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Aim & Scope

Scripta is the publication of the Center for Research & Innovation at Fulton Science Academy, Alpharetta, Georgia.

Scripta is a peer-reviewed academic journal published semiannually by Fulton Science Academy faculty and students. Our main aim is to provide students and teachers from diverse disciplines with a platform to exchange their ideas and share their research articles, essays, reports, viewpoints, and book reviews.

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Scripta

Verba volant, scripta manent

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Foreword

Dear readers,

We are thrilled to unveil our latest edition.

As we share new student research articles with you, we're also celebrating Scripta's second anniversary. Our journey commenced two years back, inspired by the exceptional students at Fulton Science Academy. This idea took root during my early days at FSA, after meeting and working with the brilliant young minds.

Our humble beginnings saw a devoted team convene for our inaugural meeting—names like Nick Papciak, Abhiram Chennupati, Anna-Sophia Mehta, Hafsa Koker, Shivam Jain, Tom Jeong, Zeynep Ozdemir, and others. The vision of launching a student-led, peer-reviewed research journal spurred us on. I vividly recall the thrill of beholding our inaugural cover, designed by Miro Kavaliou. Through the collective efforts of our editorial board members and contributors, led by Abhiram and Nick, we published our first issue in the spring of 2022.

Many of our founding members graduated soon after our debut issue hit stands. Yet, buoyed by that success, Scripta's reach expanded, and the second year welcomed a fresh cadre of editors, reviewers, and authors. Guided by Ishwar Haridth, Nyla Hussain, Krishna Suresh, Rohan Movva, Kevin Yuan, Hiba Shaikh, and Sofia Vishnyakova, we produced three exceptional Scripta editions.

While our pioneers ventured into higher education, Scripta remains a thread binding us all. They continue to contribute articles and serve on the Alumni Advisory Board, fostering connections among our students, alumni, and readers.

Writing transcends time and place, forging a bridge between past, present, and future. Research and writing unite past thinkers with today's and tomorrow's researchers and writers worldwide. Scripta's primary aim is to introduce this timeless and boundless conversation to young minds.

Scripta endeavors to furnish our students, educators, and readers with an intellectual forum—a space to exchange ideas, pose questions, and seek solutions for both theoretical and real-world challenges. Our goal is to cultivate an epistemic community, a community of inquisitive researchers and readers, a goal we're pleased to report significant progress on.

Moreover, I'm thrilled to share some fantastic news: alongside our biannual issues, we're introducing Scripta Astronomia—an astronomy special issue. This will mark our foray into peer-reviewed student-led astronomy research, în collaboration with Liceul Teoretic Internațional de Informatica Bucuresti, our sister school in Romania.

Our journey wouldn't have been possible without the steadfast support of the school administration, teachers, and parents. To them, the Scripta team extends our heartfelt gratitude.

It is with immense excitement and pleasure that we present our Fall 2023 Issue to you. We hope you relish diving into the fascinating articles penned by our students.

Verba volant, scripta manent!

Dr. Ramin Ahmadoghlu

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Assessing the Causes of Sociocultural Mental Illness Stigma in Female Indian Elite Athletes

*Isha Patkar**

ABSTRACT

Mental illness, defined as a clinically significant disruption in one's cognitive, emotional, or behavioral health, affects 450 million people globally, leading to millions of related deaths. Despite the great magnitude of individuals affected by mental illness, rather than finding a solution to avoidable mental illnesses, society creates stigmas and discriminations which exist at high levels globally, contributing to lack of access to mental health services and resources, especially in a less-represented group: female high-level athletes. Kudva et. al. also emphasizes the role that discrimination plays in being a barrier to seeking help for these athletes, as prejudice and ignorance from society create a negative perception of mental illness. González-Sangunio, et al. identifies causes of mental illness stigma being directly linked to sociocultural factors, which lead to negative and oftentimes inaccurate "beliefs about the lack of ability... as well as judgements of dangerousness and unpredictability that generate negative reactions in the public" which manifests through shunning, belittling, and excluding. Due to the many discrepancies of sociocultural settings in various countries, the direct causes of this stigma in female high-level athletes differ based on sociocultural factors.

This study aims to identify the sociocultural factors leading to mental illness stigma in female Indian elite athletes through a mixed-method qualitative and quantitative approach followed by a thematic and statistical analysis. Academic prioritization, past gender roles, and media portrayal were found to be the great contributors to mental illness stigma with specific influence of athletic stereotypes found in the media. Future studies can take these findings and ascertain to what extent they apply to countries with similar sociocultural environments, while finding causes for similarities and discrepancies in causes.

Introduction

Sources were obtained through EBSCO and Galileo with the filter "peer-reviewed" selected. Key search words included: Mental Illness Stigma, Female Elite Athletes, Sociocultural, India.

Mental illnesses, while gaining attention and awareness in Western countries, continue to face almost unwavering stigmatization and taboos in non-Western countries, due to differing sociocultural norms and beliefs [1]. In a

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study highlighting the Eastern and Western divide of prevalence of mental illness stigma, Krendl and Pescosolido found that mental health "stigma was higher overall in Eastern countries" compared to Western nations due to the traditional perception of mental illness and consequent current manifestations [2]. For instance, as stated in *Mental Health: Culture, Race, and Ethnicity: A supplement to Mental Health: A Report of the Surgeon General*, mental illness stigma (MIS) is less prevalent in Western countries as "mental health care in the United States... [is] embedded in Western science and medicine, emphasize[ing] scientific inquiry and objective evidence" [3]. Moreover, in Western societies, the reasons for stigma are not as closely tied to the religious dimension of cultural norms. However, despite these explanations for MIS in Western cultures, non-White minorities in the United States were reported as less inclined to seek treatments for mental illness often due to cultural differences which can result in fears of retribution or internalized stigma. Furthermore, in a study investigating the use of mental health resources in college, Krendl and Pescosolido found that individuals with a European ancestry were significantly more likely to utilize the resources over Asian students [2].

For instance, in a systematic review of studies in the Pacific Rim region highlighting cultural factors contributing to MIS, researchers concluded that specific commonalities in South Asian and East Asian culture and religion play a role in the stubborn negative perception of mental illness [4]. As communities in the Pacific Rim region, such as Japan, China, and India are characterized as cultures strongly rooted in Collectivist values that prioritize family and social status, any behavior which is seen as a danger to this construct is stigmatized. Additionally in Collectivist cultures, those with mental illness are often viewed as dangerous, unpredictable, and harmful as they are seen to threaten the harmonious relationships within a community [5]. This is attributed to the prevalent historical East and South Asian ascription of mental illness to supernatural entities [6]. As established by Ran et al., supernatural beliefs attributing mental illness to the consequence of evil actions in a past life or God's way of punishing wrong-doers result in mental illness being associated with evil spirits and dead souls [4]. Consequently, instead of being given access to resources and professional help, individuals encounter intolerance and inequity. Specifically, in India, with 94% of the population identifying as Hindu, which has a Collectivist culture, the sociocultural causes of MIS identified in the Pacific Rim region also apply to India [7]. For instance, a study breaking down

stigma in South India showed negative responses including social restrictiveness stigma and authoritarianism stigma with 71.46% and and 74.38% prevalence respectively [8].

In South Asia, female non-athletes were found to be more predisposed to stigma which can be attributed to lack of awareness coupled with sociocultural norms. For instance, in a study comparing prevalence of MIS in males and females in Pakistan, Khan, et al. found that higher levels of stigma were experienced by women which was similarly found by Venkatesh, et al in South India, with 80% stigma prevalence on average [8, 9]. Currently, there are little to no studies investigating sociocultural factors of MIS in female athletes in India; however, the literature which does exist specifically focuses on MIS in female non-athletes. This contributes to MIS in young females since a woman's role in society is often narrowly perceived as being centered around bearing children leading to the neglect and dismissal of their own mental struggles. Similarly, many females only worry about the future of the family reputation, or their capacity to secure a stable marriage, prioritizing the pride they bring to their family over their mental health,often deeming it as inconsequential. Lastly, social constructs in India lead to women being expected to stay at home and do household chores which correlates with women being perceived as being generally weaker than their husbands [10]. Thus, females, who are already seen as inferior to men, face the additional stigma of being viewed as weak, when dealing with mental illness, which may also extend to female athletes.

Recently, MIS has begun to be addressed and combatted, especially as significant individuals speak out and take action to mitigate stigmas. World-renowned athletes have begun to emphasize care of their mental health instead of powering through and concealing symptoms, as done in the past. In 2021, Simone Biles, an Olympic gold medalist, took the bold action of prioritizing her mental health over the possibility of an Olympic gold medal winning performance [11]. This sparked world-wide conversation about the validity of Biles's decision with both awe-inspiring comments as well as disapproving criticisms. This increased conversation surrounding Bile's withdrawal translated into a larger discussion of stigma in elite athletes as a whole. Taredlli et al. established that the prevalence of mental illnesses such as depression and anxiety is 34% greater in elite athletes than in the general population [11]. However, due to MIS surrounding elite athletes, the culture of elite sport "decrease[s] help-seeking behaviors and leads sports organizations to deprecate mental health issues as unwelcome

"weaknesses" not compatible with high-level sports" [12]. The causes of these stigmas can be attributed to "the belief that athletes are inherently mentally tough", "overt comments and encouragement from [others] to play through disorder", or "subtle suggestions that imply those who experience injury are weak" [13]. Furthermore, many elite athletes feel as though their mental illness will result in the loss of a contract or marketing deal, which is reinforced by coaches encouraging athletes to push through mental illness symptoms [14]. Moreover, in many cultures, female athletes fail to speak up about their mental illness due to stigma not only resulting from the identified elite athlete stigmas, but due to sociocultural factors disapproving of women in sports [14]. While scholarly research has not explicitly been conducted on the sociocultural beliefs contributing to views on Indian female elite athletes (IFEA), from the previously identified sociocultural factors presented by Venkatesh et al., Insan et al., and Ran et al.,I posit that the societal expectations previously imposed on women in India will also contribute to Mental Illness Stigma (MIS) surrounding female athletes [1, 4, 8].

Gap in Literature

While previous literature addresses female non-athlete MIS in India and elite athlete MIS in Western countries, sociocultural causes of female elite athlete stigma have not been addressed in India. Furthermore, although the causes of stigma based on gender of the individuals may play a similar role in MIS that female non-athletes face, the discrepancies of age and societal role between the non-athletes and the athletes result in an infeasible comparison due to the numerous changing variables. Similarly, while high-level athletes stereotypes are shared globally, the differences in sociocultural history and setting make it infeasible to use the sociocultural causes for MIS in female athletes in Western countries for athletes in India. Moreover, the gap targeted by this study raises the question: What are the sociocultural-specific causes of Mental Illness Stigma in female athletes (IFEA)? My research will fill this gap by fulfilling two objectives: The connection of sociocultural causes of female non-athlete MIS in India to females in elite sport and the translation of the stereotype of high-level athletes into India.

I propose that mental health issues believed to be a sign of spiritual possession combined with disapproving attitudes about women in sports in India and the stereotype of athletes being immune to mental illness

Participants reside in India or have resided in India in the past 20 years.
Participants are in close relation with an IFEA who is training or has trained in India.
Participants are well-versed with the sociocultural climate of India and other countries in modern day and in the past.
Participants are above the age of 18.

Table 1: Participant Selection (Justifications in Appendix E)

contributes to a stigma that mental health issues in IFEA make them weak and unworthy of achieving high-level performance.

Methods

To assess this hypothesis, a double-pronged approach with both qualitative and quantitative aspects was utilized. More specifically, a semi-structured interview and numerical questionnaire were employed. A semi-structured interview model was chosen since it allows for added flexibility, elimination of numerous rounds of interviews, and interviewee-answer guided conversation as opposed to a rigid structured interview which may limit discussion and extension of viewpoints. In tandem, the numerical questionnaire supported interview data while minimizing gray zones and providing concrete numbers. Furthermore, this double-pronged approach was chosen over alternate investigation methods such as content analysis or meta-analysis to allow for novel data to be collected and paired with the associated questionnaire. The structure of this mixed method study will allow for both open-ended qualitative and fixed quantitative support for each individual participant's responses.

Participant Selection

Since this study evaluates the sociocultural causes of MIS in athletes, unconscious bias must be eliminated to ensure undistorted and more accurate conclusions [15]. Consequently, instead of directly consulting the IFEA themselves, individuals such as family members or family friends were chosen to provide a more holistic and unbiased set of responses. These individuals were selected by strict criteria to assure educated, knowledgeable, and fair data.

To identify potential participants meeting this criteria, 22 connections were reached out to. If the potential participant did not respond within 1 week, a follow-up email was sent. After 2 weeks, the participant pool was narrowed down to 10 individuals who matched all of the criteria, had access to stable technology, and were willing to speak with me. To present a broad variety of perspectives and eliminate bias, a combination of participants of various ages, locations in India, and sports affiliations were ultimately selected.

Semi-Structured Interview

To conduct interviews, a Zoom link was sent to the participant in accordance with Indian Standard Time and Eastern Standard Time.Regarding the semi-structured interview, questions were formulated in accordance with the Harvard Sociology Department's recommendations. The interview incorporated narrative aspects, opinions, speculations, direct questions, indirect questions, structuring statements, follow-up questions, specifying questions, and interpreting questions. These questions were designed to explore factors influencing societal stigma, to elicit narrative accounts providing supporting experiences of stigma or its absence, and to draw comparisons between the socio-cultural landscapes of India and other countries. For this specific purpose, direct questions, the only type necessitating a yes or no answer, were placed at the end of the interview to avoid unduly influencing the direction of the interview. The interview questions posed are listed in Appendix C; however, due to the structure of the interview, the discussion was guided by the participants' responses and simply used these questions for structure.

Numerical Questionnaire

To obtain numerical data, after completion of the interviews, participants were asked to complete a Google Form. This Google Form listed 7 statements and asked participants to rate the statements on a scale of 1 to 5 based on level of agreement.

Thematic Analysis

Following the conclusion of the semi-structured Zoom interviews, which were recorded with the full permission of participants, the responses were transcribed to allow for efficient analysis. Subsequently, the next phase of

the study was to thematically analyze the interviews; thematic analysis is a tool which sorts raw data into patterns to discern commonalities and significant themes across the set [16]. In this case, thematic analysis was used to identify recurring sociocultural factors which directly or indirectly lead to derogatory perceptions about mental health in Indian female athletes or stigma. These causes were presented in the forms of experiential data, observations, speculations, and narrative data surrounding one's interactions and inspection of the athlete and his or her life.

The transcribed interviews were read for similar notions between interviews which hinted at or explicitly stated negative connotations for mental illness in IFEA. For instance, these could have been recounts of experiences during which the athlete faced stigma, narrations of past conversations during which mental health in IFEA was discussed, or media which enforces MIS in India. Many responses also spoke on the awareness of mental health in IFEA or lack thereof which, since relevant to my study, were taken into consideration. However, many interviewees spoke explicitly on MIS in male athletes, which was not taken into account when identifying common ideas since this strays from the population target of study.

These ideas, experiences, recounts, and comparisons were then separated into overarching themes which encompassed all of the information given and discussed within that section. These themes ultimately allowed for conclusions to be made about specific sociocultural components of the landscape in India which contribute to MIS in IFEA.

This specific type of thematic analysis which involves first identifying similar experiences, opinions, and ideas then compiling them, was ideal for this case study since the participants were not directly asked the research question. It was not practical to directly compile responses into themes since the sociocultural causes of MIS in IFEA were not explicitly stated. First, the responses needed to be sorted into experiences, opinions, or speculations which centered around the same ideas. Furthermore, the main goal of this process was to identify commonalities in the various responses and frame them into an answer to the research question. After these similar responses were sorted, common themes (Appendix F) identified in the responses were able to concretely provide answers for the research question.

These common themes were then further analyzed in terms of how the sociocultural environment unique to India had cultivated and fostered these causes for stigmas in comparison to other countries and how they had contributed to the persistence of these stigmas for the past decade. These

themes were defined based on common phrases identified during the interviews to ensure each experience, idea, opinion, and speculation under this theme was covered by the definition. This technique ensures the most quality and knowledgeable answers could be provided for the initial research question without posing it directly. Instead, individuals were given the opportunity tototo indirectly address the question through first hand accounts, observations, speculations, and opinions. Themes were created from this content which connected both the content from the interviews and the initial question, further reinforcing the usage of this analysis technique.

Statistical Analysis

For the second part of the analysis, a quantitative statistical analysis was conducted of the questionnaire responses. The responses were inputted into an Excel spreadsheet to create a graph with the average rating from 1 to 5 for each statement. From this graph, the most plausible sociocultural factors leading to stigma were discerned to further support the findings from the qualitative analysis. Statistical analysis gave the ability to directly compare the uncertain areas of the interviews since as per the general guidelines of semi-structured interviews, the research question itself could not be directly asked but rather guided around by leading questions and follow-up questions. Thus, if the interviewee was not able to give a definitive answer on a specific question, this questionnaire would be able to gain a better consensus of where the populations of individuals stood.

Participant #	**Significant Ideas Presented**	**Theme Present**
1	Females are judged for pursuing sport since it is male-dominated and women are inferior to men in sport.	Past Gender Norms
	Many people are misinformed about mental health which leads to incorrect assumptions.	Lack of Education

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Participant #	Significant Ideas Presented	Theme Present
2	Videos and articles say female athletes are above the average person in terms of mental strength.	Media Portrayal
	Therapy is the same as talking with a close friend or family member except you have to pay for it.	Therapy Stigma
3	If female athletes were focused on school, they would not have these mental health issues since females are perceived to be weaker and more fragile to begin with.	Education Prioritization
	Most people do not understand mental health and dismiss it as mood swings or a rough patch in life.	Lack of Education

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Participant #	Significant Ideas Presented	Theme Present
4	People shame athletes with anxiety because they say the athlete would not have anxiety if they simply stuck with schoolwork. Female athletes particularly know they will eventually need to provide for a family so they should prepare through school.	Education Prioritization
	All of the powerful athletes on TV seem unstoppable and fierce like mental health will not affect them.	Media Portrayal
5	When seeking therapists, the athlete is told to keep it quiet because people will think she is unstable.	Therapy Stigma
	People say the athlete should stay in school like most girls her age so they can take care of the family later and let her husband pursue sports.	Education Prioritization

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Participant #	Significant Ideas Presented	Theme Present
6	Aunt of IFEA frowned upon athlete's mental illness symptoms as when female athletes started to face symptoms of depression, she said this was not typical of a girl.	Past Gender Norms
	People will not take time to learn about mental illness in athletes before making hurtful comments. They assume sport is inferior to education without knowing all the hard work that goes into sport.	Lack of Education
7	Mental illness is associated with therapy which many see as a waste of money.	Therapy Stigma
	People are used to girls staying in the home so now that they are in sport and may be experiencing mental illness, people think they are frail.	Past Gender Norms

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Participant #	Significant Ideas Presented	Theme Present
8	When people think of IFEA, they think of people who have overcome all odds and are unaffected by all because of the amazing stories seen on the news.	Media Portrayal
	Mental illnesses are just as detrimental as physical injuries but they cannot be seen so they are deemed a sign of weakness in athletes. This applies to female athletes specifically because they are already seen as weaker than men, so they feel like they need to prove themselves.	Lack of Education
9	People think girls should focus on school over sport so if they face mental illness, people see this as a reinforcing sign.	Education Prioritization
	Mental health is an excuse to take off from school or work even though everyone goes through stress.	Lack of Education

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Participant #	Significant Ideas Presented	Theme Present
10	Therapy is the last option because this means that the athlete is not stable enough to continue doing their sport which leads to stigma about mental illnesses.	Therapy Stigma
	Girls are seen as more gentle and fragile so when they engage in hard sports and face mental health consequences, people think they should not do sports anymore because it is more of a male position.	Past Gender Norms

Table 2: Themes Present in Interviews—A Summary

Findings

This table includes the main information gleaned from each interview with quotes or experiences reworded to be general statements from a third person perspective. Names, region of India, and relationship with female athletes were omitted due to confidentiality as noted in the consent form. Thus, the first row simply goes in order of first contact with the individual through email. The second row highlights the main experiences, ideas, opinions, or speculations the individual addressed in terms of the nuances of the sociocultural environment of India and MIS in female athletes. The third row connects the ideas in row two with a theme identified from the most common responses in the interviews.

Results

The analysis focused on the three most frequently occurring themes. The other two were acknowledged since they appeared in multiple interviews but require additional investigation to be confirmed as responses to my research question.

Past Gender Roles: Theme 1

The theme most frequently highlighted, as noted by 8 participants, was past gender roles of males and females being applied to males and females in athletes today, resulting in comparisons and preset expectations fostering stigma and an unsupportive environment. Participant 2 stated that members of society, especially older ones, are used to seeing females attend classes then stay in the home to assist with cooking or caring for the family. Consequently, when they learn about female athletes being affected by the psychological consequences of difficult coaching, toxic training environments, or performance in competition they assert such endeavors are unsuitable for young women. In their view, women should be inside the home and leave the sports to the men. As expressed by Participant 4, "the young athletes do not want to be seen as frail, weak little girls who cannot handle the demands of high-level sport so they keep to themselves and hide any symptoms of mental illness they are experiencing." When fellow athletes see their teammates suppressing their symptoms and avoiding seeking help, they feel compelled to do the same, fearing being perceived as inferior to their teammates. As noted by Participant 1, this stigma created by past gender roles initiates a chain reaction among groups of athletes, where nobody wants to be the first to succumb to the perceived notion of weak and incapable of competing at high levels. No one is wishing to disturb the delicate balance that currently exists between the tentative acceptance of females in sport and associations of mental illness in females with weakness and fragility. This careful balance forces athletes to tread carefully and limit their expression of mental illness symptoms to even their parents and loved ones, as highlighted by Participant 5. As further pondered by Participant 5, "My daughter was told by my own sister that her mental illness symptoms were not tangible like a broken bone or sprained ankle so my daughter's symptoms of depression may be a sign to drop out of sport since she is obviously not strong like the men who have previously dominated the sport. My daughter was crushed and has not spoken to me about her

feelings and symptoms since, which worries me."

The athletes, obligated to conform to these predefined roles set by society's traditional expectations of women, fosters an unhealthy comparison between males and females in sport. Participants 2, 6, and 7 all expressed that they believe past gender roles versus current gender roles play the most significant role in existing stigma today, especially since young athletes are hesitant to jeopardize their developing reputation. Participant 2 stated that her daughter was told that large sports federations and organizations will actively turn away from those that have spoken about mental illness because they perceive the individual as being unfit for professional due to their delicate and fragile demeanor. Therefore, the persistence of past gender roles in today's society contributes to stigma and lack of access to professional help.

Academic Prioritization: Theme 2

Out of the total ten interviews, 5 of the participants either explicitly or implicitly cited this idea of academic prioritization over athletics contributing to the persistent stigma surrounding MIS females. This meant that in modern Indian culture, IFEA were not taken seriously when undergoing symptoms of mental illness because they were told this is expected as they chose to pursue sports over education. This was explained to be a consequence of the pressures to attain a stable job and income so later, the female can contribute to the family and establish a household. Thus, when an individual experiences symptoms of mental illness, they face dismissal compelling them to experience shame and embarrassment. For example, Participant 5 stated, "My daughter who recently joined the highest level tennis team offered at her program was not met with support from the community. Even my own parents scolded me for encouraging [name of daughter] to pursue tennis instead of focusing only on school. However, she can do both-I do not think she should be forced to pick one or the other. My parents did not react well when I shared about my daughters' issues with anxiety."

Similarly, Participant 4 shared insights on the reactions of public to news surrounding academic achievement versus athletic achievement. She noted most responses to her posts about her daughter's success in sports seemed reserved and potentially judgemental. Both this participant and Participant 3 remarked that individuals appeared quick to comments the

athlete's performance in school without considering their achievements in sports. This fostered an environment where discussions about mental illness were avoided because athletes were reluctant to reinforce the notion that education is a superior path compared to sports. In reality, as the participant above highlighted , many felt as though they could successfully balance both. Participant 6 stated that "I do not know why society forces such young athletes to choose whether they want to pursue a sport or a science career so early in life. They should allow young people to explore many things and especially not make them feel belittled about mental illness." A similar statement was provided by Participant 9, with the overarching theme that stigma is created by the idea that when presented with the option of following one's educational careers or pursuing one's athletic endeavors, the "correct answer" is education. Furthermore, are deterred from discussing mental illness due to fear of criticism and judgment at not prioritizing academics. This dynamic creates and reinforces Mental Illness Stigma.

Media Portrayal: Theme 3

Five of the participants cited media portrayal of athletes to contribute to the current view of MIS in IFEA. The main type of portrayal represented through the media was athletic stereotypes of both men and women creating unhealthy comparisons and unrealistic expectations for athletes. Specifically for women, as explained by Participant 2, TV and news channels seem to only discuss the trail-blazing, powerful aspect of women's sports. While beneficial to display females in this position light, media of this nature gives the impression to real-life athletes that genuine, successful athletes cannot be influenced by mental illness. They may measure themselves against the athletes seen on TV who seem innumerable or unaffected by mental illness issues. Furthermore, Participant 5 stated how athletes may tell themselves that they must ignore and push past their mental illness symptoms if they want to be in the media like they see today. Similar rhetorics were contributed by Participants 7 and 2, stressing the role of unrealistic expectations leading to comparison among blossoming athletes. Moreover, Participant 2 followed up with specific athletic stereotypes they had seen reinforced by the media, "I see these athletes who appear to be all-powerful and greater than the average human. This creates the idea that being at such a high level in sport makes [one] invincible to internal issues and so

when I meet a IFEA who does have mental illness issues, this seems out of the norm when in fact, this is completely normal and expected." Hence, stigma is generated by the selectively crafted portrayal of athletes on media in India which make female athletes with mental illness feel as though they have failed and cannot live up to the lofty expectations and precedents set by their predecessors.

Statistical Analysis

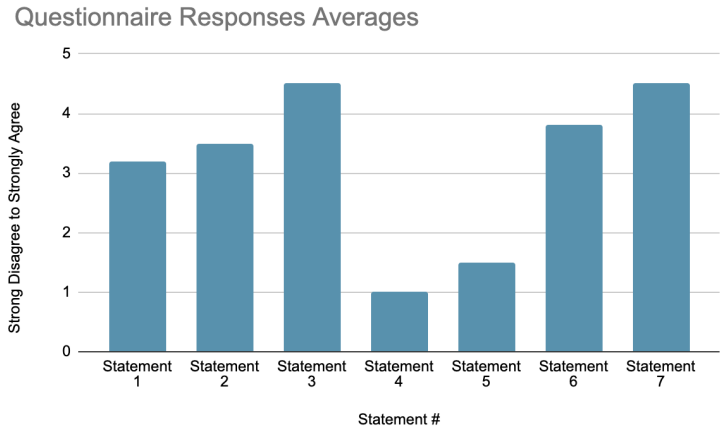


Figure 1: Questionnaire Responses Average

After taking the averages of the ratings to each statement (Appendix D) on the questionnaire, past gender roles, athletic stereotypes, and education prioritization were found to have a rating greater than 3, meaning the majority of the responses agreed with the statement and its implications. These findings were able to further support the main themes identified in the qualitative interviews and eliminate gray areas surrounding the main role of media portrayal, which was proved to be athletic stereotypes.

Discussion

As demonstrated through the analysis of the interviews and questionnaire results, the initial hypothesis was partially correct but needed to be amended. Instead of spirituality, gender roles, and athletic stereotypes being the main sociocultural causes of MIS in IFEA, academics prioritization over athletics,

past gender roles, and media portrayal of athletic stereotypes were the main contributors. In contrast to the initial hypothesis, rather than applying traditional religious beliefs and ideals to the current discussion surrounding stigma in modern IFEA, modern causes like media representation or conversations surrounding therapy play a more significant role. Furthermore, stigmas are reinforced not only on the smaller communal scale through rumors or backhanded comments but also on the larger scale of TV, news channels, or articles.

Moreover, this study was able to successfully fill the gap in aforementioned literature by addressing the overlap between causes of MIS in non-athletes in India, athletes in Western countries, females in Western countries, and females in the Pacific Rim region. By specifically focusing on the sociocultural causes of MIS of IFEA, assumptions and translations from papers discussing a different demographic will not need to be made but rather specific data from the target group can be accessed from this study.

Implications and Future Research

Additionally, the findings of my study can be applied on a communal, national, and global scale. Within communities, sports psychologists can collaborate with training facilities to provide targeted counseling and support addressing the specific sources of stigma identified in my study rather than focusing on general support not tailored to IFEA. For example, by raising awareness about the unrealistic expectations set by the portrayal of IFEA in the media and its contribution to fostering this detrimental stigma, communities could take steps to work directly with the media to alter norms. On a national level, high-level athletes could have increased access to workshops and seminars implemented by organizations with national oversight to specifically target stigma in females which will create communities among these athletes. This approach reinforces the idea of community and should not feel ashamed or embarrassed. On a global level, my findings can be applied in the scope of countries similar to India in terms of its sociocultural environment since although these results are specific to India, certain themes such as past gender roles could be found in other countries. Furthermore, the causes of stigma may not have the exact same origin but will lead to similar harmful effects on the athletes and the community. Therefore, in international competitions such as the Olympics or World Championships, athletes from India and countries with similar socio-cultural environments

will have access to specialized sources of therapy and professional help. Moreover, if these techniques are successfully implemented to target causes of stigma through dismantling stereotypes about high-level athletes and the role of women in society and progressively changing media portrayal of IFEA, the effect will radiate for younger generations as well. Generational stigma will be directly challenged as young females interested in sports will no longer experience the reinforced stigma that mental health is unimportant and should be dismissed. For future research, I suggest for this method to be implemented into different geographical regions in the Pacific Rim region, specifically in countries with Collectivist cultures. This is important so as to gauge the role of Collectivist culture characteristics in the MIS in female athletes. Furthermore, each individual theme identified in this study-past gender roles, athletic stereotypes, and media portrayal-should be analyzed through the perspective of the sociocultural environment of each geographical region.

Limitations

Although this study did contain many different perspectives and a diverse group of individuals being interviewed which contributed to the broad scope of the study, due to the nature and circumstances in which the methods were carried out, limitations are important to address. Firstly, by improving the relatively smaller sample size of this study, a more precise representation of the public in India could have been procured leading to more accurate results. Secondly, since one of my requirements was for the interviewed individuals to reside in India, I needed to utilize Zoom to connect with the individual since in-person contact was nor feasible. This resulted in all of my interviews being with individuals who lived in urban areas of India since I was able to communicate through email and schedule Zoom calls as opposed to with people in rural areas. This may have skewed the results to be based on more progressive and modern causes since in general, those in urban areas have more access to media and technology which may influence their beliefs differently to those in rural areas. Furthermore, since about two-thirds of India's population resides in rural areas, my findings may not fully represent the whole of India [17]. Lastly, since the interviewees did reside in India, language barriers and geographical barriers were important to take into account. Since I needed to occasionally translate into Marathi or reword my questions to overcome the cultural gap, the emotional connection

may have been weakened, limiting the full extent of the response.

References

1. Insan, N., Weke, A., Rankin, J. & Forrest, S. Perceptions and attitudes around perinatal mental health in Bangladesh, India and Pakistan: a systematic review of qualitative data. *BMC Pregnancy and Childbirth* **22,** 1–13 (2022).
2. Krendl, A. C. & Pescosolido, B. A. Countries and cultural differences in the stigma of mental illness: the east–west divide. *Journal of Cross-Cultural Psychology* **51,** 149–167 (2020).
3. Of Health, U. D., Services, H., *et al. Mental Health: Culture, Race and Ethnicity, a Supplement to Mental Health, a Report of the Surgeon General. Vol. 2* (2002).
4. Ran, M.-S. *et al.* Stigma of mental illness and cultural factors in Pacific Rim region: a systematic review. *BMC psychiatry* **21,** 1–16 (2021).
5. Kudva, K. G. *et al.* Stigma in mental illness: Perspective from eight Asian nations. *Asia-Pacific Psychiatry* **12,** e12380 (2020).
6. Gautam, S. & Jain, N. Indian culture and psychiatry. *Indian journal of psychiatry* **52,** S309–S313 (2010).
7. Evans, J. *7 facts about Hindus around the world* `https://www.pewresearch.org/short-reads/2022/10/26/7-facts-about-hindus-around-the-world/`.
8. Venkatesh, B. T., Andrews, T., Mayya, S. S., Singh, M. M. & Parsekar, S. S. Perception of stigma toward mental illness in South India. *Journal of family medicine and primary care* **4,** 449 (2015).
9. Khan, N., Kausar, R., Khalid, A. & Farooq, A. Gender differences among discrimination & stigma experienced by depressive patients in Pakistan. *Pakistan journal of medical sciences* **31,** 1432 (2015).
10. Center, P. R. *Gender roles in the family* Mar. 2022. `https://www.pewresearch.org/religion/2022/03/02/gender-roles-in-the-family/`.
11. Tardelli, V. S., Parmigiano, T. R., Castaldelli-Maia, J. M. & Fidalgo, T. M. *Pressure is not a privilege: what we can learn from Simone Biles* 2021.

12. Lundqvist, C. & Andersson, G. Let's talk about mental health and mental disorders in elite sports: a narrative review of theoretical perspectives. *Frontiers in psychology* **12,** 700829 (2021).

13. Poucher, Z. A., Tamminen, K. A., Kerr, G. & Cairney, J. A commentary on mental health research in elite sport. *Journal of Applied Sport Psychology* **33,** 60–82 (2021).

14. Castaldelli-Maia, J. M. *et al.* Mental health symptoms and disorders in elite athletes: a systematic review on cultural influencers and barriers to athletes seeking treatment. *British Journal of Sports Medicine* **53,** 707–721 (2019).

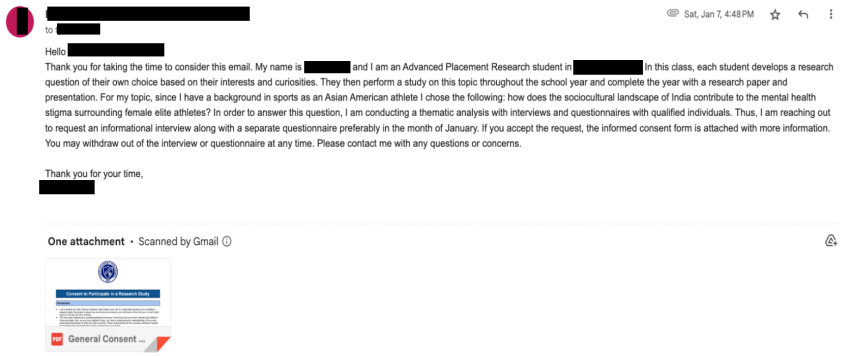
15. Simundic, A.-M. Bias in research. *Biochemia medica* **23,** 12–15 (2013).

16. Thompson, J. A guide to abductive thematic analysis. *The Qualitative Report* **27,** 1410–1421 (2022).

17. Chakravarty, A. The Evolving Scope of Rural India. *Advances in Economics abd Business,* 261–271 (2015).

Appendix

Appendix A: Initial Interest Email for Potential Participants


[redacted]
Sat, Jan 7, 4:48 PM
to [redacted]

Hello [redacted]

Thank you for taking the time to consider this email. My name is [redacted] and I am an Advanced Placement Research student in [redacted] In this class, each student develops a research question of their own choice based on their interests and curiosities. They then perform a study on this topic throughout the school year and complete the year with a research paper and presentation. For my topic, since I have a background in sports as an Asian American athlete I chose the following: how does the sociocultural landscape of India contribute to the mental health stigma surrounding female elite athletes? In order to answer this question, I am conducting a thematic analysis with interviews and questionnaires with qualified individuals. Thus, I am reaching out to request an informational interview along with a separate questionnaire preferably in the month of January. If you accept the request, the informed consent form is attached with more information. You may withdraw out of the interview or questionnaire at any time. Please contact me with any questions or concerns.

Thank you for your time,
[redacted]

One attachment • Scanned by Gmail

Consent to Participate in a Research Study

PDF General Consent ...

Figure 2: Interest Email

Note: I have colored out my name and email as well as the potential participant to retain anonymity.

Appendix B: Consent Form sent to All Potential Participants in Initial Interest Email

[redacted]

Informed Consent to Participate in Research

Study title: Identifying cultural and societal factors for mental health stigma in female elite athletes in India

Researcher[s]: [redacted]

I am inviting you to take a survey for research. This survey is completely voluntary. There are no negative consequences if you do not want to take it. If you start the survey, you can always change your mind and stop at any time.

What is the purpose of this study?

This study is meant to determine the cultural and societal key causes behind the increased stigma in mental health issues in elite female athletes in India and the connection behind causes of stigma in mental health in other groups in India and elite athletes in other countries. The information gleaned from this study can be used to identify these specific factors which result in this more conservative mindset in female athletes and work towards changing and dismantling these beliefs. Through this process, the future implications are beneficial for the younger generation and athletes all over the world.

What will I do?

Firstly, you will be asked to participate in a semi-structured interview lasting about 15-20 minutes. This interview will ask general questions about your experiences, observations, and opinions regarding my topic. Next, you will be asked to complete a questionnaire which will list various statements about the connections of culture, religion, societal expectations, and previously collected data to mental health stigma in elite athletes. There will be a 1-10 scale to state the extent to which the subject agrees or disagrees with these statements.

Risks

There are no physical or emotional risks associated with this study or survey. All data will be kept anonymous and unpublished.

Agreement to Participate

Your participation is completely voluntary, and you can withdraw at any time. If you would like to take the survey, please continue.

Figure 3: Informed Consent Form

Appendix C: Sample Interview Questions Guiding Semi-Structured Interview

Sample Interview Questions

1. **What is your relationship with the female elite athlete who you know? Did you grow up around them or meet them recently?**
2. **Would you say there are any significant experiences you have had or seen which reinforced the pronounced stigma surrounding female athletes as a whole? Why do you think these stigmas exist?**
3. **How prevalent would you say the conversation about mental health in athletes is in India? Female athletes?**
4. **From your experience, which factors would you classify as being cultural causes for increased mental health stigma in mothers? Societal causes? Do you feel these female-based specific stigmas translate into increased stigma for female elite athletes too?**
5. **Do you feel as though the increased conversations surrounding mental health in elite athletes due to events such as Simone Biles bowing out of the olympics in 2021 due to her mental health is evident for athletes in India as well? Please let me know if you are unfamiliar with this event.**
6. **Do you think there is pressure for children to pursue academics and studies rather than athletics? What about females? Do you think this plays a role in the stigma associated with mental illness in athletes?**
7. **From your experience, why do you think South Asian cultures have been found to have increased stigma surrounding mental health? Do these reasons differ or change when the focus is on athletes or specifically, female athletes?**

Figure 4: Sample Interview Questions

Appendix D: Questionnaire Distributed Post-Interview

AP Research Questionnaire: Sociocultural Causes of Mental Health Stigma in Indian Athletes

Please read the statements below and choose a number based on how much you agree with the statement. 1 is strongly agree and 5 is strongly agree.

1. **Female elite athletes face more pressure and increased mental health stigma in society over male elite athletes in India.** *

1 2 3 4 5

2. **Through my experience, female athletes are more prone to facing animosity when speaking out about mental health issues.** *

1 2 3 4 5

3. **There are parallels between mental health stigma in athletes due to the idea that athletes are viewed as indestructible and unaffected by physical or mental issues.** *

1 2 3 4 5

4. **India has a space for athletes to safely speak out about their mental health issues and not lose opportunities.** *

1 2 3 4 5

5. **Historical cultural factors results in stigma surrounding mental health stigma in Indian athletes. This includes past beliefs that mental illness is a result of karma or misdoings in a past life.** *

1 2 3 4 5

6. **Gender roles, which in the past have leaned towards women staying in the home or providing for the family, contribute to mental health stigma in female Indian athletes.** *

1 2 3 4 5

7. **Stigma is magnified in India due to the pressure that young adults "should" prioritize education over athletics.** *

1 2 3 4 5

Figure 5: Post-Interview Questionnaire

Appendix E: Participant Selection Criteria Rubric

Justification for Criteria
The participant was required to have resided or currently reside in India to ensure first-hand, proven experiences which they could use to support testimony of common beliefs, thought schools, and value systems in their area.
The participant was required to be in close relation with an IFEA who is currently training or has trained in India so as to have closely witnessed stigmatizing actions or experiences by the athlete and to speculate causes for these cases. In terms of measuring and determining what constitutes a close relation, each case was unique and reviewed individually as opposed to strict guidelines to adhere by. All of the participants ended up falling into the category of having grown up with the athlete, gone to university with them, or been the close friend of their guardian.
The participant was to be well-versed in the global changing sociocultural climate and aware of major events in India and other countries, such as the general upward trend of mental health awareness stigma in athletes after the 2021 Summer Olympic Games. To gauge awareness and understanding of such events and trends in sociocultural landscapes, potential participants were asked if they were aware of and felt familiar with recent, relevant events enough to speak on them.
The participant was required to be over the age of eighteen so as to speak to not only current times in terms of mental health awareness stigma but to also reflect on changes from the past when belief systems may have been different as opposed to now.

Table 3: Participant Selection Criteria

Appendix F: Theme Definitions

Theme	Definition
Academic Prioritization	Pressures to succeed academically and seek higher education over pursuing sports. Higher education guarantees a stable career; those with stable careers will be able to have a family.
Past Gender Norms	People still apply traditional norms for females to female athletes today including staying inside the home and caring for children. On the other hand, males seemed to be more physically able to pursue sports.
Therapy Stigma	Therapy is condemned and those who attend are seen as weak or unstable. Athletes face discrimination since they may have been seen to be strong and indestructible but are now seen as fragile and weak-minded.
Lack of Education	Scarce resources surrounding mental health are available in India. This leads to incorrect assumptions about mental illness from the general public such as the impression that they cannot be a functioning member of society and that they are to blame for their own mental health conditions.
Media Portrayal	Media portrayal of female athletes only highlights positives such as strength, perceived invincibility, perceived indestructiveness, and perceived immunity to mental health issues.

Table 4: Theme Definitions

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Assessing the Effects of Family Caregivers of Alzheimer's Disease

*Isra Hussain**

ABSTRACT

This study focuses on the unique challenges faced by family caregivers of Alzheimer's patients in the densely populated city of Karachi, Pakistan. Employing a two-pronged methodology, we aimed to understand the impact of the demographic context on these caregivers. The first phase involved a qualitative survey utilizing a semantic scale with options ranging from "Strongly Disagree" to "Strongly Agree" to gauge emotional conditions. The second phase comprised qualitative interviews to delve deeper into participants' survey responses. Thematic analysis revealed five recurrent themes among caregivers, shedding light on the challenges they face in this specific demographic: guilt, compassion fatigue, religious and cultural stigmatization, lack of official support in Karachi, and enduring long-term effects on caregivers.

This study concludes that family caregivers in Karachi encounter a range of challenges, including guilt, compassion fatigue, religious and cultural stigmatization inhibiting them from seeking professional help, and enduring long-term physical and mental effects. The findings underscore the need for further research to explore strategies to provide support for caregivers in developing nations like Karachi. Such efforts can empower caregivers to navigate their roles effectively while mitigating the adverse effects they experience.

Introduction

Alzheimer's Disease stands as the prevailing form of dementia, impacting approximately 55 million individuals worldwide [1]. This debilitating disorder disrupts daily functioning as the brain undergoes deterioration, affecting memory and cognitive abilities. The primary caregivers for those grappling with these challenges are often immediate family members, shouldering the responsibility of round-the-clock care and supervision [2]. Despite extensive research on the disease itself, The University of San Francisco Weill Institute for Neurosciences notes a notable oversight regarding the health and well-being of family caregivers [3]. Immersed in the care of the afflicted patient, these caregivers invest all their time, often neglecting their own

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physical and mental health.

This study underscores the imperative to delve into the mental health of caregivers, particularly those situated in diverse demographic locations, potentially impeding their access to essential resources and exacerbating their burdens. As highlighted by K.S Shaji et al., developing nations, while benefiting from extended family and home care, grapple with the dual challenges of economic strain and caregiver burden [4]. In light of this, our focus extends beyond the disease itself to unravel the intricate dynamics of caregiver well-being, shedding light on the impact of different demographic contexts on their ability to access support and navigate the associated challenges.

Literature Review

Search Strategies

To understand the effects of caregiving for Alzheimer's Disease (AD) in Karachi, Pakistan, it is important to take a look at the prior research conducted on AD in regard to caregivers as a whole in different settings and circumstances. Sources were obtained by scrutinizing databases that ensured credibility through peer review including Google Scholar, Galileo, and EBSCO. Keywords included "compassion fatigue," "family caregivers," "Alzheimer's disease stress," "developing nations," and "minority groups".

Specific Outcomes of Caregiving

Limited research exists on AD family caregivers and their experiences with the associated negative effects and contributing factors. Existing studies tend to narrow their focus, examining specific aspects of caregiving and extrapolating them to a broader context. A notable study by the University of Madrid delved into the profound impact of guilt on AD family caregivers [5]. This investigation identified various guilt types, encompassing feelings related to negative emotions arising from changes in the caregiver-patient relationship, guilt induced by the person being cared for, and guilt influenced by external sources. The study also recognized feelings closely associated with guilt or anticipated guilt [5].

However, the conclusions drawn from this research primarily centered on the caregiver's sense of inadequacy in meeting the needs of their patient, categorizing guilt into seven distinct types. While this analysis provided valuable insights into the nuances of guilt experienced by caregivers, it

fell short in offering a comprehensive exploration of the broader effects on caregivers' mental health. To address this gap, future research should extend beyond a singular focus on guilt, considering additional factors and wider implications that contribute to the overall negative mental health of caregivers in the context of AD.

Building on this approach of examining specific effects, Dr. Donna Cohen and Carl Eisdorfer conducted a study that explored depression among family members providing care for a relative with Alzheimer's Disease, shifting the focus from guilt to the realm of depressive experiences.

The caregivers, who participated in a study, underwent evaluation using the Beck Depression scale—an instrument designed to gauge the severity of depression through specific questions [6]. The results revealed that over half of the caregivers received a diagnosis of depression. Notably, the study identified external factors as significant contributors to the caregivers' depressive symptoms. An intriguing finding was that the duration of cohabitation with the patient correlated with an increased likelihood of developing depression or experiencing other negative effects. Parallel to the University of Madrid study, Cohen and Eisdorfer's research focused on a single effect of caregiving—guilt and depression, respectively.

However, a study by Gallagher-Thompson et al. challenges the correlation observed in Cohen and Eisdorfer's research [7]. In contrast to the conclusion drawn by Cohen and Eisdorfer that prolonged cohabitation with the patient exacerbates symptoms for the caregiver, Gallagher-Thompson et al. asserted that closer caregivers experience an improvement in their mental health as the patient's cognitive health declines. The pivotal factor, as defined by Gallagher-Thompson et al., was the occurrence of "sundowning symptoms," characterized by a differential nocturnal exacerbation of seven disruptive behaviors, including hallucinations and confusion. The study found that caregivers reported reduced stress levels when sundowning characteristics were evident in the Alzheimer's patient.

Despite its focus on sundowning characteristics, the study falls short of clearly establishing a correlation between these symptoms and the caregiver's well-being, as it does not provide specific examples of the caregiver's health effects.

Other studies focus on compassion fatigue inflicted upon caregivers. Compassion fatigue (CF), as defined by Day & Anderson, is when a caregiver deals with feelings "of anger, inefficacy, apathy, and depression, resulting from a caregiver's inability to cope with devastating stress" [7, 8].

This study specifically focused on female daughters. While it concluded that daughters experienced the highest levels of Compassion Fatigue (CF), the findings may appear generalized due to the potential variation in outcomes across different demographics. A previous study by Day & Anderson examined CF in the context of informal caregiving [9]. This study posited that CF involves a "combination of hopelessness, helplessness, apathy, and emotional disengagement that occurs after prolonged exposure to suffering." Informal caregivers, particularly family members, are noted to be more emotionally attached to their patients due to pre-existing relationships, aligning with Day & Anderson's earlier findings.

Despite successfully defining CF, both studies fall short in accounting for diverse demographics and situational factors, resulting in a broad conclusion regarding the prevalence of CF on a case-by-case basis. These findings raise questions about the potential influence of specific factors such as demographics and the caregiver's relationship to the patient. Further exploration of these variables is essential to understanding the nuanced impact of CF in different caregiving scenarios.

Figure 1: Compassion Fatigue: A model *Adapted from Middleton*

Caregivers in Developing Nations and Rural Areas

Several studies have explored the impact of rural settings on family caregivers. Wood and Parham conducted a study specifically examining minority groups in rural areas, drawing a comparison between urban and rural contexts [10]. This comparison involved assessing Caucasian caregivers from an urban setting and African-American caregivers from rural areas.

Parham assembled primary caregivers for AD patients, selecting participants based on race and area of residence to draw a distinct comparison between metropolitan and rural environments [10]. The study's findings

and scale indicated that urban areas perceive themselves as more capable of accessing assistance compared to rural counterparts, with a notable inclination in urban areas towards resource mobilization. African-American caregivers exhibited stronger family ties, fostering a family-oriented approach rather than an action-centric one. Additionally, the study highlighted that minorities, particularly African Americans, tend to form kinships rooted in religion, leveraging spirituality as a coping mechanism—an observation supported by researchers Hodge and Fei Sun in their study on Latino families [11].

Hodge and Sun's research underscored the positive impact of spirituality in sparking a favorable change in attitude among Latino families, serving as a coping mechanism for excessive stress. However, it is important to note that while this study identifies spirituality as a positive influence, the intertwining factors of religion and culture may yield negative outcomes for caregivers, potentially subjecting them to social pressure and escalating stress levels. This study falls short in providing a conclusive understanding that is universally applicable across different countries and demographics.

In addition, studies have begun to shift their focus to developing nations such as Pakistan, the focus of my research. Farah Qadir et al., researchers affiliated with Fatima Jinnah University, conducted a study in Rawalpindi and Islamabad, Pakistan. Their focus was on informal caregivers, examining their lack of awareness about Alzheimer's Disease (AD) and how this contributed to heightened stress and physical burdens associated with caregiving [12]. Qadir and her colleagues explored AD in the context of Pakistan, shedding light on the prevalent lack of awareness among families regarding the causes and effective management of the disease without sufficient assistance. The study's findings revealed that a significant number of caregivers were unfamiliar with dementia or AD, often attributing the symptoms to the natural aging process. Moreover, religious affiliations influenced caregivers' perceptions and attitudes towards patients, as their adherence to Islam dictated the manner in which they treated their parents with utmost respect.

While the researchers delved into caregiving dynamics in a developing nation, their analysis predominantly focused on the collective attitudes of caregivers rather than delving into individual caregiver effects. Following a similar line of investigation, Amna Aurooj and Zahid Muhammad conducted research on Alzheimer's Disease (AD) caregivers specifically in rural areas of Pakistan [13]. Aligning with the conclusions drawn by Qadir et al.,

Aurooj and Muhammad identified a significant impact of caregivers' lack of awareness about AD, emphasizing the role this played in hindering optimal performance. The caregivers' limited access to information on AD and lack of comprehensive education were identified as contributing factors to their challenges in caregiving.

Gap in Research and Hypothesis

Most studies focus on caregivers or family caregivers as a whole and effects based on generalized approaches rather than looking at specific issues arising in certain family caregivers with an in-depth analysis of each person based on their environment, cultural and religious experiences affecting them in a developing nation [13]. Existing research tends to discuss minority groups or focus on areas in a developing nation that differ from my research. This study aims to focus on the factors as well as the long and short-term effects that caregivers gain due to living in a developing nation, and a particularly overpopulated and religiously affiliated one. Current discussion today focuses on broader aspects of the effects of caregivers and gives similar reasons as to why they occur, rather than going into an in-depth discussion on the types of depression or anxiety arising. These problems and gaps pose the question: How are family caregivers negatively affected when caring for a family member with Alzheimer's Disease in Karachi, Pakistan? The primary objective of this study is to comprehensively comprehend the short-term and long-term impacts on each family caregiver, enabling a thorough analysis of the underlying causes and consequences associated with their caregiving roles. The hypothesis posits that family caregivers in Pakistan experience significant Compassion Fatigue (CF) influenced by religious and cultural affiliations. The anticipated effects encompass mental stress, demographic factors, depression, physical impacts, and a distinct psychological framework following the caregiving period. Additionally, the results may reveal a connection between guilt and strained relationships with the patients.

Research Design and Methods

Study Design

This study aims to understand the long-term and short-term effects of family caregivers in Karachi, Pakistan which is a developing nation with

strong cultural and religious ties and struggles with overpopulation. A two-pronged qualitative method case study 'The 2-Pronged Approach Case Study' was conducted in the form of a case study. A case study is useful when working with research for in-depth issues in a natural-life context [14]. For this particular study, a case study was chosen since this method of design allowed for a more in-depth analysis of not just a single individual but a larger group. Furthermore, with a case study, especially with people, general trends and patterns are most feasible to identify as opposed to a cross-sectional study. Through interviews, a thorough understanding of the participant's relationship with the patient, CF, as well as long-term and short-term effects. Employing a qualitative method is crucial for this study as it provides a reliable means to acquire information regarding participants' emotional attitudes. With this qualitative analysis, two methods were utilized to gather data which included a questionnaire in the form of a survey and qualitative interviews with each family caregiver. As seen in the literature review, past researchers have neglected to conduct an analysis on participants in Karachi, Pakistan. Moreover, researchers investigating Pakistan through case studies have often relied on the stereotype of rural areas to inform their findings. Utilizing a qualitative method in the urban setting of Karachi, Pakistan, introduces a fresh perspective that brings specificity to densely populated regions, shedding light on the unique effects experienced by family caregivers in these particular circumstances.

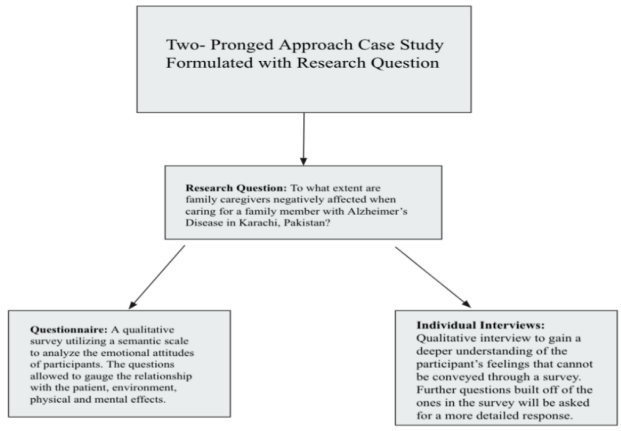

Figure 2: The 2-Pronged Approach Case Study

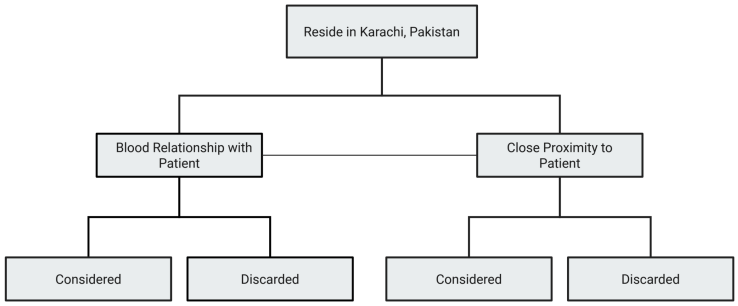

Figure 3: Choosing Potential Participant Criteria

The participants in this study comprised various family members of the patient, each demonstrating distinct caregiving approaches. Specific instances within this demographic included individuals living with or in close proximity to the patient, those visiting the patient weekly or bi-weekly, and individuals staying with the patient for extended periods throughout the year. (Figure 3). The participants must be from Karachi, Pakistan to stay in line with the cultural and religious standards as well as the effects of the environment on their duties as a family caregiver. Subjects were recruited by finding family members in Karachi, Pakistan with a family member diagnosed with AD.

Research Instruments

After gathering specific subjects, each was emailed a request to participate in the study by explaining the two-pronged approach case study (Appendix A).The email also included a cautionary note that the forthcoming questions were not designed to inflict emotional harm, and participants were assured that they could opt out if necessary. Each subject was instructed to respond by email if they agreed to participate in the study. Upon confirmation from participants, a questionnaire in the form of a survey was subsequently emailed to them via Google Forms. This study involved three distinct families, each associated with an AD patient. In the first family, there were three daughters of the patient, the patient's wife, and two grandchildren. Specifically, one daughter, two grandchildren, and the wife co-resided with the patient. The second family included one son of the patient, the patient's wife, and two grandchildren. The third family comprised one daughter of the patient, one son of the patient, and one grandchild. To be eligible for inclusion in this study, all participants were required to reside

in close proximity to or with the patient. Questions revolved around CF to understand the extent to which the caregiver was affected by caring for the patient. The questions utilized a semantic scale for the participant to choose from options "Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree" (Appendix C).

The interviews of each participant took place via Zoom to assess physical body language and create a personal discussion to create an understanding towards the research question (Appendix D). All interviews were standardized with a set of four questions focusing on the participant's physical and mental well-being during caregiving, the observed effects, the dynamics of relationships, and specific emotions within subsections such as guilt, along with decisions influenced by religious and cultural considerations.

Participants were categorized according to their relationship with the patient, specifically as daughter, son, wife, or grandchild. This categorization facilitated a more efficient identification of commonalities, enhancing the study's ability to draw concise conclusions. The study encompassed three families: the first family comprised one wife, three daughters, and two grandchildren; the second family included one wife, one son, and two grandchildren; and the third family consisted of one daughter, one son, and one grandchild.

Thematic Analysis

Once interviews were conducted, the study proceeded to the next step: a case study involving a qualitative thematic analysis. A thematic analysis is a method utilized qualitatively to understand underlying patterns and themes in different participants of a study [12]. This method was employed to scrutinize the interviews and participant responses, with common themes identified through the application of qualitative analysis. A thematic analysis was implemented with both the questionnaire and the interviews conducted. Initially, responses from the semantic scale were analyzed to formulate questions for subsequent interviews with each participant. Subsequently, recordings of interviews involving all thirteen participants were scrutinized to identify recurring themes and underlying patterns

Findings

Once data was collected from the thirteen participants, the caregivers were grouped into their respective families creating three case studies. For the

purpose of this study, the participants will be distinguished based on their affiliation to the respective family (1, 2, or 3) and their relationship to the patient (ex. Family 1, Wife).

Interviewee	**Content**	**Main Points in Caregivers**
Wife	Consistently helped the patient with daily tasks such as medication, food, and changing clothes.	CF, guilt, depression, high blood pressure, heart disease.
Daughter #1	In charge of buying medication, organizing toiletries.	CF, guilt, dissociation, frequent panic attacks.
Daughter #2	Took patient to the doctor, entertained patient, helped stimulate brain.	CF, guilt, Post traumatic stress disorder
Daughter #2	Took patient to the doctor, entertained patient, helped stimulate brain.	CF, guilt, Post traumatic stress disorder
Daughter #3	Helped feed medication, organizing everyday items	CF, guilt, frequent panic attacks
Grandchild #1	Sat for an hour a day with patient, helped serve food	Guilt, anxiety

Table 1: Family 1

Interviewee	Content	Main Points in Caregivers
Wife	Manual labor, medicine, helped with motor skills such as feeding food or giving water, stimulated memory	CF, Depression, Essential Tremor, Abdominal Cyst Formation, Guilt
Son	Paperwork, finances, medicine bills, doctoral visits	CF, Guilt, Anxiety, insomnia
Grandchild #1	Organizational necessity, spending time with patient	Guilt
Grandchild #2	Spent time with patient	Guilt, Anxiety

Table 2: Family 2

Interviewee	Content	Main Points in Caregivers
Daughter #1	Emotional connection with patient, utmost respect, conservative viewpoints on mental health	Guilt, Insomnia, Excessive back pain, Anxiety
Son #1	Paperwork, finances, medicine bills, doctoral visits, conservative viewpoints on mental health	CF, Guilt, Anxiety
Grandchild #1	Helping with motor skills with patient, spent 2+ hours with patient per day	CF, Guilt

Table 3: Family 3

The charts addressed each of the three families. In the first column, the participant's relationship with the patient as a family member was

documented, with consent for this information confirmed through a consent form (Appendix B). The second column provided a detailed account of the content covered in each interview, expanding on responses from the survey and engaging in an open-ended discussion on the participant's experiences as a family caregiver. The third column delved into overarching main ideas extracted from the interviews, which were then categorized into themes observed in each participant. By utilizing these three tables, overarching themes within the participants' experiences were identified and subjected to thematic analysis. This approach aimed to enhance the understanding of the challenges and experiences encountered by caregivers within this particular demographic.

Results

The interviews conducted with each of the participants depicted their experiences being family caregivers and outlined the process they went through throughout their daily lives. The experiences documented in Tables 1, 2, and 3 for each participant were subsequently compiled and analyzed to identify correlating themes, as outlined below. This section serves to discuss the results of the thematic analysis utilized by understanding the recurring themes and patterns in the participants. In doing so, an accurate understanding of the effects of family caregivers in the urban aspect of Pakistan, a developing nation, can be understood and utilized for future steps. The five themes listed below were seen in the majority of the participants, and thus discussed in depth to gain an understanding.

Theme 1: Guilt

Guilt emerged as the predominant and widespread theme, with all thirteen participants highlighting it as a prominent effect in their caregiving experiences. In the context of this study, guilt refers to the sentiments of family caregivers who believe they are not adequately meeting their patient's needs and experience a sense of hopelessness in improving the patient's diagnosis. These emotions often led caregivers to feel trapped in their thoughts and experience a profound sense of being unloved. Family 1, Daughter 2 articulated: "I often felt guilty because... no matter what I did Abu [Dad] would progressively get worse. I regret not spending more time with him before because now it feels like talking to a wall."

To add on, Family 3, Son explained that he felt guilty that he did not have a close relationship with the patient prior to the AD diagnosis and now was unable to connect to his father. Each daughter, son, and grandchild from family 1, 2, and 3 communicated similar feelings and explained how these emotions affected their performances in being a caregiver. Family 1, Wife explained that "I wish that this never happened, it's just so hard to even have a conversation with him..." The wives in each family, in particular, shared an exceptionally close connection with the patient before the diagnosis.

Theme 2: Compassion Fatigue

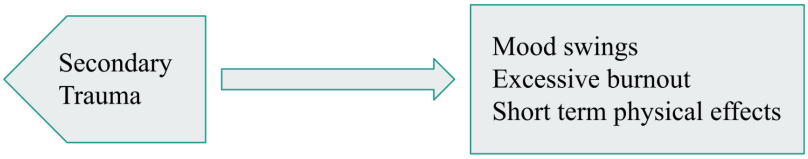

Figure 4: Effects of Secondary Trauma

The next theme seen in eight of the thirteen participants was Compassion Fatigue (CF). As observed in Day's study in the literature review, CF occurs when a caregiver undergoes a range of intense emotions, including extreme anger, sadness, and stress, stemming from witnessing the patient's experiences. As depicted in Figure 1, burnout and secondary trauma contribute to CF. However, this study revealed that secondary trauma also resulted in effects such as short-term physical impacts and mood swings, as illustrated in Figure 4. Multiple participants shared experiences of lashing out not only at other family members but also at the patient throughout the day.

In terms of secondary trauma itself, Family 2, Wife explained that "He [the patient] wouldn't even be able to walk or pick up a spoon. I never thought a day like this would come." This secondary trauma, as depicted in Figure 4, created tremendous effects for the family caregivers. Family 1, Daughter 3 discussed in her interview that, "he [the patient] would just never listen to me and although I knew he couldn't understand what I was saying, it would make me so mad and I just couldn't be patient." This was also seen in three other patients throughout the families. Short-term effects

were seen in six out of thirteen participants such as headaches, migraines, and spurts of back pain, making them unable to perform everyday tasks and alter their appetites.

Theme 3: Religion and Cultural Stigma

The third theme indicated by seven out of thirteen participants was the religious and cultural stigma affecting their caregiving abilities. In Karachi, 91% of the population practices the religion of Islam [15]. As seen in survey question #1, all the family caregivers in this study practiced Islam.

Filial Piety

A pivotal concept integral to the roles within family units is filial piety, a term deeply rooted in Karachi's religion and culture. It emphasizes the belief that "family must respect and obey the elders." In the context of Islam, not fulfilling these responsibilities to the best of one's ability is condemned as a sin (Abdullah et al.).Therefore, filial piety imposes a burden on family caregivers, leading to overexertion in their efforts to provide for their patients. Family 3, Son 1 expresses that "I would go out of my way to help my mother [the patient] and would skip work or neglect my own children's needs since I wanted to do my very best for her and would pray for her forgiveness."

The continuous act of praying for the patient and the deeply ingrained concept of filial piety among all participants posed obstacles, hindering caregivers from prioritizing their own self-care, as exemplified in the case of Family 3, Son.

Prayer and Supplication to God

The religious and cultural perspectives in Karachi hindered participants from seeking medical treatment. Five out of thirteen participants believed praying and making dua (religious supplication to God) would suffice in their contributions to official treatment as seen in Family 1, Daughter 1 communicating that "I would often go to the mosque and sit on my prayer rug, asking God for forgiveness for Abu [the patient]". This action was seen in eight of the thirteen participants, utilizing religion as the source of answers rather than finding the necessary time to seek external sources for guidance.

Cultural Stigmatization: Punishment from God

In Karachi, the cultural attitudes towards mental diseases involving memory loss are seen as a punishment from God, thus creating shame for the caregivers as articulated by Family 1 Daughter 1,2, and 3, Family 2, Wife, Son, and Family 3 Daughter 1. "I was often scared to talk to my friends or the public about it because word spreads in Karachi and rumors would just add to my stress," said Family 1, Daughter 2. Moreover, owing to the shame deeply ingrained in the minds of caregivers in Karachi, many sought guidance from religious leaders or healers to interpret the meaning of the initial memory loss. They were often unable to pinpoint that it was Alzheimer's Disease causing the patient's cognitive decline. Family 2, Wife, stated that "I did not even realize that my husband's [the patient] memory loss was connected to a life-altering disease and instead treated the memory loss as an evil sign from God. Because of this, I did not even think to show him to a doctor in the beginning stages. Maybe if I had done so, things wouldn't have gotten as bad as they are now." The prevalence of shame of mental disorders such as forgetfulness (symptoms of AD) causes most caregivers to refuse professional treatment as seen in the three families of this study.

Theme 4: Lack of Official Support in Karachi, Pakistan

Healthcare System

The fourth theme seen in this study is the lack of official support in Karachi, Pakistan. According to six out of thirteen participants, there is a lack of support in the healthcare system in Karachi. Family 3, Son explains that "I just did not know where to turn to for advice. No one even knew what AD was and there were only 5 doctors for it in Karachi, all needing money we didn't have." Four additional participants expressed similar perspectives, underscoring the notion that professional help is limited in the city of Karachi. As elucidated through the responses of the participants in this study, the reason for this scarcity is that mental disorders are often overlooked, given that their effects are not as immediately noticeable as those of physical diseases. Due to this, critical diseases such as AD and the necessary training and help needed to support a patient are often not given to families. Expressed by Family 2, Son "Because of the amount of people lined up in different hospitals around the city, it's hard to dedicate ones to

just mental diseases since the amount of people with physical ones surpass them" [11].

Government System

In Pakistan, the inflation rate has risen to 19.4% in the past two decades creating a currency devaluation and a rise in prices of simple everyday items [16]. Consequently, families in densely populated areas of Pakistan, exemplified by the demographic under scrutiny in this study, namely Karachi, encounter heightened challenges due to inflation. The increased competition among a larger population in the area for similar everyday necessities exacerbates these issues. Family 3, Daughter 1 explains that her family could not afford simple everyday grocery items, let alone the expenses of doctor visits and medical bills for the patient. The inability of caregivers to seek formal help or afford the needs to support their patient adds to the overbearing burden they carry when caring for a patient. Furthermore, all three families indicated the Jinnah Postgraduate Medical Center of Karachi as one step and resource that they often resorted to yet the center was understaffed and did not have enough resources to bring about adequate advice to the family members. The government of Karachi in particular, lacks the funding for not just the Jinnah Postgraduate Medical Center, but almost every healthcare facility lacks the funding necessary for research on AD and steps to care for families [11].

Theme 5: Long-Term Effects on Well-Being

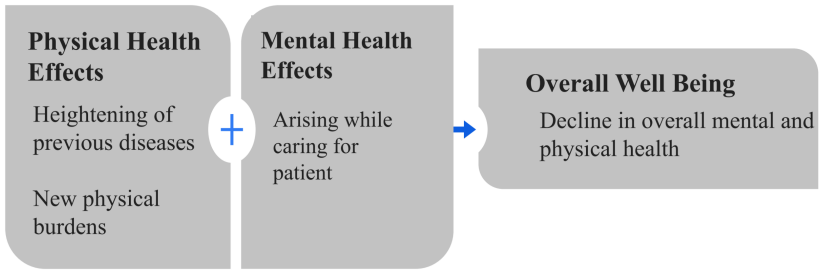

Figure 5: Assessing the Long-Term Physical and Mental Effects on Caregivers

The long-term effects were analyzed and seen as a theme in eight out of the thirteen participants all affecting the overall well-being of each of the

caregivers in a decline in their physical and mental health. Firstly, when talking to Family 1, Wife and Family 2, Wife, including Family 1, Daughters 1 and 2 and Family 2, Son faced physical diseases such as abdominal cyst, heart disease, lung cancer, and arthritis. Although five participants in particular faced physical diseases as they cared for their patients simultaneously, they were so immersed in their patients' diseases that oftentimes their own diseases were neglected, and did not spend money on their medicines or doctoral visits. Furthermore, while caring for a patient, mental disorders/diseases arose in eight of the thirteen caregivers including anxiety, depression, Post Traumatic Stress Disorder, and insomnia. The culmination of both physical and mental disorders/effects created an overall decline in well-being for a caregiver 'Assessing the Long-Term Physical and Mental Effects on Caregivers'.

Limitations

Before gaining a broader understanding of the implications of this study, it is important to note the limitations. Firstly, each of the thirteen interviews were conducted over a virtual platform, Zoom, and the initial survey was conducted via Google Forms. This was due to the geographical distance of Karachi, Pakistan from the area I reside in. If interviews were conducted in person, a better understanding of feelings towards caregiving and experiences could be conveyed with a full scope of emotions through body language and comfort. Next, this study was conducted with participants who did not speak English as their first language, rather speaking Urdu from time to time throughout interviews. Thus, when quotations were translated from Urdu to English, the full extent of the emotions and meanings may not accurately be relayed. Finally, the unfamiliarity of technology with multiple participants (five out of thirteen) created the necessity for a third person to intervene to help with inserting data into the Google Forms and downloading the Zoom application.

Discussions of Results

Thus, the results of this study prove that the initial hypothesis was inaccurate.Rather than harnessing the positive aspects of religion and culture through spirituality and support groups, which could aid caregivers in similar situations, religion and culture, in this context, served to stig-

matize mental diseases like Alzheimer's and impede the search for effective treatment. Furthermore, cultural groups were not implemented to gain an understanding of accurate caregiving since the topic was immensely stigmatized and shunned in society. Lastly, the idea of the dense population serving as an indication of prestigious hospitals with medical treatment was inaccurate since the Karachi government lacked the ability to provide the necessary funds to modernize healthcare centers. Due to the lack of support, many caregivers gained long-term and short-term physical and mental effects, extreme guilt, and Compassion Fatigue with sub effects of secondary trauma and burnout.

Implications

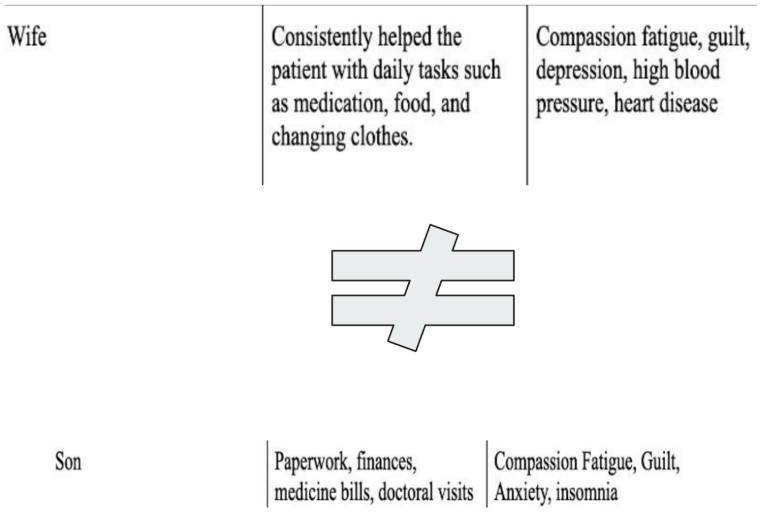

Figure 6: Demonstration in Relationships Inequality of Effects

The conclusions drawn from this study regarding the effects on family caregivers in Karachi carry significant implications for the future of caregiving and understanding how to provide effective care. Notably, in Karachi, there exists a 1:3 ratio of patients to family caregivers. This means that the effects identified in the analysis impact over 30% of the population of Karachi, given that 20% of the population is affected by Alzheimer's Disease [17]. The failure to recognize and address the challenges and hardships faced by caregivers is disconcerting. This study aims to shed light on the effects experienced by caregivers in Karachi, elucidating the struggles aris-

ing from inadequate support and the impact of the geographical location in an overpopulated area that neglects the prioritization of mental health and mental diseases. An important revelation from this study is the nuanced influence of the caregiver's relationship to the patient on the tasks performed, consequently affecting the degree of negative effects, as depicted in 'Demonstration in Relationships Inequality of Effects' dimension that has not been explored previously. This newfound understanding opens avenues for the development of tailored programs in developing nations like Karachi, addressing the specific needs of caregivers. By allocating funds into such programs, the government can enhance the overall quality of caregiving in these circumstances.

Therefore, it is imperative to take future steps at both the community level and on a global scale to alleviate the challenges caregivers face in developing nations. At a community level (Karachi), religiously and culturally oriented groups can play a crucial role in bringing like-minded caregivers together through forums such as Mosque circles, leveraging shared beliefs and practices as a means to uplift morale throughout the caregiving process. Additionally,the government can enhance its commitment by increasing investments in research and healthcare services specifically tailored for Alzheimer's Disease ensuring that technology and advice remain current and effective. On a global scale, tailored awareness programs can be developed to accommodate each nation and cater to individual caregivers based on their relationship with the patient. Collaborating with organizations like the Alzheimer's Association would be highly beneficial, providing caregivers with awareness and understanding of the challenges associated with Alzheimer's Disease, all presented in their native language according to their respective nations.

References

1. Association, A. *2023 Alzheimer's Disease Facts and figures - Alzheimer's Association* `https://www.alz.org`.
2. DSHS, T. *Alzheimer's Disease - Options for Care* `https://www.dshs.texas.gov/alzheimers-disease/risk-reduction-promoting-cognitive-health/prevention/alzheimers-disease-options-care`.
3. Institute, W. *Memory and Aging Center* `https://memory.ucsf.edu/`.

4. Shaji, K. S., Smitha, K., Lal, K. P. & Prince, M. J. Caregivers of people with Alzheimer's disease: a qualitative study from the Indian 10/66 Dementia Research Network. *International journal of geriatric psychiatry* **18,** 1–6 (2003).

5. Gallego-Alberto, L. *et al.* "I feel guilty". Exploring guilt-related dynamics in family caregivers of people with dementia. *Clinical Gerontologist* **45,** 1294–1303 (2022).

6. Cohen, D. & Eisdorfer, C. Depression in family members caring for a relative with Alzheimer's disease. *Journal of the American Geriatrics Society* **36,** 885–889 (1988).

7. Gallagher-Thompson, D., Brooks III, J. O., Bliwise, D., Leader, J. & Yesavage, J. A. The relations among caregiver stress,"sundowning" symptoms, and cognitive decline in Alzheimer's disease. *Journal of the American Geriatrics Society* **40,** 807–810 (1992).

8. Day, J. R., Anderson, R. A. & Davis, L. L. Compassion fatigue in adult daughter caregivers of a parent with dementia. *Issues in mental health nursing* **35,** 796–804 (2014).

9. Day, J. R., Anderson, R. A., *et al.* Compassion fatigue: An application of the concept to informal caregivers of family members with dementia. *Nursing Research and Practice* **2011** (2011).

10. Wood, J. B. & Parham, I. A. Coping with perceived burden: Ethnic and cultural issues in Alzheimer's family caregiving. *Journal of Applied Gerontology* **9,** 325–339 (1990).

11. Hodge, D. R. & Sun, F. Positive feelings of caregiving among Latino Alzheimer's family caregivers: Understanding the role of spirituality. *Aging & mental health* **16,** 689–698 (2012).

12. Qadir, F., Gulzar, W., Haqqani, S. & Khalid, A. A pilot study examining the awareness, attitude, and burden of informal caregivers of patients with dementia. *Care Management Journals* **14,** 230–240 (2013).

13. Aurooj, A. & Mahmood, Z. Subjective Experiences of Alzheimer's Disease in the Pakistani Cultural Context: An Exploratory Study. *Journal of religion and health* **61,** 125–138 (2022).

14. Crowe, R. K. *et al.* Foods and beverages provided in out of school hours care services: an observational study. *BMC Public Health* **22,** 1–9 (2011).

15. Mahmood, Q. K., Jafree, S. R., Sohail, M. M. & Akram, M. B. A cross-sectional survey of Pakistani Muslims coping with health anxiety through religiosity during the COVID-19 pandemic. *Journal of religion and health* **60,** 1462–1474 (2021).

16. Khan, M. S. & Schimmelpfennig, A. Inflation in Pakistan. *The Pakistan development review,* 185–202 (2006).

17. Adamson, M. M. *et al.* Brain injury and dementia in Pakistan: current perspectives. *Frontiers in neurology* **11,** 299 (2020).

Appendix

Appendix A: Initial Correspondence with Potential Participants via Gmail

Note: For the safety of the participants, the names to whom this email was sent to has been replaced with a "___". This is a draft of the emails sent out to different participants:

Hello ___,

I hope you are doing well. My name is ___ and I am conducting a research project on Alzheimer's Disease family caregivers' effects in caregiving for a patient in Karachi, Pakistan for my AP Research class where we create a year-long project and conduct a study on an evident gap present in a certain topic. The necessary criteria to be considered for this study are to live with or in close proximity to your patient, and be a blood relative of your patient. I am emailing you to inform you that in order to express interest in my study, you must email back expressing your interest in being a participant of the study. The study consists of a survey and an interview to discuss your caregiving experiences in Karachi. Please note that if at any time you feel uncomfortable with the information and questions asked, then you can opt out at any time.

Please let me know the status of your interest

Appendix B: Consent Form Sent to Participants

Note: The consent form encompasses consent for the surveys and interviews, indicating that emotional topics will be mentioned regarding anxiety, depression, and suicide. Furthermore, the boxes indicate the confidentiality of sensitive information such as personal names and school names.

Fulton Science Academy

Informed Consent to Participate in Research

Study title: Alzheimer's Disease Effects in Caregivers in Karachi, Pakistan

Researcher[s]: Isra Hussain, 11th Grade

I am inviting you to participate in my study for research. Involvement is completely voluntary. Please feel free to withdraw participation at any time if uncomfortable and sensitive topics arise where you feel at danger in your mental/physical health.

What is the purpose of this study?

This study is meant to gain an in-depth understanding of family caregivers in Karachi, Pakistan and the long and short term effects that come with it due to recurring themes.

What will I do?

Participation includes a survey and interview. The survey will assess your emotional attitudes towards a variety of topics by asking you to choose from a scale of strongly agree to strongly disagree. The link via google forms will be emailed to you once this consent form is signed. After the survey is completed, participants will be asked to find a time they are available to be interviewed in order to gain an in-depth understanding that would not be capable through a survey.

Risks

There are no physical or emotional risks associated with this study, survey, or interview. All data will be kept anonymous and unpublished.

Agreement to Participate

Your participation is completely voluntary, and you can withdraw at any time. If you would like to take the survey, please continue.

Warning:

The topics dealt with throughout the study may be sensitive to a participant with topics that include depression, anxiety, guilt and grief. The intent of this study is not to induce negative feelings but if at any time you feel in danger, please withdraw participation.

Appendix C: Questions from the Google Forms

Research Questionnaire Alzheimer's Disease Effects in Caregivers

This form will ask a series of questions regarding the effects of caring for a family member with Alzheimer's Disease, both long term and short term. Participation in this survey is completely voluntary and, if at any time you fill uncomfortable, please feel free to click off the form.
Thank you!

1. Name

_____

2. What religion do you identify with?

Mark only one oval.

- ◯ Islam
- ◯ Christianity
- ◯ Judaism
- ◯ Hinduism
- ◯ Option 5
- ◯ Other: _____

3. Do you believe your religion affects your method of caring for your patient?

Mark only one oval.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree
- ◯ Other: _____

4. Were there any times where you realized you were putting your caregiver first before your own health?

Mark only one oval.

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

5. Did you ever experience symptoms of feeling worthless, or not doing enough?

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

6. How was your relationship to the patient prior to the diagnosis of Alzheimers?

Mark only one oval.

- ◯ Extremely close
- ◯ Close
- ◯ Neutral
- ◯ Distant
- ◯ Extremely distant
- ◯ Other: _____

7. Physically, does your body feel tired and do you get sick more often when caring for the patient?

Mark only one oval.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

8. How many times do you get a headache or experience physical pain per day?

Mark only one oval.

- ◯ Less than 1
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4+

9. Have you been diagnosed with any physical/ psychological issues after caring for your patient?

Mark only one oval.

- ◯ Yes
- ◯ Maybe
- ◯ No

10. If YES for the previous question, please list below:

_____

_____

_____

_____

_____

11. Do you tend to neglect your own eating habits when caring for your patient?

Mark only one oval.

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

12. Do you ever grow angry with your patient?

Mark only one oval.

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

13. Are there ever times where you feel helpless for your patient?

Mark only one oval.

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

14. Are there ever times where you feel numb to the situations around you in regards to your Alzheimer's patient?

Mark only one oval.

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

15. Do you experience feelings of nausea and dizziness?

Mark only one oval.

- ◯ Yes
- ◯ No

16. I am unable to focus on simple tasks

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Sometimes

17. I am able to fully differentiate my personal life with my patient's life

Mark only one oval.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Appendix D: List of Questions Utilized in the Survey and Interviews

Question 1	What religion do you identify with?
Question 2	Do you believe your religion affects your method of caring for your patient?
Question 3	Were there any times where you realized you were putting your caregiver first before your own health?
Question 4	Did you ever experience symptoms of feeling worthless, or not doing enough?
Question 5	How was your relationship to the patient prior to the diagnosis of Alzheimers?
Question 6	Physically, does your body feel tired and do you get sick more often when caring for the patient?
Question 7	How many times do you get a headache or experience physical pain per day?
Question 8	Have you been diagnosed with any physical/ psychological issues after caring for your patient?
Question 9	Do you tend to neglect your own eating habits when caring for your patient?
Question 10	Do you ever grow angry with your patient?
Question 11	Are there ever times where you feel helpless for your patient?
Question 12	Are there ever times where you feel numb to the situations around you in regards to your Alzheimer's patient?
Question 13	Do you experience feelings of nausea and dizziness?
Question 14	I am unable to focus on simple tasks
Question 15	I am able to fully differentiate my personal life with my patient's life

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Comparative Performance of Facial Recognition Algorithms

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ABSTRACT

Artificial Intelligence and Machine Learning algorithms are growing in popularity and their influence is rising into our everyday lives. Facial detection technologies and recognition technologies have become crucial to maintaining security and privacy in the modern world. Nevertheless, the potent impacts of algorithmic bias and errors persist. Currently, many generic facial recognition softwares are drawing improper conclusions based on skin tone and similarities. These software applications use algorithms that depend on supervised learning datasets. Without representative data from minority populations, the software struggles to distinguish individuals within the same race. Dubbed the 'coded gaze' by MIT scholar Joy Buolamwini, its implementation into police identification software could lead to inaccuracies in suspect identification, significantly impacting marginalized communities. Our study determined that flaws originate most notably with changes in illumination and facial expressions. Testing and implementing algorithms that rely on unsupervised learning or make predictions through adaptable supervised learning would dramatically reduce the inaccuracies in modern facial recognition software. To determine the quickest and most effective facial recognition algorithm in scenarios with varying illumination and facial expressions, we conducted research and implemented five popularized algorithms. The study involved seven different students.

Introduction

With the popularization of Artificial Intelligence and Machine Learning algorithms, there has been a rise in their implementation into our everyday lives. Facial detection and recognition have become crucial to maintaining security and privacy in the modern world. However, the impacts of algorithmic bias and mistakes are potent. Currently, many generic facial recognition softwares are drawing improper conclusions based on skin tone and similarities; some can't detect darker skin tones at all while others can't distinguish between people of the same race. Coined by MIT scholar Joy Buolamwini as the "coded gaze," if implemented into police identifica-

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tion software it could lead to inaccuracies in suspect identification heavily aimed at different races of people [1]. The flaws are most notable when there are changes in illumination and facial expressions. Our team decided to research and implement five popularized facial recognition algorithms in order to determine the quickest and most effective one based on their F1-Score, accuracy, precision, and recall when tested under different illumination and facial expression. We used the Eigenfaces, Fisherfaces, SURF, CNN, and LBPH algorithms.

Theoretical Background

Eigenfaces Algorithm

Eigenfaces are the name given to a set of eigenvectors that are used in the computer vision problem of facial recognition [2]. A set of eigenfaces is generated by performing a mathematical process called Principal Component Analysis (PCA) [3]. Eigenfaces that are created will appear as a black and white image with the light areas and dark areas arranged in specific patterns. These patterns show how different features of a face are singled out to be evaluated and scored. Some examples of these features include symmetry, the style of facial hair, the size of the nose or mouth, the location of the hairline, etc. Some eigenfaces have patterns that are simpler and the image of the eigenface may not look like a face. When used in facial recognition, multiple images are saved as a collection of weights that describe the contribution of each eigenface to a specific image. Then, methods such as the nearest-neighbor method are used to find the Euclidean distance between two vectors, where the minimum can be classified as the closest subject.

Fisherfaces Algorithm

Fisherfaces algorithm is an algorithm that is used after eigenfaces to classify the images better [4]. Before using the Fisherfaces algorithm, PCA is used to extract features from the image and reduce the dimension of the images. Then, during the training process, Fisherfaces algorithm uses Linear Discriminant Analysis (LDA) to PCA-transformed data to maximize the distances between the means of the different classes and minimize the distances between each image from the same class [5]. LDA finds a subspace that maps the images of the same person in a single spot and images of the

different people apart from each other. The basis vectors of such subspaces are called Fisherfaces. Then during the testing process, new images get projected to an eigenspace. The new image is then compared to the closest person.

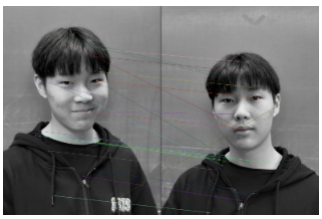
SURF Algorithm

The Speeded-Up Robust Features (SURF) Algorithm, extracts facial features from digital images and establishes local correspondence between a pair of images: the reference image and the image being compared [6]. SURF is faster and more efficient than its predecessor, the Scale-Invariant Feature Transform (SIFT) algorithm [7]. It achieves this by utilizing interest points and performing local analyses on these points to extract and store facial features from digital images.

During local analyses, SURF employs Random Sample Consensus (RANSAC) to efficiently eliminate matches that do not adhere to the homography restraint. It highlights the confirmed matches between interest points in the two images.

While SIFT descriptors are occasionally more accurate, SURF detectors are invariant to rotation, scale, and brightness. They utilize the Hessian Matrix and second-order Gaussian derivatives to enhance real-time image analysis [8].

SURF Algorithm Results



Same Person

Different Person

Table 1: Surf Algorithm Results: Images

- The F1-score, accuracy, precision, and recall of the SURF algorithm couldn't be measured in this experiment due to the way the algorithm analyzes an image. Nevertheless, it can return a new image for comparison and has detector lines to display similarities.

- In the left image, numerous detector lines between the two imported images indicate that they represent the same person. Conversely, the right image shows only one detector line, which is between the school logo, indicating that it's the only similarity between the two images.

CNN Algorithm

Utilizing the Keras, Tensorflow, and Numpy modules, Convolutional Neural Network (CNN) employs neural networks to scan and train images for identification [9–11]. The algorithm scans the entire image, creates sub-images, and then saves each value in a Numpy array. By using Keras and Tensorflow, the algorithm saves each sub-image as a vector value and employs each sub-image as inputs for the neural network. The neural network is constructed through the logistic regression model represented by the provided equation. Each input is stored within a series and subsequently summed to generate an output.

The entire process can be divided into four steps. The first two steps, convolution and subsampling, run concurrently. During convolution, a specific portion of an image is scanned, while subsampling analyzes each portion and saves the pixels in a vector. Every processed image is referred to as an epoch, which is then stored as a branch for a neural network. After the completion of Convolution and Subsampling, the process proceeds to the Full Connection Step, which reconstructs the image from the sub-image scan [12]. Subsequently, the Gaussian Step compares the tested image with the trained recreated image and generates a linear graph depicting its accuracy level.

LBPH Algorithm

LBPH stands for Local Binary Patterns Histograms [13]. LBP (Local Binary Pattern) is a texture operator that outputs binary values based on thresholding the neighbors of each pixel. In simple terms, higher values of the neighbor are assigned a higher binary value, whereas lower values receive lower binary values. After creating the binary matrix, the binary digits are converted into decimals and then set to the original center value. Subsequently, the image is recreated, resulting in our LBPH outcome: a new image that emphasizes the distinct characteristics of the subject.

By employing the grid X and grid Y values, we divide the image into smaller grids to create histograms representing occurrences of each pixel

intensity. The histograms from each region are then combined into one concatenated histogram. The values in this histogram are compared to those of another image to evaluate the accuracy of the two images [13].

Experimental Process

Downloaded and fine-tuned, the testing of each algorithm involved initially comparing the same person under various lighting conditions, ranging in brightness, and facial expressions, including smiling, pouting, frowning, and grinning. Each comparison required the use of a common dataset to determine whether one person was different from the other.

Results

$$\text{Accuracy} = \frac{t_p + t_n}{t_p + t_n + f_p + f_n}$$

$$\text{Precision} = \frac{t_p}{t_p + f_p}$$

$$\text{Recall} = \frac{t_p}{t_n + f_p}$$

$$\text{F1} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

Figure 1: Various Measurements

The equations above illustrate the F1-Score, accuracy, precision, and recall. According to the values in the graph shown below, Fisherfaces emerged as the most effective algorithm, while CNN demonstrated the potential to be the most adaptable. CNN's image processing can be subdivided into multiple epoch levels, and each can include its own Gaussian Step, thereby increasing its adaptability. Meanwhile, Fisherfaces relies on multiple tests with the same person and, at most, can discern the differences between two people but not a multitude of people. Therefore, CNN would be the best algorithm to implement into facial recognition software.

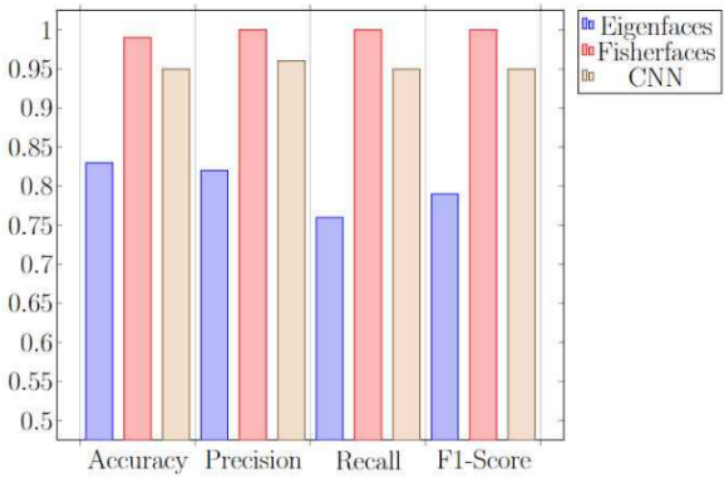


Figure 2: Measurement Values for Various Algorithms

Conclusion

Based on the results the fisherfaces algorithm would be the best to implement into facial recognition software that strictly relies on comparison between two people. However, the CNN seems to be the most adaptable for different conditions and is the more reliable algorithm to implement into the real world. In the future, we plan to test each algorithm with larger sets of data to detail and analyze each algorithm's strengths and weaknesses. We plan to develop a machine learning program that chooses which algorithm best suits a certain data set after evaluating the strength and weakness of each algorithm. Even though CNN is the best to use in most cases, there are still weaknesses associated with it that can be covered with another algorithm. Creating a program that can evaluate a situation and choose which algorithm to use based on that situation will practically eliminate further bias or inaccuracies.

References

1. Buolamwini, J. *Fighting the 'Coded Gaze'* 2022. `https://www.fordfoundation.org/news-and-stories/stories/fighting-the-coded-gaze/`.

2. Jalled, F. Face recognition machine vision system using Eigenfaces. *arXiv preprint arXiv:1705.02782* (2017).
3. Turk, M. A. & Pentland, A. P. *Face recognition using eigenfaces* in *Proceedings. 1991 IEEE computer society conference on computer vision and pattern recognition* (1991), 586–587.
4. Anggo, M. & Arapu, L. *Face recognition using fisherface method* in *Journal of Physics: Conference Series* **1028** (2018), 012119.
5. Adouani, A., Henia, W. M. B. & Lachiri, Z. *Comparative study of face detection methods in spontaneous videos* in *2019 International Conference on Control, Automation and Diagnosis (ICCAD)* (2019), 1–6.
6. Bay, H., Tuytelaars, T. & Van Gool, L. *Surf: Speeded up robust features* in *Computer Vision–ECCV 2006: 9th European Conference on Computer Vision, Graz, Austria, May 7-13, 2006. Proceedings, Part I 9* (2006), 404–417.
7. Lowe, D. G. *Object recognition from local scale-invariant features* in *Proceedings of the seventh IEEE international conference on computer vision* **2** (1999), 1150–1157.
8. Oyallon, E. & Rabin, J. *An analysis of the SURF method* 2015. `https://www.ipol.im/pub/art/2015/69/?utm_source=doi.`.
9. Chollet, F. *et al. Keras* `https://github.com/fchollet/keras`.
10. Martín Abadi *et al. TensorFlow: Large-Scale Machine Learning on Heterogeneous Systems* Software available from tensorflow.org. 2015. `https://www.tensorflow.org/`.
11. Harris, C. R. *et al.* Array programming with NumPy. *Nature* **585,** 357–362. `https://doi.org/10.1038/s41586-020-2649-2` (Sept. 2020).
12. Martinez, J. *Introduction to convolutional neural networks vnns* 2020. `https://aigents.co/data-science-blog/publication/introduction-to-convolutional-neural-networks-cnns`.
13. Patil, S. & Kavitha, H. *Implementation of LBPH Algorithm for Covid Patient Isolation Violation Detection* in *2022 IEEE 7th International Conference on Recent Advances and Innovations in Engineering (ICRAIE)* **7** (2022), 20–24.

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High Altitude Weather Balloons: Development and Data Collection

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ABSTRACT

A High Altitude Weather Balloon (HAB) was developed, which can be used to measure various atmospheric parameters at a variety of conditions. We employ tracking devices along with simulations to predict the landing location of the balloon payload, facilitating payload recovery. Additional tracking methods are proposed to improve the chance of recovery. Furthermore, payload sensors allow us to examine various atmospheric parameters, including temperature and pressure as a function of height. These datasets can be used to extrapolate the adiabatic lapse rate, as well as the heat capacity ratio. Further studies with the HAB data can translate these measurements into more detailed weather and atmospheric predictions, and offer more research opportunities. Efforts are being made to improve the HAB design to be able to launch it in any weather, as well as test satellite components onboard.

Introduction

High-altitude balloons (HABs) offer a simple and cost-effective method of transporting scientific instrumentation into the troposphere and stratosphere [1]. They are generally uncrewed, and can reach altitudes between around 18 to 37 km, although some have reached altitudes of above 50 km [2]. They are often lifted by a latex balloon filled with helium [3] (or some other gas less dense than the atmosphere at sea level), and are commonly used to study these lower atmospheric layers, alongside weather patterns. More recently, hobbyists and high schoolers have utilized these balloons for learning experiences and easy research on the lower atmosphere [4].

In addition to the balloon itself, a payload is often attached below, carrying various sensors, an onboard computer, and a GPS unit. Some payloads include a camera either pointed downwards looking at the Earth or horizontally at the horizon. Payloads typically range from 0.5-5 kg, though the FSA HAB sets a limit of 1.5 kg on the payload to meet the balloon lift capabilities, as well as follow FAA regulations. Temperatures at such altitudes can drop to around -100 degrees Celsius, necessitating thermal

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protection of onboard components, as well as decreasing the battery life of the power supplies.

Several launches have been conducted in the past year. FSA's HAB development began in the summer of 2022, using an Eagle Flight Computer [1], as well as a basic HAB kit. These allowed a couple of launches and data collection throughout the 2022-2023 year. However, many flights and data were lost due to GPS failures, as well as weather conditions. Since the beginning of the 2023 school year, more work has been put into the HAB project, focusing on developing the payload structure, communications, and sensors.

This study will highlight the steps taken in designing, constructing, and improving the HAB, as well as an analysis of some of the data collected.

Methods

The essential components of a HAB include the weather balloon, providing the lift force; the recovery parachute, facilitating the safe recovery of the payload; and the payload, containing the sensors and tracking devices.

Payload

The HAB payload connects to the parachute-balloon system through a series of ropes. The payload is encased in a 3D-printed enclosure to protect it from wind, minor moisture, as well as to keep all of the components secure.

Structure

The HAB payload structure was modeled in a CAD software and 3D-printed. It consists of 3 major layers: the sensor layer, the On-Board Computer (OBC) layer, and the power layer.

The sensor layer is designed as an enclosure for the sensors. It is not isolated from the atmosphere to allow air to reach the pressure, temperature, and air-composition sensors. The layer also contains attachment points for tracking devices (see Tracking).

The power layer holds the power bank used to power all onboard components: the OBC, sensors, and the tracking devices. Additionally, at the bottom of this layer, the payload antenna (see Tracking) is attached.

The OBC layer holds the onboard computer(s). In the most recent model of the HAB, both a Raspberry Pi zero and an Arduino nano (a small form factor microcontroller) [5] are used. The Raspberry Pi zero is equipped with a GPS-tracking hat, while the Arduino controls the sensors. Additional side ports may be uncapped to allow attachment points for cameras, strobes, or additional sensors that require alternative mounting points compared to the sensor layer.

Tracking

At all three stages of a successful HAB mission—before the launch, during the flight, and after the landing—various tracking and prediction methods exist to ensure the highest chance of recovery.

Before a flight begins, it is important to verify the distance and direction the weather balloon will travel. Depending on the burst height, payload weight, parachute strength, and, chiefly, the atmospheric conditions, the balloon travel distance may vary drastically. We use the HAB-HUB website [6] to approximate the landing location before launch, allowing us to anticipate driving time and direction. However, given the complex nature of the atmosphere, as well as the large amount of ambiguity in the inputs to the HABHUB predictor, the landing locations are often 10-20 km off from the prediction. Therefore, it should not be used for locating the landed balloon.

During and after the flight, we have developed three methods for staying in touch with the HAB. First, we use the SPOT tracker, which is a commercially available GPS tracker. This system consists of a tracker that one attaches on the payload, as well as an app, that informs the user of the most recent location every 2.5 minutes. However, the SPOT is often unreliable, because after landing, it does not send the most recent location. Thus, there is an ambiguity of 0-2.5 minutes after receiving the last location of where the balloon landed. Additionally, the height of the balloon is not transmitted, which complicates the recovery process. Furthermore, the SPOT tracker cuts off above a certain altitude, making it impossible to track until the payload falls below a certain altitude again. Therefore, during the 1-2 hour "blackout" period, one must rely on simulations conducted before the launch to estimate the landing location. Unfortunately, once the balloon lands, the SPOT will most likely be obstructed by small twigs or branches, or even tall grass. Most of our unrecovered missions are

not located due to this issue, and the one recovered months later (see FSA HAB Launches), only was found during the winter when the leaves cleared, allowing the SPOT to reconnect with GPS satellites.

The next redundancy supplied with new missions is the Apple AirTag, which provides extremely accurate positioning when nearby. However, the AirTag relies on being within 50 meters of some Apple products; therefore, when the balloon lands in remote areas, the AirTag data is often not received.

The most recent, and most promising method, is LoRa communication. Although the common range on LoRa is placed at 20 km, recent launches have shown great results, maintaining relatively secure contact throughout the entire flight. With improvements to the ground-station antenna, this data could be reliable throughout the entire launch. In addition to sending data at intervals of time one can decide, the LoRa option also provides real-time altitude data, further facilitating landing location and time prediction. However, the LoRa method is often unreliable once the balloon lands. This is because the transmission antenna (mounted on the bottom of the power layer), is extremely delicate. Once the balloon lands, the antenna is deformed, thus losing most of its transmission power.

Unfortunately, there are some missions in which the payload is lost, not due to communication errors, but due to the balloon landing in a body of water or in the branches of a tall tree. In this case, strobe lights attached to the side ports of the OBC layer (Structure) can be used to aid in finding the stuck balloon.

Launch Date	Spot Tracker	Air Tag	LORA	Status
August, 2022	Functional	n/a	n/a	Successfully Recovered
September 3, 2022	Unreliable	n/a	n/a	Recovered After Months
November 18, 2022	n/a	n/a	Unreliable	Unrecovered
August 18, 2023	Unreliable	Recovery Method	n/a	Successfully Recovered
September 18, 2023	Unreliable	No signal	Successful Signal	Recovered
October 11, 2023	Unreliable	No signal	No signal	Unrecovered

Table 1: FSA HAB Launches

Sensors

The first three balloon launches used the Eagle Flight Computer to collect various atmospheric data, supporting the connection of sensors. However, this method is quite unreliable, and the sensor data often cuts out for periods of time. These sensors included temperature, pressure, accelerometer,

as well as altitude data.

Further launches have used a Raspberry Pi or, most recently, an Arduino to interface the sensors and store data. This has allowed for additional sensors to be implemented, as well as software-side redundancies ensuring a constant stream of data is recorded. These new sensors include the BME680, which has temperature, humidity, barometric pressure, and VOC gas sensing capabilities. Additionally, we employ the L3GD20H triple-axis gyrometer, and the MQ2 gas sensors. Further improvements may include a triple-axis magnetometer or a Geiger counter.

Various cameras have been employed to collect photo and video data from the Pi. As of now, we are using GoPro cameras, and other similar cameras to obtain video both looking down and looking to the side. The side camera allows us to see the curvature of the earth. These cameras can be mounted on the additional attachment ports on the OBC layer of the structure Structure. These additional cameras allow us to discern the weather conditions, such as cloud density and precipitation, for reference to the sensor data.

Atmospheric Models

We now present two theoretical models of the atmosphere that we will use to calculate various parameters: the isothermal (constant temperature) model, and the adiabatic atmosphere model. As will be seen by the collected temperature data, the temperature of the atmosphere is not constant with height. However, using the isothermal model will provide us with a value of T that is approximately the average along the path. On the other hand, the adiabatic atmospheric model assumes air packets move adiabatically (without loss of heat), and can predict the temperature (and thereby pressure) with much more accuracy.

We begin by deriving the isothermal atmosphere model. Consider a slice of the atmosphere of thickness $\mathrm{d}z$ with area A will have mass $\rho A \mathrm{d}z$. The weight of this slice will be compensated for by a decrease of pressure with height, where a pressure gradient of $\mathrm{d}P$ will change over this height. Thus we can equate

$$\rho A \mathrm{d}z g = -A \mathrm{d}P,$$

which can be written as

$$\frac{\mathrm{d}P}{\mathrm{d}z} = -\rho g. \tag{1}$$

By the ideal gas equation, we may write $PV = Nk_bT$, which can be solved for the density (assuming the average air molecule has mass m:

$$\rho = \frac{Nm}{V} = \frac{Pm}{k_bT}.$$

Now this equation can be substituted back into equation 1. Then this provides

$$\frac{\mathrm{d}P}{\mathrm{d}z} = -\frac{Pm}{k_bT}g, \tag{2}$$

a seperable diff. eq. Assuming $P = P_0$ at ground level, we may integrate to find (and here we must assume isothermality):

$$\int_{P_0}^{P} \frac{\mathrm{d}P}{P} = \int_{z_0}^{z} -\frac{mg}{k_bT}\,\mathrm{d}z. \tag{3}$$

Standard procedures yield

$$P(z) = P_0 \exp\left(-\frac{mg}{k_bT}(z - z_0)\right). \tag{4}$$

The quantity $\frac{mg}{k_bT}$ is called the *isothermal scale height* [7].

As we will see later, the assumption of an isothermal atmosphere is poor, but the collected HAB data is surprisingly still valid to the isothermal equation.

We will now present the adiabatic atmosphere formula, which assumes an adiabatic transfer and motion in the atmosphere, giving the adiabatic constant γ. After a lengthy derivation, one arrives at the formula

$$\frac{\mathrm{d}T}{\mathrm{d}z} = -\left(\frac{\gamma - 1}{\gamma}\right)\frac{mg}{k_b}. \tag{5}$$

The quantity given by $\left(\frac{\gamma-1}{\gamma}\right)\frac{mg}{k_b}$ is called the *adiabatic lapse rate* [8].

Further atmospheric models predict the troposphere (approximately the lower 10 km of the atmosphere) to follow the adiabatic atmosphere model. On the other hand, at the tropopause, and throughout the stratosphere (the transition between the troposphere and stratosphere), the temperature will flatten out to give $\frac{\mathrm{d}T}{\mathrm{d}z} \approx 0$ [9].

The two quantities will be found and evaluated for the collected HAB data. Furthermore, the overall shape of the temperature gradient will be evaluated in terms of its adherence to the model described above.

Results

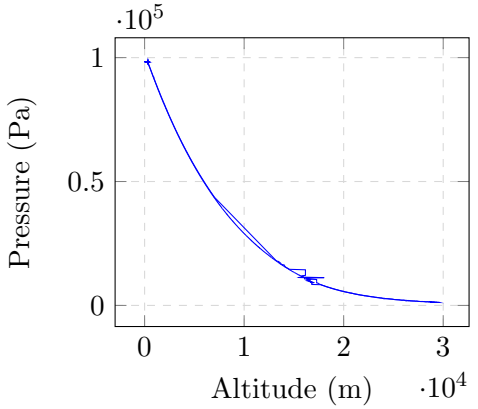

Figure 1: Pressure Distribution

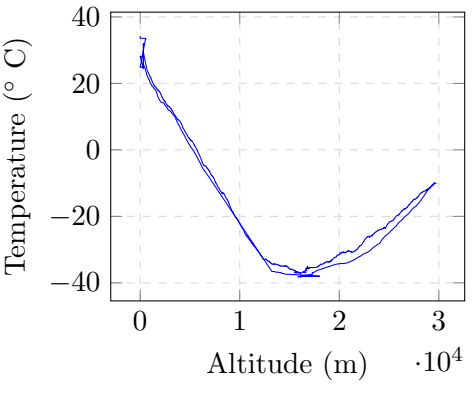

Figure 2: Temperature Distribution

As mentioned in 'Sensors', we collected the temperature and pressure as a function of altitude. Other measurements, such as velocity, and gas parameters were also taken but lost in failed missions. Shown in 'Pressure Distribution' and 'Temperature Distribution', the left figure shows the pressure gradient, while the right figure shows the temperature gradient in the atmosphere. The data in the graphs and subsequent analysis only include data from the first launch, as further launches contained poorly recorded data, with many downtime periods.

Discussion

Fitting the isothermal pressure curves to the data, we approximate the values $P_0 = 98000\,\text{Pa}$ and $z_0 = 350\,\text{m}$. These are common values associated with the altitude above sea level of Alpharetta, obtained by reading $P(0)$ from the collected data. Applying a curve fit with these parameters, we find the isothermal scale height to be $\frac{mg}{k_b T} = 0.00012834\,\text{N J}^{-1}$. If we assume m to be $\frac{1}{N_A} \cdot 28.96\,\text{g}$, and $g = 9.81\,\text{m s}^{-2}$. We find $T = 266.2\,\text{K} = -6.95°\,\text{C}$, which, as discussed before, could be a value for the average temperature in the atmosphere.

There are several important conclusions we can draw from the results. First, from 'Temperature Distribution' above, we can see that the isothermal atmosphere is a relatively good approximation, especially for the lower atmosphere as shown. As we chose P_0 and z_0 from commonly known data,

the lower range of this fit, near z_0 and P_0 will be very near the data.

Next, we fit to the adiabatic equation. As previously stated, the adiabatic equation generally applies to altitudes below 10 km. Thus, we apply a linear fit to this region. The fit gives $\frac{\mathrm{d}T}{\mathrm{d}z} = -5.0001\,\mathrm{K\,km^{-1}}$. Typical values of this rate are around 6 to 10 $\mathrm{K\,km^{-1}}$. Therefore, the decrease in height recorded by our HAB is a bit less quick than most other experiments. However, this difference could be attributed to a different time of day or weather conditions.

The FSA HAB project continues, as the development of the satellite and more atmospheric parameter sensors. The HAB project offers various avenues of future work. First, we may add control to the balloon using servo motors to alter the lengths of the parachute lines, controlling the balloon's direction of travel. This would involve using a special type of parachute called a parasail, specifically crafted to provide the most maneuverability. Additional studies will need to be conducted to determine the extent to which various motors and lines will affect the balloon's descent. After determining this, a program to guide the HAB to the desired location will be implemented. Additional challenges may arise in implementing the deployment mechanism for the parasail. With a more complex connection to the various servo motors of the payload, the parasail will have to stay inside an enclosure until after the balloon pops, to prevent tangling. Furthermore, a balloon release mechanism will be developed to control the maximum height and reduce line clutter before deploying a parasail.

Another avenue of work is sensor development and interpretation. Many other sensors exist, as previously discussed; however, they are often unreliable. Future work focus on studying the composition of the lower layers of the atmosphere. Additionally, various aspects of the FSA Satellite project will be tested on the HAB. Satellites share many similarities with HAB payloads, such as communications, power, sensors, and an OBC. The current plan for the satellite project involves using spectrometer data alongside ionospheric data measured in-situ to determine the effects of solar and cosmic background radiation on the upper ionosphere. Although the HAB will not reach even the lowest layers of the ionosphere, the various sensors including ionosondes, radiation sensors, magnetic field sensors, and spectrometers, can be tested on these launches.

Finally, the HAB will be launched in a variety of other weather conditions. At the moment, we have limited the launches to fair-weather days, with relatively low winds. However, different values of the isothermal scale

height and adiabatic lapse rate may be recorded in other weather conditions. Time of day also impacts the reading. Different processes supply heat to the atmosphere at different times of day. Therefore, launching early in the morning, as opposed to late in the afternoon, will be studied to observe any changes during the day.

References

1. Price, A. An apparatus for personalized atmospheric and flight data collection aboard high altitude weather balloons. *HardwareX* **6,** e00077 (2019).
2. Pacheco, L. E. *Japan sets new balloon altitude record: 53.7 kms* `https://web.archive.org/web/20160322234357/http://stratocat.com.ar/news0913e.htm`.
3. Science, H. A. *Weather Balloon 600 g* `https://www.highaltitudescience.com/products/600-g-near-space-balloon`.
4. Coleman, J. S. & Mitchell, M. Active learning in the atmospheric science classroom and beyond through high-altitude ballooning. *Journal of College Science Teaching* **44,** 26–30 (2014).
5. Arduino. *What is Arduino?* `https://www.arduino.cc/en/Guide/Introduction`.
6. Jessop, P. P. *Habhub* `https://habhub.org/`.
7. Fitzpatrick, R. *The isothermal atmosphere* `https://farside.ph.utexas.edu/teaching/sm1/lectures/node55.html`.
8. Blundell, S. J. & Blundell, K. M. *Concepts in thermal physics* (Oup Oxford, 2010).
9. Ramaswamy, V. *et al.* Stratospheric temperature trends: Observations and model simulations. *Reviews of Geophysics* **39,** 71–122 (2001).

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South Asian Entrepreneurs Shaping Western Markets

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ABSTRACT

This paper examines economic transformations within the South Asian diaspora in Western countries, with a focus on entrepreneurship, consumer behavior, employment trends, and the overall business landscape in urban areas. South Asian immigrants are reshaping entrepreneurship by blending cultural authenticity with innovative business models. Consumer behavior and market trends are influenced by cultural preferences, leading to the emergence of specialized e-commerce platforms and hybrid businesses that combine tradition with modernity. Advocacy for inclusive policies is also on the rise, addressing unique challenges faced by South Asian immigrants in the job market and promoting diversity, equity, and equal opportunities.

Case studies highlight businesses that have successfully integrated cultural identity with Western business norms, emphasizing authenticity when building customer relations and brand loyalty. The following research underscores the importance of inclusive policies recognizing and supporting the unique economic contributions of South Asian immigrants for harmonious development in Western societies. It contributes valuable insights for policymakers, business leaders, and the community to foster inclusive economic development.

Introduction

The entrepreneurial spirit within the South Asian immigrant community has undergone a notable shift, influenced by both Western ideals and a desire to maintain cultural identity. Traditionally focused on establishing small businesses rooted in ethnic niches, recent trends showcase a diversification of entrepreneurial ventures. From technology startups to niche service providers to cosmetics companies, South Asian immigrants contribute dynamically to the business ecosystem. Some entrepreneurs have successfully integrated cultural elements into their business strategies, creating a unique selling proposition that resonates more closely with the South Asian community, but could this develop into a form of exploitation?

A particular focus lies on the influence of Western ideals on their entrepreneurial endeavors. The infusion of Western business practices is a

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powerful force, providing South Asian entrepreneurs the means to access broader markets, connect with diverse consumer bases, and foster economic growth beyond conventional boundaries [1]. Nevertheless, as these entrepreneurs embrace modern business practices, a balance emerges between preserving cultural values and integrating contemporary norms.

Case Studies: South Asian Entrepreneurs Blend Trends with Innovation

Case studies become a critical lens through which we explore the journeys of these entrepreneurs, revealing how they adeptly blend cultural authenticity with innovative practices. These narratives offer profound insights into the challenges faced, the strategies employed, and the overarching impact of these ventures on the South Asian diaspora and the wider business community. With these studies, we can better understand how entrepreneurs successfully navigate the middle ground of tradition and modernity, establishing themselves as trailblazers in the dynamic business ecosystem.

One compelling example of entrepreneurs and their innovation practice is illustrated by the success story of "SareeSaga," an online fashion platform founded by South Asian immigrants. Recognizing the demand for traditional South Asian attire within their community and beyond, SareeSaga strategically incorporated modern e-commerce practices while maintaining the cultural essence of sarees and ethnic wear. Feedback on the startup reveals the challenges faced by the founders in navigating the digital market space, the strategies employed to seamlessly fuse traditional aesthetics with online retail, and the broader impact of their venture on promoting South Asian cultural identity globally [2].

Another noteworthy example is the restaurant "SpiceFusion," established by Pakistani entrepreneur Shamsud Duha in metropolitan England. SpiceFusion blends traditional Pakistani and Malaysian flavors with modern culinary trends, offering a unique dining experience that resonates with the South Asian diaspora and a diverse local customer base. Words from the founder provided insights into the challenges of adapting traditional recipes to contemporary tastes, the strategies employed in marketing and menu innovation, and the impact of such ventures on fostering cross-cultural understanding in the broader business community [3]. Through such startups, we can gain a deeper understanding of the entrepreneurial journey and the far-reaching impact of these ventures on both the South Asian

diaspora and the broader business landscape. Moreover, as research continues to unravel the layers of this entrepreneurial narrative, shedding light on the multifaceted dynamics that define the economic contributions of South Asian immigrants in Western societies.

The Key to Entrepreneurship: Inspirational Business Moguls

Understanding consumer behavior is crucial for businesses catering to South Asians. Cultural preferences, values, and evolving lifestyles are pivotal in shaping consumption patterns. Businesses that align with these preferences thrive, while others may face challenges in penetrating this market. Furthermore, with the rise of numerous businesses attempting to crack these trends, the market has become oversaturated with mediocre attempts, making it rare to discover brands and entrepreneurs who can introduce themselves in a stimulating and refreshing manner.

One remarkable entrepreneur who navigated this transformation is couture designer Shravan Kummar, who built his brand from the ground up. His designs have spread like wildfire over the past decade, from his Hyderabad-based clientele to now one of his biggest demographics of luxury clients ranging from the U.S. through Europe and Asia. He not only designs for his clients but also created outfits for the "Threads of Strength" fashion show hosted by the Premier Health Hospitals Foundation. "As we count on the courage and draw inspiration from the cancer fights of nearly 40 patients and dedicated caregivers, we are excited to have them don unique ensembles personally crafted by Shravan Kumar," said Jhansi Koduri, MD, a board-certified oncologist at Miami Valley Hospital and chair of the Threads of Strength event [4]. His authenticity and generosity have created a long-lasting impact on numerous campaigns and charities, and his expression through art and fashion has inspired a multitude of others worldwide.

A more recent business mogul who has recently entered the influencer spotlight while simultaneously pursuing entrepreneurship is Shivani Bafna, who launched her loungewear line, Corefelt. She is also the founder of her marketing agency, BFN Agency. In her profile, she describes her profession, "As an influencer, I work with global fashion, beauty, travel, and lifestyle brands to create impactful campaigns. As a marketer, I work with international brands to build and execute campaigns that target the South Asian diaspora" [5]. Her content and work have formed an audience nationwide

and globally, and she acts as a role model to young girls everywhere.

As the demand for high-quality, authentic South Asian products and services is met with a surge in businesses and business moguls catering to diverse tastes and preferences within the community, only a select few are able to meet those standards and deliver their work with elegance and grace.

Consumer Behavior and Market Trends

In the business realm within the South Asian community, a profound understanding of consumer behavior guides enterprises toward economic success. This section delves into consumer preferences and market trend dynamics. For businesses catering to South Asian immigrants, cultural preferences form the cornerstone of market strategies, ranging from culinary tastes to apparel choices to the entertainment space. Deeply rooted in cultural values and traditions, these preferences significantly influence consumption patterns. Ventures that align with these preferences often find a receptive audience, thriving amidst communities thrilled to feel closer to their homeland.

However, penetrating this market comes with its unique set of challenges. These specific preferences require a unique approach, and businesses that align with these values may need help gaining community acceptance. In order to break that mold, businesses need to make active efforts to bridge the gap and establish a meaningful connection with their target audience. One sought-after but surprisingly tricky element is authentic South Asian products and services because they can become a driving force within the market with high quality and honest effort. Over the past few decades, the number of businesses aimed to draw a primarily South Asian audience has skyrocketed. This surge is not merely a response to market demand; it reflects a broader cultural movement where authenticity and cultural resonance precede consumer choices. In other words, people have experienced many consumer preferences but are more motivated and intrigued by services/products they resonate with.

The rise of e-commerce platforms specializing in cultural products exemplifies the community's embrace of technology while retaining cultural authenticity. These platforms offer a virtual marketplace where South Asian consumers can access authentic products, fostering a sense of connection to their roots. Products sold in Asia are now accessible here, and many of

those brands have diversified to America and Europe.

One significant observation is that many ancient remedies or products used in South Asia for their health or healing properties were looked down upon or received judgment. For the longest time, especially with younger kids, there was so much teasing and bullying that many immigrant or first-generation kids had to deal with frequently for their cultural practices and even their food. It has become a common issue and actively occurs daily.

However, although these older remedies may have evolved, they are still frequently practiced or followed and even turned into social media trends, like hair-oiling, turmeric masks, and even golden milk. All these were original practices that South Asians would often receive judgment for, but now those same individuals are using the same remedies and even promoting them but with glorified names. The mix of cultural traditions and modern technology shows how such practices can be connected and evolve into media trends.

Employment and Workforce Dynamics

South Asian immigrants contribute significantly to the workforce in Western countries, but, as expected, their employment dynamics reflect both opportunities and challenges. Many are driven by educational aspirations towards professional careers, resulting in a notable presence of South Asians in technology, medicine, and finance. However, the influence of Western ideals on career choices is also apparent, leading to shifts towards non-traditional sectors and entrepreneurial pursuits. Their dedication to academic excellence contributes to success in their professional careers and future endeavors.

For all employees to be considered equals and provided with the same opportunities, there needs to be an understanding of employment trends, emphasizing the necessity for inclusive policies addressing the unique challenges faced by South Asians and other immigrants in the job market. These policies may include targeted support for startups, cultural competency training for business services, and initiatives to bridge resource access gaps. Furthermore, these policies should extend to startups and small businesses, which often require more resources and support networks for sustainable growth.

In addition to inclusivity policies, another critical issue that requires attention is matters such as stereotyping, cultural misperceptions, and bi-

ases that may impact the career trajectories of South Asian professionals. By addressing these issues, it advocates for policies beyond surface-level diversity initiatives, delving into the root causes of disparities and promoting inclusivity at all workforce levels. This approach is more effective than somewhat ineffective attempts to be inclusive. Understanding the cause and rectifying such situations effectively is crucial. A workforce reflective of the diverse talents within the South Asian diaspora is not just an ethical but also an economic necessity. It is essential to harness the full potential of this dynamic workforce and contribute to the vibrancy and innovation of Western economies.

Cultural Integration

Cultural integration is a double-edged sword for South Asian entrepreneurs. While some seamlessly blend their cultural identity with Western business norms, creating a powerful synergy, others grapple with balancing tradition and innovation. The success of businesses within this community is often contingent on the ability to strike this delicate balance, as mentioned before. Cultural integration is not merely an aesthetic choice but a strategic imperative. By doing so, this resonates not only with the South Asian community but also finds resonance in the broader market.

Once again, we often see these examples through fashion, health and wellness, e-commerce, and culinary ventures. The entrepreneurs who succeed in these endeavors recognize that cultural values are not antithetical to innovation but can serve as a foundation for unique selling propositions. Entrepreneurs can leverage cultural values to shape business models, foster customer relations, and build resilient brand loyalty.

Cultural Competency and Fostering Inclusive Growth

Cultural competency training for business services is another critical component of this policy framework. The essay contends that businesses catering to South Asian entrepreneurs should be equipped with the necessary tools and resources to understand the cultural facets that need to be studied and established. Specific policies catered to this idea can mandate or incentivize cultural competency training for service providers, creating an ecosystem where businesses receive support that is not only practical but also culturally attuned.

The concluding section forms an urgent appeal for policy initiatives beyond mere acknowledgment, recognizing and actively addressing the unique economic challenges and contributions of the South Asian immigrant community. This advocacy for inclusive policies becomes a foundational pillar, one that seeks to foster an environment where businesses owned by South Asian entrepreneurs not only survive but thrive.

Conclusion

In conclusion, the essay functions both as a documentation of economic trends and a manifesto for change. It urges policymakers to adopt a nuanced perspective when assessing the South Asian immigrant community, recognizing their potential for economic contributions while acknowledging their unique challenges. Each aspect contributes to a dynamic business landscape, encompassing entrepreneurship, consumer behavior, employment trends, and cultural integration. Economic transformations benefit both individuals and Western societies as a whole. They prompt reflection on the motivations, challenges, and triumphs that define the entrepreneurial spirit within this community. As Western societies continue to develop and evolve, these policy frameworks can serve as a roadmap for the coming generations, unlocking the next level of potential and ensuring that economic prosperity is not a privilege limited to a few but a shared reality for all.

References

1. Ely, R. J. & Thomas, D. A. Getting serious about diversity. *Harvard Business Review* **98,** 114–122 (2020).
2. Dewan, S. *"Beautiful ikat patola saree, french chiffon sarees, fashionable chiffon/gold zari work saree* `www.fibre2fashion.com/industry-article/4778/saree-saga-draped-for-elegance-growth-too`.
3. Ting, N. *Spice, fusion, balance: delving into authentic malaysian cuisine* `southwestmanagementdistrict.org/2022/01/02/spice-fusion-balance-delving-into-authentic-malaysian-cuisine/`.

4. Health, P. *Premier Health Hospital Foundations Host 'Threads of Strength' Oncology Fashion Show* www.premierhealth.com/news-and-events/news/news-release/2023/11/08/premier-health-hospital-foundations-host--threads-of-strength--oncology-fashion-show.

5. Bafna, S. *LinkedIn Profile* https://www.linkedin.com/in/shivani-bafna.

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The Reign of the Iron Fist: Long-Term Harmful Outcomes of Authoritarian Parenting

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ABSTRACT

Amid heated debate concerning parenting styles and their outcomes in society, the following questions arise: To what extent does an authoritarian parenting style harm children's future behavior, especially regarding self-discipline and social functioning? What steps should society take to mitigate this harm? Authoritarian parenting is known to cause poor self-discipline, reinforce a cycle of depression, and compromise social functioning, all of which persist well into adulthood. These results suggest that authoritarian parenting is counterproductive (given that some parents mean well when they use this parenting style) and has lasting effects that should be addressed, possibly by public advocacy, change of parenting style, and support methods.

Introduction

Parenting has been a challenge present as long as the human race has existed. Throughout history, there has been no shortage of punitive parenting with the motivation of raising a child fit to support their household. As child-rearing has evolved, however, these motivations have become less common and have been replaced with the common goal of raising a family for fulfillment. With this change came the distinction of parenting styles. In the 1960s, Diana Baumrind distinguished three common parenting styles–authoritarian, authoritative, and permissive. These parenting styles, along with a fourth—neglectful or uninvolved—added in the 1980s, serve as the basis for the modern discussion of parenting [1]. Although the most severe form of parental punishment may appear to be a thing of the past, do some vestiges of this reign remain within authoritarian parenting today? Indeed, these remnants are seen through several of the following examples.

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Defining and Comparing Parenting Styles

Based on and expanded upon Baumrind's theory, the four aforementioned parenting styles span a spectrum ranging from total parental control to complete freedom. On one extreme, authoritarian parenting describes a style where "the parent establishes strict rules that the child obeys," with little explanation or room for negotiation. In other words, parents have high expectations but little nurturing and mistakes typically lead to punishment [2]. On the other hand, authoritative parenting leans aways from the extremes of the scale, with the implementation of not only clear but also well-explained rules and disciplinary methods are employed instead of mere punishment for mistakes [2]. Under authoritarian parenting, children may perceive rules as arbitrary, lacking clear reasons. Under authoritative parenting, however, children may acquire the capacity to exercise independent judgment in alignment with the implemented rules. Compared to the previous styles, permissive parents are nurturing and rarely impose rules upon or discipline their children. Finally, at the opposite end of the spectrum, uninvolved parents fulfill their children's needs but do not nurture or communicate with them, thus imposing no rules [2]. Note that this style was introduced after Baumrind's study was finished, thus hindering the relevance of uninvolved parents. Overall, the aforementioned evidence substantiates the notion that authoritative parenting is the most well-rounded of the styles. Conversely, authoritarian parenting suggests that harsh and unnecessary discipline is directly harmful to mental health, while permissive parenting may lead to bad habits due to a total lack of discipline. Finally, uninvolved parenting is likely the least ideal parenting style due to its lack of the essential aspects of parenting.

Self-Discipline and Bad Habits

Background

A key characteristic of authoritarian parenting is harsh discipline. With any signs of misbehavior, an authoritarian parent is on the child's tail, often bringing with them punitive methods [3]. But aside from the immediate emotional harm, what are the long-term damages of this discipline? Intuitively, it makes sense that this harsh discipline weakens decision-making: if all decisions are made by the parent, a child may not grow up with the skills necessary to make their own. For further context, one meta-analysis

of several studies by Martin Pinquart "found that harsh discipline and psychological control were actually the biggest predictors of a [child's] behavior worsening over time," leading to the premature conclusion that "kids subjected to authoritarian tactics... tended to develop more externalizing behavior problems" in the future [3]. While this cannot be reduced to pure causation, this finding introduces the prospect that authoritarian parenting may contribute to long-term behavioral issues, particularly in self-discipline and the development of bad habits, as these examples will discuss.

Alcohol Use

A significant scenario demanding self-discipline to prevent poor outcomes is in alcohol use, a widespread and potentially destructive problem. Adolescence "is the key period for the initiation of alcohol consumption", meaning parenting styles may have amplified effects on alcohol consumption [4]. Most importantly, the study by Alati et al. reinforces the assertion that "excessive discipline may actually increase adolescent alcohol intake," citing the following findings: "Among those in the high drinking trajectory, harsh discipline was not effective in reducing adolescent drinking levels, while among those in the lower drinking trajectory harsh discipline contributed to higher levels of drinking" [4]. This evidence suggests that authoritarian parenting harms children's future self-discipline because authoritarian parenting can continue or worsen bad habits (chiefly, alcohol usage). Additionally, this evidence supports the idea that authoritarian parenting could be counterproductive since it may lead to outcomes opposite of the parent's wishes. It is crucial to bear in mind that alcohol, with its potential to induce effects like antisocial behavior, can significantly impair lives [4]. Consequently, authoritarian parenting may have detrimental implications that extend well into adulthood.

Dietary and Dental Habits

In a similar vein, this same theory can be applied to the consumption of other unhealthy yet satisfying substances—namely, junk food. One universally known effect of junk food is dental caries. Dental caries describes tooth decay that occurs when acids demineralize the enamel, and can be caused by high sugar consumption and poor dental hygiene [5]. Thus, caries are mitigated with good habits, such as moderation of foods high in sugar (e.g. common junk foods) and optimal dental hygiene. From this evidence,

a theory can be formed that if a certain parenting style is known to result in children with more caries, it may be that the parenting style has failed to address the bad habits that cause caries. Accordingly, this theory is supported by research linking authoritarian parenting and the incidence of caries. Namely, a study exploring this link found that "[a]uthoritarian parenting accounted for 10 children (91 percent) with caries and one child (nine percent) without caries", which led to the conclusion that there is "an association between authoritarian parenting and increased caries" [6]. Although limitations arising from the study's sample size should be taken into account, one could reasonably infer from these findings that authoritarian parenting is also associated with unhealthy habits contributing to dental caries. This reflects a counterproductive relationship between authoritarian parenting and poor self-discipline. It is also worth noting that caries tend to be chronic [5], suggesting that these self-discipline problems stemming from authoritarian parenting persist far into the future, similar to the impact of alcohol.

Mental Health and Social Functioning

Background

According to a study done by Eugene Paykel, social functioning describes "an individual's ability to function within their usual environment" and is "considered a key feature of quality of life" [7]. Therefore, a lack of social functioning can suggest a lower quality of life. Additionally, studies have found that depression significantly lowers social functioning [7], thereby lowering one's quality of life. This statement holds pivotal significance in the argument against authoritarian parenting, given that research has revealed children with authoritarian parents report depressive symptoms more frequently than those with authoritative parents [8].

Long-Term Problems

The challenge of lowered social functioning stemming from authoritarian parenting is potentially detrimental to a child's future, given mental health issues such as depression is described as a "chronic or episodic condition requiring long-term therapy" [7]. Immediately, a clear inference can be made from this evidence indicating that authoritarian parenting has enduring negative effects on a person's mental health long-term given the

established link between authoritarian parenting and depression. This is underscored by the revelation that impaired social functioning persists even after depression symptoms are resolved [7]. However, long-term effects are likely not limited to this; if authoritarian parenting leads to depression, it might lead to decreased social functioning as well. In theory, decreased social functioning would further worsen one's mental health as social functioning dictates a person's ability to live their life as they wish to. Certain measures of social functioning include "occupation, household role, marital functioning, parental role, family/kinship role, social role, leisure/general interest, and self-care" [7]. Within impaired social functioning, these measures will receive lower scores, signifying an individual's challenge fulfilling those roles. Since they will not be able to carry out several societal roles, their depression may worsen, as "poor social support networks, poor marital relationships, and poor economic status" are risk factors for progression of depression [7].

The risk factors for depression appear to align with the roles contributing to social functioning, suggesting the possibility that depression not only impairs social functioning but also that diminished social functioning exacerbates depression in what seems to be a positive feedback loop. Authoritarian parenting, therefore, triggers this positive feedback loop when it leads to depression. The enduring nature of this feedback loop is underscored by previous evidence indicating neither depression or impaired social functioning are easily eradicated.

Solution

Background

To fully grasp the extent of harm caused by authoritarian parenting and discern a viable solution, the reasons for its use must be established; after all, with its previously established counterproductivity and enduring consequences, why should this parenting style be employed at all? Chiefly, the reason authoritarian parenting continues to persist is due to cultural beliefs. For instance, research has shown that the overall styles of Chinese and Arabic parenting lean authoritarian [9], and another source was able to make the broad statement that "[w]ithin the United States, parenting styles have been shown to differ substantially by cultural groups as measured by their race/ethnicity" [10]. A more specific explanation for parents

use of authoritarian methods is their misguided belief they are benefitting their child. For instance, a widely-read parenting magazine suggests that parents may "feel that a strict approach is the best way to gain compliance" and "raise capable, well-rounded, high-achieving members of society." Notably, this source also highlights the influence of parental personality traits in making this choice [11]. It is important to acknowledge that altering cultural beliefs and personality traits poses significant challenges. Many individuals will be resistant to accepting advice on such a sensitive topic as parenting. Consequently, some solutions remain theoretical. It should also be noted that a solution is only needed when authoritarian parenting is used to an extreme extent; for example, if a parent uses authoritarian discipline one time, it should not be assumed to be harmful as long as the parent maintains reasonable methods at other times.

Having identified the reasons for the adoption of authoritarian parenting, the question arises: why should it be addressed? The previous sections of this paper have established the several harms of this parenting style, all of which are psychological or social. In a contemporary world where many pursue fulfillment in life, it is imperative that children receive the necessary care to attain happiness. The adverse effects of authoritarian parenting in childhood may persist throughout an individual's lifetime, jeopardizing their ability to achieve this goal by detrimentally affecting self-discipline and social functioning. If one goal of authoritarian parenting is to create "capable, well-rounded, high-achieving members of society" and outcomes are consistently negative, the endeavors of most authoritarian parents prove counterproductive. These harms are only emphasized by the longevity of the problems authoritarian parenting causes. If they are not addressed now, they will continue long into an individual's life and be passed on to future generations.

Solution 1: Public Advocacy

Despite the aforementioned cultural limitations, a solution can be derived from one key reason for authoritarian parenting as mentioned before: misconception. As explained in the previous section, some authoritarian parents may believe that they are raising their children to be successful members of society, when in reality they may be doing the opposite. A tried and true method to address misconceptions is to advocate for the solution. As articulated by the Child Friendly Cities initiative, "child rights

must be known and understood" before efforts for child rights can be put into practice [12]. Some ways to spread awareness are public advertisements, news articles, and word of mouth. Although a single poster or article will not revolutionize parenting entirely, widespread dissemination of such materials may reach enough viewers, including "local government authorities, members of civil society organizations, academics, media and business professionals, parents/caregivers and children", fostering a collective understanding of the concepts and encourage participation in the advocacy movement against authoritarian parenting [12].

Solution 2: Parenting Style Changes

Another approach to advocate against authoritarian parenting is to directly address parents who use this style and speak to them personally in hopes of changing their methods. Instead of advocating to a collective, this approach could also be utilized for first-time parents to instill beneficial ideas before detrimental notions take hold. In practice, this could be implemented through individualized advice provided to parents by friends, family, or even professionals. This solution refers back to the crucial distinction between authoritarian and authoritative parenting particularly how and why rules are enforced. First, the "how" must be addressed: as established, one harm of authoritarian parenting stems from the harsh punishments and threats for any mistakes made by children [3]. Thus, to mitigate this particular harm, authoritarian parents should reflect before punishing their children. Decisions regarding punishment should not be impulsive; rather, parents should think more thoroughly and refrain from implementing disproportionately harsh consequences for minor mistakes, safeguarding the immediate emotional well-being of their children. Additionally, physical punishment should be avoided at all costs as its harms have already been well-established. Research has revealed its link to mental health issues in children [3]. Concerning the "why" of punishment, authoritarian parents typically refrain from providing explanations for the enforcement of specific rules in contrast to authoritative parents [2]. If authoritarian parents made a minor adjustment to their current approach and began explaining the reasons behind rule enforcement, it could be advantageous to both their own thinking and their children's. Specifically, parents may realize that certain rules are unnecessary and children may learn the true implications of their mistakes leading to improved decision-making skills and the reduced

likelihood those mistakes would be repeated in the future. These changes effectively tackle the self-discipline challenges associated with authoritarian parenting, as discussed earlier. Although implementing these changes would likely pose initial challenges, providing easily accessible professional counseling and therapy to any parents in need can support the adoption of these ideas. Alternatively, family and friends of parents could also offer advice to parents they know.

Alternative Solution: Support

The previous solutions aim to solve the problem from the parental side, but there may be solutions that children can initiate themselves as well—after all, as the Child-Friendly Cities initiative states, "children themselves must understand their own rights and how to assert these" [12]. While it is likely beneficial to address the problem from the root, the subsequent solutions are likely to work when the previously mentioned do not, as children can enact them themselves. Specifically, if a child is under the care of a staunchly authoritarian parent, they could derive benefits from establishing a robust support system consisting of friends and trusted adults [13]. While these figures may not be able to reshape parenting, they can offer essential emotional support to the child, potentially preventing the onset of depression that is associated with authoritarian parenting, and protecting the child from a recurring cycle of depression and impaired social functioning. This solution may be the most feasible to enact as others require extensive work.

Conclusion

This paper only touches the surface of the extensive effects of authoritarian parenting and further research is needed to confirm that the harms of authoritarian parenting are indeed as direct as they seem. Additionally, the subjects of parenting can be viewed through various perspectives and lenses, indicating that it may not be a one-size-fits-all style suitable for everyone. Nevertheless, even if its possible benefits remain unexplored, authoritarian parenting has consistently demonstrated its tendency to yield negative outcomes in a child's behavior. This research found that the harmful effects of authoritarian parenting are lasting; they are not limited to childhood harm, but persist for a lifetime. It is important that the cycle of authoritarian parenting is broken sooner rather than later, preventing detrimental ideas from permanently affecting a child. By eliminating harmful ideas from the

root with advocacy and societal change, more children will grow up well-adjusted and finally break the reign of the iron fist that is authoritarian parenting.

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References

1. Power, T. G. Parenting dimensions and styles: a brief history and recommendations for future research. *Childhood Obesity* **9,** S–14 (2013).
2. Sanvictores, T. & Mendez, M. D. Types of parenting styles and effects on children (2021).
3. Dewar, G. Authoritarian parenting outcomes: what happens to the kids? *Parenting Science.* `parentingscience.com/authoritarian-parenting` (2022).
4. Alati, R. *et al.* The role of parental alcohol use, parental discipline and antisocial behaviour on adolescent drinking trajectories. *Drug and alcohol dependence* **134,** 178–184 (2014).
5. Nowak, A. J. *Pediatric dentistry: infancy through adolescence* (Elsevier, 2019).
6. Howenstein, J. *et al.* Correlating parenting styles with child behavior and caries. *Pediatric dentistry* **37,** 59–64 (2015).

7. Hirschfeld, R. *et al.* Social functioning in depression: a review. *Journal of Clinical Psychiatry* **61,** 268–275 (2000).

8. Romero-Acosta, K., Gómez-de-Regil, L., Lowe, G. A., Lipps, G. E. & Gibson, R. C. Estilos parentales, ansiedad y depresión en niños y adolescentes. *International Journal of Psychological Research* **14,** 12–32 (2021).

9. Janak, A. *"The effects of culture and economics on parenting style and childhood success."* Academic Festival, Event 40. 2022. https://digitalcommons.sacredheart.edu/acadfest/2022/all/40/.

10. Pong, S.-l., Johnston, J. & Chen, V. Authoritarian parenting and Asian adolescent school performance: Insights from the US and Taiwan. *International journal of behavioral development* **34,** 62–72 (2010).

11. Perry, C. *Authoritarian parenting: the pros and cons, according to a child psychologist.* https://www.parents.com/parenting/better-parenting/style/authoritarian-parenting-the-pros-and-cons-according-to-a-child-psychologist/.

12. UNICEF. Advocacy and Awarness Raising. *Child-Friendly Cities.* childfriendlycities.org/advocacy-awareness-raising..

13. Maisel, E. R. "10 tips for surviving your authoritarian parent.". *Psychology Today.* psychologytoday.com/us/blog/rethinking-mental-health/201812/10-tips-surviving-your-authoritarian-parents (2018).