and economic characteristics of local environments? *Journal of Epidemiology and Community Health*, *60*(6), 490–495. doi: https://doi.org/10.1136/jech.2005.043562

Keane, H. (2014). Feminism and the complexities of gender and health. *Australian Feminist Studies*, *29*(80), 180–188. doi: https://doi.org/10.1080/08164649.2014.928192

Krieger, N. (2003). Genders, sexes, and health: What are the connections—and why does it matter? *International Journal of Epidemiology*, *32*(4), 652–657. doi: https://doi.org/10.1093/ije/dyg156

Lee, H., Choi, Y., Park, H., & Lee, S. (2012). Changing patterns in the association between regional socio-economic context and dental caries experience according to gender and age: A multilevel study in Korean adults. *International Journal of Health Geographics*, *11*(1), 30. doi: https://doi.org/10.1093/ije/dyg156

Lee, Y., An, J., & Chon, S. (2019). Sex differences in the hypothalamic-pituitary-adrenal axis in patients with burning mouth syndrome. *Oral Diseases*, *25*(8), 1983–1994. doi: https://doi.org/10.1111/odi.13195

Lempert, L. B. (1986). Women's health from a woman's point of view: A review of the literature. *Health Care for Women International*, *7*(3), 255–275. doi: 10.1080/07399338609515739

Lukacs, J. R. (2011a). Sex differences in dental caries experience: Clinical evidence, complex etiology. *Clinical Oral Investigations*, *15*(5), 649–656. doi: https://doi.org/10.1007/s00784-010-0445-3

Lukacs, J. R. (2011b). Gender differences in oral health in South Asia: Metadata imply multifactorial biological and cultural causes. *American Journal of Human Biology*, *23*, 398–411. doi: https://doi.org/10.1002/ajhb.21164

Marcenes, W., Kassebaum, N. J., Bernabé, E., Flaxman, A., Naghavi, M., Lopez, A., & Murray, C. J. L. (2013). Global burden of oral conditions in 1990–2010: A systematic analysis. *Journal of Dental Research*, *92*(7), 592–597. doi: https://doi.org/10.1177/0022034513490168

Marshall-Catlin, E., Bushnik, T., & Tjepkema, M. (2019). Trends in mortality inequalities among the adult household population. *Statistics Canada Health Reports*, *30*(12), 11–17. doi: https://doi.org/10.25318/82-003-x201901200002-eng

Martinez-Mier, E. A., & Zandona, A. F. (2013). The impact of gender on caries prevalence and risk assessment. *Dental Clinics of North America*, *57*(2), 301–315. doi: https://doi.org/10.1016/j.cden.2013.01.001

Mostafavi, B., Akyuz, S., Jacobsson, M. E., Nilsen, L. V., Theander, E., & Jacobsson, L. H. (2005). Perinatal characteristics and risk of developing primary Sjögren's syndrome: A case-control study. *The Journal of Rheumatology*, *32*(4), 665–668. Retrieved September 8, 2020, from https://www.jrheum.org/content/jrheum/32/4/665.full.pdf

National Cancer Institute Dictionary of Cancer Terms. (n.d.). *Risk Factor*. Retrieved November 12, 2020, from https://www.cancer.gov/publications/dictionaries/cancer-terms/def/risk-factor

Nguyen, K., Smallidge, D., Boyd, L., & Rainchuso, L. (2017). Vietnamese oral health beliefs and practices: Impact on the utilization of Western preventive oral health care. *Journal of Dental Hygiene*, *91*(1), 49–56. Retrieved March 9, 2021, from https://jdh.adha.org/content/jdenthyg/91/1/49.full.pdf

Petersen, P. E., Bourgeois, D., Ogawa, H., Estupinan-Day, S., & Ndiaye, C. (2005). The global burden of oral diseases and risks to oral health. *Bulletin of the World Health Organization*, *83*(9), 661–669. Retrieved February 10, 2020, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2626328/pdf/16211157.pdf

Pohjola, V., Rekola, A., Kunttu, K., & Virtanen, J. (2016). Association between dental fear and oral health habits and treatment need among university students in Finland: A national study. *BMC Oral Health*, *16*(26), 26. doi: https://doi.org/10.1186/s12903-016-0179-y

Priori, R., Medda, E., Conti, F., Cassara, E., Sabbadini, M., Antonioli, C., & Stazi, F. (2007). Risk factors for Sjögren's syndrome: A case-control study. *Clinical and Experimental Rheumatology*, *25*(3), 378–384. Retrieved August 8, 2020, from https://www.clinexprheumatol.org/abstract.asp?a=3087

Qin, B., Wang, J., Yang, Z., Yang, M., Ma, N., Huang, F., & Zhong, R. (2015). Epidemiology of primary Sjögren's syndrome: A systematic review and meta-analysis. *Annals of the Rheumatic Diseases*, *74*(11), 1983–1989. doi: https://doi.org

/10.1136/annrheumdis-2014-205375

Ramírez Sepúlveda, J. I., Kvarnstrom, M., Eriksson, P., Mandl, T., Braekke Norheim, K., Joar Johnsen, S., . . . Wahren-Herlenius, M. (2017). Long-term follow-up in primary Sjögren's syndrome reveals differences in clinical presentation between female and male patients. *Biology of Sex Differences*, *8*(25). doi: https://doi.org/10.1186/s13293-017-0146-6

Ricci, B., Cenko, E., Varotti, E., Puddu, P. E., & Manfrini, O. (2016). Atypical chest pain in ACS: A trap especially for women. *Current Pharmaceutical Design*, *22*(25), 3877–3884. doi: https://doi.org/10.2174/1381612822666160309115125

Röhrig, B., du Prel, J. B., Wachtlin, D., & Blettner, M. (2009). Types of study in medical research: Part 3 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *106*(15), 262–268. doi: https://doi.org/10.3238/arztebl.2009.0262

Rossi, M. C., Cristofaro, M. R., Gentile, S., Lucisano, G., Manicardi, V., & Mulas, M. F. (2013). Sex disparities in the quality of diabetes care: Biological and cultural factors may play a different role for different outcomes. *Diabetes Care*, *36*(10), 3162–3168. doi: https://doi.org/10.2337/dc13-0184

Savitz, D., Poole, C., & Miller, W. (1999). Reassessing the role of epidemiology in public health. *American Journal of Public Health*, *89*(8), 1158–1161. doi: https://doi.org/10.2105/ajph.89.8.1158

Schaumberg, D. A. (2001). Hormone replacement therapy and dry eye syndrome. *Jama*, *286*(17), 2114–2119. doi: https://doi.org/10.1001/jama.286.17.2114

Schiebinger, L. (2012). Gendered innovations in biomedicine and public health research. In S. Oertelt-Prigione & V. Regitz-Zagrosek (Eds.), *Sex and gender aspects in clinical medicine* (pp. 5–8). London, UK: Springer-Verlag. doi: https://doi.org/10.1007/978-0-85729-832-4_2

Schiebinger, L., & Klinge, I. (2015). Gendered innovation in health and medicine. *Kultur Und Gesellschaft*, *7*(2), 29–50. Retrieved from https://nbn-resolving.org/urn:nbn:de:0168-ssoar-452079

Schiebinger, L., Klinge, I., Sánchez de Madariaga, I., Paik, H. Y., Schraudner, M., & Stefanick, M. (Eds.) (2011–2021). *Gendered Innovations in science, health & medicine, engineering and environment*. Retrieved January 27, 2020, from http://genderedinnovations.stanford.edu/

Schiebinger, L., & Schraudner, M. (2011). Interdisciplinary approaches to achieving gendered innovations in science, medicine, and engineering. *Interdisciplinary Science Reviews*, *36*(2), 154–167. doi: https://doi.org/10.1179/030801811X13013181961518

Schienle, A., Scharmüller, W., Leutgeb, V., Schäfer, A., & Stark, R. (2013). Sex dif-

ferences in the functional and structural neuroanatomy of dental phobia. *Brain Structure and Function*, *218*(3), 779–787. doi: https://doi.org/10.1007/s00429-012-0428-z

Shaffer, J. R., Leslie, E. J., Feingold, E., Govil, M., Mcneil, D. W., Crout, R. J., & Marazita, M. L. (2015). Caries experience differs between females and males across age groups in Northern Appalachia. *International Journal of Dentistry*, *2015*(938213), 1–8. doi: https://doi.org/10.1155/2015/938213

Sharma, R., Harris, V., Cavett, J., Kurien, B., Liu, K., Koelsch, K., & Scofield, R. (2017). Brief report: Rare X chromosome abnormalities in systemic lupus erythematosus and Sjögren's syndrome. *Arthritis & Rheumatology*, *69*(11), 2187–2192. doi: https://doi.org/10.1002/art.40207

Shorrocks, A., Davies, J., & Lluberas, R. (2019). Global Wealth Report 2019. Zurich, Switzerland: Credit Suisse. Retrieved December 15, 2021, from https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html

Skrabski, Á., Kopp, M., & Kawachi, I. (2003). Social capital in a changing society: Cross-sectional associations with middle aged female and male mortality rates. *Journal of Epidemiology and Community Health*, *57*(2), 114–119. doi: https://doi.org/10.1136/jech.57.2.114

Stafford, M., Cummins, S., Macintyre, S., Ellaway, A., & Marmot, M. (2005). Gender differences in the associations between health and neighborhood environment. *Social Science & Medicine*, *60*(8), 1681–1692. doi: https://doi.org/10.1016/j.socscimed.2004.08.028

Sugimoto, C., Ahn, Y., Smith, E., Macaluso, B., & Larivière, V. (2019). Factors affecting sex-related reporting in medical research: A cross-disciplinary bibliometric analysis. *The Lancet*, *393*(10171), 550–559. doi: https://doi.org/10.1016/S0140-6736(18)32995-7

Thomson, W., Locker, D., & Poulton, R. (2000). Incidence of dental anxiety in young adults in relation to dental treatment experience. *Community Dentistry and Oral Epidemiology*, *28*(4), 289–294. doi: https://doi.org/10.1034/j.1600-0528.2000.280407.x

Tingen, C. M., Kim, A. M., Wu, P. H., & Woodruff, T. K. (2010). Sex and sensitivity: The continued need for sex-based biomedical research and implementation. *Women's Health*, *6*(4), 511–516. doi: https://doi.org/10.2217/whe.10.45

Trocchio, E. (2017). *Patient survey results: Living with Sjögren's*. Reston, VA: Sjögren's Foundation. Retrieved January 27, 2020, from https://www.sjogrens.org/home/about-sjogrens/livingwithsjogrenssurvey

Verdonk, P., Benschop, Y. W. M., De Haes, H. C. J. M., & Lagro-Janssen, T. L.

M. (2008). From gender bias to gender awareness in medical education. *Advances in Health Sciences Education*, *14*(1), 135–152. doi: https://doi.org/10.1007/s10459-008-9100-z

Vivino, F. (2017). Sjögren's syndrome: Clinical aspects. *Clinical Immunology*, *182*, 48–54. doi: https://doi.org/10.1016/j.clim.2017.04.005

Wabnegger, A., Scharmüller, W., & Schienle, A. (2014). Sex-specific associations between grey matter volume and phobic symptoms in dental phobia. *Neuroscience Letters*, *580*, 83–87. doi: https://doi.org/10.1016/j.neulet.2014.07.054

Zitzmann, N., Schilling, J., Weiger, R., Pastoret, M., & Loretan, P. (2007). Gender-specific dental health issues and treatment considerations. *The International Journal of Prosthodontics*, *20*(4), 360–368. Retrieved from https://primoapac01.hosted.exlibrisgroup.com/permalink/f/enmgnl/TN_cdi_proquest_miscellaneous_68160737

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