CORNELL HEALTHCARE REVIEW

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REVIEW

Note from the Cover Artists:

Our cover art illustrates how CHR articles illuminate obscure and innovative topics in healthcare, from the intersection of music and cognition to nutritional risks in everyday foods. Our work showcases people in red who aren't looking directly at the light, which represents people who aren't knowledgeable about certain healthcare topics mentioned in CHR. The person in blue is a reader of CHR. Using the effect of blue light on a red and blue composition, only the blue person is illuminated by the light through the blue CHR vaccine vial, showing how CHR provides a new perspective on healthcare topics that would otherwise not be apparent.

The process behind our piece was multifaceted. We started by drawing red figures on a black ink background, representing those who have yet to engage with diverse healthcare topics. Then, we drew a blue figure in the foreground, which represents exposure to the wide range of topics covered in our publications; a light was shone through a vial with blue food coloring, labeled "Cornell Healthcare Review," to illuminate the blue figure and provide contrast against the red background. We transferred a photograph of our composition into Autodesk Sketchbook, a digital art software, and sketched medical symbols to represent some topics enlightened by CHR.

Sincerely,
Rachel Jacob, Co-VP of Arts
Andrew Mo, Artist

Rachel Jacob
Andrew Mo

Dear Readers,

As we near the end of both a fruitful semester and academic year, we celebrate the wonderful ideas, insights, and contributions of CHR members in bringing the publication before you to life.

Throughout our time in CHR, we have been continuously inspired by the passion and care that define this community—the unending drive of pursuing curiosity, weaving science into stories, and opening eyes to new perspectives. Health is not a single story: it is a mosaic of lived experiences, community interactions, research discoveries, and creative expression. Intersections create insight, and each article and artwork has approached healthcare from its own thoughtful angle.

Although this will be our final semester as Co-Presidents, we are grateful to have witnessed CHR's tremendous growth over the years: expansion of our in-person collaborative and social events, new opportunities for involvement through the student seminar and special edition, and growth of the size and involvement of the general body, most noticeably our artists, who bring vibrancy and illumination to our ideas. We depart with full confidence in the vision and dedication of those who will carry it forward, as well as excitement for the new directions CHR will explore next. It has been an honor and privilege to lead such a driven and talented cohort, and we are grateful for all the fun memories and whimsical moments that have woven together our CHR experience and brought our community closer than ever.

To our Writers, Editors, Artists, and Executive Board members, thank you for creating a space where healthcare passion and creativity can meet. To our graduating members, we would like to extend a special gratitude for making CHR part of your experience at Cornell. Whatever your future endeavors may be, know that we are incredibly proud of how far you've come and all that you will accomplish moving forward.

On that note, we are excited to present our Spring 2026 issue. Happy reading!

Julia Chen and Olivia Qin
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*Check out our online-exclusive articles at www.cornellhealthcarereview.org

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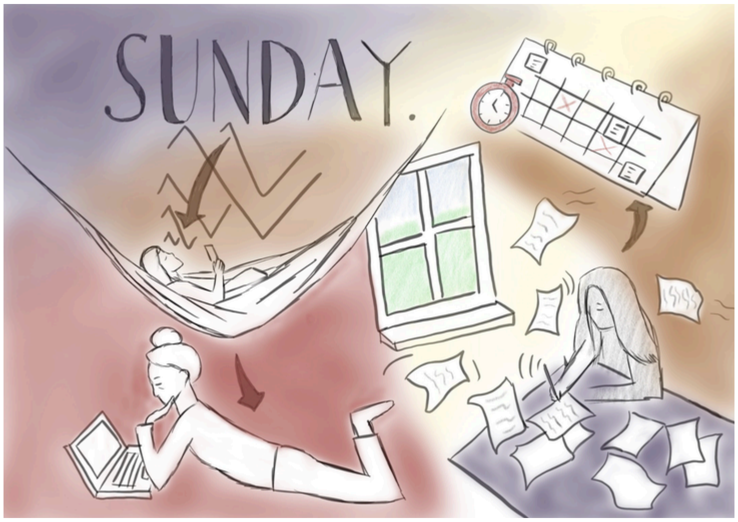
How To Reclaim Sundays From The "Sunday Scaries"

by Ellie Altmann, Human Biology, Health, and Society '28



Artwork by Sandy Kong

Growing up, my local news station would play The Bangles' Manic Monday every Monday morning, with the line "...wish it was Sunday, 'cause that's my fun day." Somehow, Canvas notifications seem louder on Sundays, which is hardly considered fun for most students. Sunlight streams through dorm windows with the weekend still technically intact, yet thoughts of the week ahead quietly begin to take over. By the afternoon, the change is visible; it is harder to find a seat in the library, and the coffee shop line stretches a little longer than usual. The campus seems to be collectively bracing for Monday. It raises the question of whether Sundays need to feel this way at all. What many students casually call the "Sunday Scaries" may, in fact, reflect a well-documented psychological phenomenon called anticipatory stress.

Ever wonder why we arrive at the airport hours before a flight, mentally rehearse interviews long before they occur, or feel a flicker of tension before making a simple phone call? Though seemingly unrelated, these experiences, along with the "Sunday Scaries," are linked by a shared psychological mechanism: the activation of stress responses in anticipation of uncertain future events. Anticipatory stress arises not from immediate danger, but from uncertainty about what lies ahead, which can activate neural circuits involved in threat detection even before a stressor occurs [1]. On Sundays, the source of distress is rarely a single identifiable task. Rather, it is the uncertainty surrounding the week ahead that limits our sense of control and heightens anxiety.

While anticipatory stress helps explain why we feel tension before upcoming obligations–like prelim-packed weeks, club commitments and interviews, or even social events like formals or birthday parties–it does not fully explain why Sundays, specifically, trigger this response. Sociological research on Sunday time use over the past three decades shows a clear shift toward increased time spent on work related tasks and domestic duties, alongside decreases in time allocated to personal needs, free leisure, and night sleep [2]. In other words, Sundays have become more crowded with obligations and less protected as a space for rest, reflection, or self-care. This social shift may compound the psychological pressures of anticipatory stress, helping to explain why many students feel especially anxious as the weekend winds down.

Notably, the decline in night sleep may be particularly consequential. Research on daily stress and sleep quality suggests that stress experienced throughout the day is less predictive of disrupted sleep than stress carried into bedtime, which may reflect anticipation of the upcoming day [3]. This form of bedtime rumination appears to heighten physiological arousal and interfere with sleep quality. Although this research was conducted at a day-to-day level, it offers insight into how a recurring weekly pattern might emerge. As Sundays become increasingly filled with academic demands, extracurricular obligations, and social expectations, students may begin to feel a diminished sense of control over their time and the week ahead. This perceived loss of autonomy can intensify anticipatory worry, contributing to disrupted sleep and, in turn, greater emotional reactivity as the new week begins, making the "Sunday Scaries" feel persistent, but ultimately, breakable.

Research suggests that the key to easing Sunday anxiety lies in regaining a sense of control and autonomy over how the day is spent. When students can choose how to structure their time, they experience higher positive affect, energy, and feelings of calm [4]. This doesn't mean avoiding responsibilities but rather intentionally shaping Sundays to balance preparation for the week with activities that energize or restore. Engaging in meaningful leisure, such as social outings, physical activity, or mindfulness exercises, can buffer the emotional strain of these demands, reducing stress and supporting well-being [5]. This is corroborated by research showing that social interaction, relaxation, and leisure activities are linked to improved emotional health and better sleep, providing multiple pathways through which students can counteract Sunday stress and break the "Sunday Scaries" cycle [6]. At Cornell, these strategies might look like studying with friends at CTB, taking a walk around campus, practicing brief mindfulness exercises, or planning small, enjoyable events for the week ahead, turning anticipatory stress into positive anticipation.

By intentionally combining restorative and preparatory activities, Sundays can feel less like a countdown to stress and more like a day to feel prepared and confident for the week ahead. By shifting the mindset to see the weekend as a space to tidy up loose ends, complete lingering to-dos, or recharge through enjoyable and restorative activities, students can enter Monday with a sense of accomplishment and readiness, rather than anxiety. In this way, the weekend becomes not just a pause from obligations, but an active tool for starting the week on solid footing. According to The Bangles, Sunday is a fun day; maybe it's time we reclaim it.

References

1. Gruppe, D. W., & Nitschke, J. B. (2013). Uncertainty and anticipation in anxiety: An integrated neurobiological and psychological perspective. Nature Reviews Neuroscience, 14(7), 488–501. https://www.nature.com/articles/nrn3524
2. Zuzanek, J. (2014). Sunday blues: Have Sunday time use and its emotional connotations changed over the past two decades? Time & Society, 23(1), 6–27. https://journals.sagepub.com/doi/full/10.1177/0961463X12441173
3. Åkerstedt, T., Nilsson, P. M., & Kecklund, G. (2012). Daily stress and sleep quality: The role of bedtime stress. Sleep Medicine, 13(6), 603–609. *https://www.sciencedirect.com/science/article/pii/S1389945712000470*
4. Fritz, C., Sonnentag, S., Spector, P. E., & McInroe, J. A. (2010). The weekend matters: Relationships between stress recovery and affective experiences. Journal of Organizational Behavior, 31(8), 1137–1162. *https://onlinelibrary.wiley.com/doi/full/10.1002/job.672*
5. Aziz, S., Meier, B., Wuensch, K., & Dolbier, C. (2023). Take a break! Leisure participation moderates the workaholism–work stress relationship. Career Development Quarterly, 71(4), 315–329. https://pubmed.ncbi.nlm.nih.gov/38390370/
6. Davis, J., Taira, D. A., Lim, E., & Chen, J. (2023). Socialization, relaxation, and leisure across the day by social determinants of health: Results from the American Time Use Survey, 2014–2016. Healthcare (Basel), 11(11), 1581. https://pmc.ncbi.nlm.nih.gov/articles/PMC10253115/

The Weight of Maternal Postpartum Depression

by Grace Liu, Human Biology, Health, and Society '28

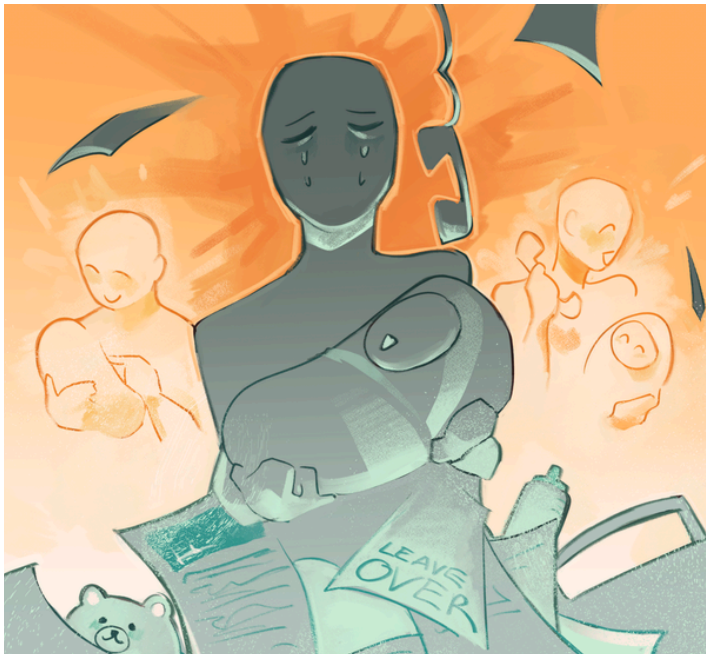
Following an arduous pregnancy, many families eagerly anticipate the birth of their child with expectations of joy and fulfillment. Yet for nearly one in five healthy mothers, this period can become isolating and overshadowed by the sadness and anxiety that result from postpartum depression (PPD). Maternal PPD, formally defined as a long-lasting depressive episode that emerges within the first few weeks after birth or up to a year later, is a leading complication of childbirth [1]. Inadequate childcare, unsupportive work environments, limited paid leave, and the sudden responsibility of caring for a new life further exacerbate the struggles. Previous studies have found that among mothers experiencing PPD, a greater workload, less job flexibility, and insufficient social support were strongly associated with higher depression scores [2].

There are currently several medications to treat PPD, like traditional SSRI antidepressants (e.g., Zoloft) and newer postpartum-specific medications (Brexanolone and Zuranolone). However, researchers are continuing to test the efficacy of these treatments and have reached mixed conclusions. Several studies found that these medications can partially alleviate symptoms, but also noted that they can lead to adverse effects like persistent fatigue and dizziness [3]. Moreover, while medications and psychiatric care alone can help treat symptoms, they still cannot address many of the broader conditions that shape maternal mental health.

Ultimately, women face a significant barrier to care due to stigma and insufficient awareness surrounding the disorder. The commonly held belief that mothers should feel pride and excitement after having a baby can make feelings of sadness seem abnormal and shameful. This directly discourages help-seeking even when symptoms are serious and treatable, especially when mothers internalize societal pressures and worry about being judged as unfit to care for their child [4]. A prior survey found that nearly one in three women refrained from sharing their emotions with healthcare providers out of fear of their baby being taken away [5]. Many mothers worry that expressing their emotions reflects personal shortcomings and leads others to perceive them as weak and undeserving. Far too many downplay their symptoms and suffer in silence as a result, and studies have found that up to half of women with PPD go undiagnosed [6]. Another critical issue leading many to avoid treatment is the persistent lack of awareness surrounding the disorder. Many mothers are simply unaware that their struggles are the result of a clinically recognized condition. Additionally, only 22% of those diagnosed receive mental health treatment for their condition, with much of the discrepancy due to mothers resolving to "get over" their struggles independently [6]. Several studies have also found that insufficient knowledge among healthcare professionals surrounding PPD and a lack of mother-centered care further delayed successful treatment [5].

History has demonstrated how redefining societal narratives can directly influence how people understand and treat mental health challenges. The "Prozac revolution" of the late 1900s, which involved mass marketing of the new antidepressant Prozac, helped reframe societal views around depression. Mass advertising and medical messaging conveyed that depression was a biological condition caused by a chemical imbalance rather than a personal failing [7]. This shift was particularly relevant to postpartum depression, as it helped reframe maternal distress as a medical condition rather than a reflection of a mother's competence or emotional strength. While mental health was previously heavily stigmatized, this movement made it more socially acceptable to speak openly about mental health and validated the struggles of many mothers. However, it also shifted the "solution" toward taking medication rather than addressing the social and structural contributors, which continue to pose challenges today [7].

The "Prozac revolution" is sufficient evidence that social narratives play a large role in the experiences of those struggling with mental health. While researchers continue to pursue exciting scientific innovation through drug development, it is becoming increasingly clear that we also need to focus on tackling these issues through social change: reducing stigma, increasing awareness, and expanding structural support through initiatives like expanded workplace protections, paid leave, and accessible childcare. Postpartum depression is not a personal weakness nor something that can be purely solved with medication; it is a public health issue with alarmingly high prevalence that also requires cultural change and awareness to combat.



Artwork by Kain Wang

References

1. Egsgaard, Sofie, et al. "Time Trends in Incidence of Postpartum Depression and Depression in Women of Reproductive Age." Journal of Affective Disorders, vol. 366, Dec. 2024, pp. 91–97, https://doi.org/10.1016/j.jad.2024.08.167.
2. Dagher, Rada K., et al. "Postpartum Depressive Symptoms and the Combined Load of Paid and Unpaid Work: A Longitudinal Analysis." International Archives of Occupational and Environmental Health, vol. 84, no. 7, 5 Mar. 2011, pp. 735–743, https://doi.org/10.1007/s00420-011-0626-7. Accessed 11 Jan. 2022.
3. Wilson, Claire A, et al. "Brexanolone, Zuranolone and Related Neurosteroid GABAA Receptor Positive Allosteric Modulators for Postnatal Depression." Cochrane Library, vol. 2025, no. 6, 26 June 2025, https://doi.org/10.1002/14651858.cd014624.pub2. Accessed 18 Aug. 2025.
4. Thorsteinsson, Einar B., et al. "Changes in Stigma and Help-Seeking in Relation to Postpartum Depression: Non-Clinical Parenting Intervention Sample." PeerJ, vol. 6, no. e5893, 8 Nov. 2018, www.ncbi.nlm.nih.gov/pmc/articles/PMC6230434/, https://doi.org/10.7717/peerj.5893.
5. Sambrook Smith, M., Lawrence, V., Sadler, E., & Easter, A. (2019). Barriers to accessing mental health services for women with perinatal mental illness: systematic review and meta-synthesis of qualitative studies in the UK. BMJ open, 9(1), e024803. https://doi.org/10.1136/bmjopen-2018-024803
6. Nonacs, Ruta. "PPD Screening and Treatment: Is There Room for Improvement? A New Study at Mass General Brigham." MGH Center for Women's Mental Health, 14 Sept. 2022, womensmentalhealth.org/posts/steps-for-ppd/.
7. Elliott, Grace K., et al. "The Utilization of Cultural Movements to Overcome Stigma in Narrative of Postnatal Depression." Frontiers in Psychiatry, vol. 11, no. 11, 30 Oct. 2020, https://doi.org/10.3389/fpsyt.2020.532600.

AI Crisis Lines: Risks of Algorithm-Driven Mental Care

by Natalia Collins, Cognitive Science ‘27

Sophie Rottenberg was only 28 years old when she decided to use ChatGPT as an avenue to treat her major depressive disorder. After months of relying on this AI-driven support, Sophie tragically died by suicide. In the time leading up to her death, Sophie confided in a chatbot named “Harry” to grapple with depressive thoughts, and on the night of her death, disclosed specific details of her planned suicide [1]. With recent improvements to AI technologies, an overwhelming number of people with mental health disorders are resorting to AI-driven therapy as opposed to professional services. Although AI-based therapy may offer significant benefits in accessibility, it also poses substantial safety risks. Furthermore, the empathetic quality of in-person interactions make human based services indispensable to mental health care.

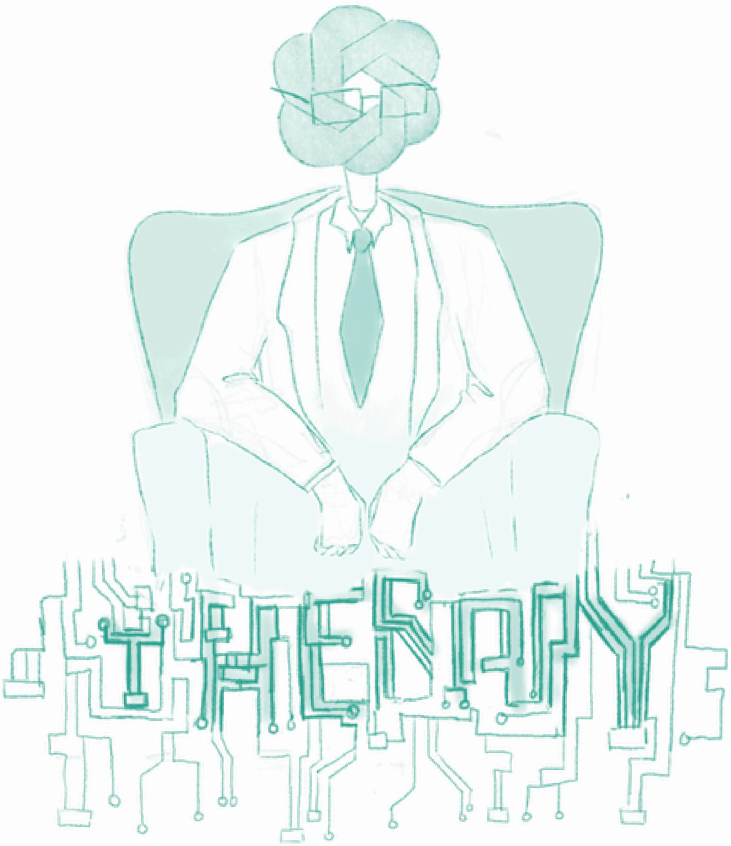
Recent digital health developments involving artificial intelligence, through the use of large language models (LLMs), do present options for large scale delivery for mental health services. The current ratio of psychiatrists per 100,000 people ranges from 0.0 to 14.7 by region, and this number varies primarily based on the country’s socioeconomic status. Given regional inequalities in psychiatric care, by increasing the affordability of AI applications, those from low-income households for whom a psychiatrist is unrealistic may benefit from digital mental health tools [2].

AI-driven therapy tools also provide a unique opportunity for a personalized form of mental health care. LLMs, in drawing on diverse and comprehensive sets of data, can provide an intelligent, human-like response that is accustomed to particular struggles, or even tailored to the personality traits of its users [3]. Without other human-led mental health resources, AI may be an acceptable and tailored resource for mental health information, specifically for those from a low-resource setting.

However, LLMs also lack the more complex social reasoning that a psychiatrist can provide. LLMs are not widely tested by human psychiatrists, and very few trials have been done on their accuracy in regards to mental health advice. Artificial intelligence reasoning still varies greatly from human reasoning skills, given psychiatrists are able to draw on their extensive education, but also their unique experiences in treatments of previous patients [3].

Sophie’s case points to the most critical aspect of human led mental health care, and that is the relationship formed between a therapist and patient that provides a deep rooted support system [4]. AI-based mental health services were unable to appropriately respond to a crisis situation, as in the instance of Sophie’s planned suicide [5]. Given the confidentiality of the platform, there was no way to inform the people in Sophie’s life about her current condition or mental state. This is unlike human-led therapies, where immediate actions are taken to prevent serious harm to patients. In many critical cases, AI may seem to serve as a replacement for human interaction for the user themselves. “Harry” gave Sophie the illusion of a sympathetic support system in mimicking human interactions and conversational methods. Yet, in reality, “Harry,” like all forms of AI, had no capacity for genuine care and empathetic understanding, emotions that are critical to the development of a trusting patient-psychiatrist relationship and productive treatment plan.

Before investing intensively into the improvement of AI mental health care, of utmost priority is the extension of human led services to low-resource regions. The care of our most vulnerable must involve human-based interaction that enables the development of a therapeutic relationship capable of responding to crisis and long term care.



Artwork by Laura Lee

References

1. Reiley, L. (2025, August 18). Opinion | What My Daughter Told ChatGPT Before She Took Her Life. The New York Times. https://www.nytimes.com/2025/08/18/opinion/chat-gpt-mental-health-suicide.html
2. Yong, E., Teo, Y. N., & Yong, K. H. (2024). AI Technology: A New Game Changer for the Future Mental Health Industry? Asia Pacific Journal of Public Health. https://doi.org/10.1177/10105395241303790
3. Torous, J., Linardon, J., Goldberg, S. B., Sun, S., Bell, I., Nicholas, J., Hassan, L., Hua, Y., Milton, A., & Firth, J. (2025). The evolving field of digital mental health: current evidence and implementation issues for smartphone apps, generative artificial intelligence, and virtual reality. World Psychiatry, 24(2), 156–174. https://doi.org/10.1002/wps.21299
4. Rubin, M., Arnon, H., Huppert, J. D., & Perry, A. (2024). Considering the Role of Human Empathy in AI-Driven Therapy. JMIR Mental Health, 11(1), e56529. https://doi.org/10.2196/56529
5. Fiske, A., Henningsen, P., & Buyx, A. (2019). Your Robot Therapist Will See You Now: Ethical Implications of Embodied Artificial Intelligence in Psychiatry, Psychology, and Psychotherapy. Journal of Medical Internet Research, 21(5). https://doi.org/10.2196/13216

Shaping Policy: Systemic Gaps In Dementia Care

by Asha Gandreti, Healthcare Policy '29

Dementia serves as one of the most pressing public health challenges of the twenty-first century [1]. Currently, over 7 million individuals are living with Alzheimer's disease and related dementias in the United States, a figure projected to rise to nearly 13 million by 2050 as the population ages [2]. Unfortunately, despite advances in research and awareness, dementia care systems remain disconnected, often lacking coordination across medical, social, and community services [3]. Systemic gaps in dementia care include fragmented infrastructure, insufficient assistance with activities of daily living, caregiver burden, limited integration of social prescribing, and, more broadly, disparities in access to care. Each of these shortcomings calls for policy reform focused on strengthening current care models with an end goal of enhancing both coordination and accessibility.

Disconnected infrastructure in patient care often results in inefficient communication and sharing of patient data. Dementia requires coordinated management across multiple specialties, including neurology, primary care, occupational therapy, speech and language therapy, and cognitive therapy, while simultaneously requiring access to long-term care services and social support systems [4]. However, these abundant and differentiated sectors often operate independently rather than collaboratively.

As a result of this poor communication, patients often receive duplicated services and diagnostic tests, along with delayed interventions. Studies indicate that up to 35% of primary care physicians report either "sometimes" or "seldom or never" receiving information from a specialist following a consultation with a shared patient [5]. Without strengthening the coordination between medical providers and support services for patients with dementia, treatment quality and long-term patient care are at significant risk.

With the progression of dementia, individuals experience a decline in memory, problem-solving capabilities, and language, significantly hindering their ability to perform everyday tasks and social functions [6]. A lack of adequate assistance with daily activities such as bathing, managing/administering medications, dressing, and preparing meals serves as another major systemic gap in dementia care. It is imperative to understand the mechanisms behind these often neglected necessities (particularly wander-risk management and nutrition/hydration) and how early intervention can address such issues before they lead to hospitalizations and other costly healthcare outcomes [7].

Additionally, studies indicate that approximately half of dementia care is provided informally by means of unpaid caregiving. This finding can have detrimental effects, leading to increased risk for caregiver burden, financial strain, and anxiety and depression [8]. According to the Alzheimer's Association, nearly 12 million Americans provide unpaid care for a family member or friend with dementia, totaling over $400 billion in unpaid care [2], leaving caregivers experiencing negative psychological effects [9].

Artwork by Sophia Liu

As a result, stronger policy support is necessary to counteract this unsustainable nature of informal care.

It is also imperative to understand that dementia care systems often fail to integrate social prescribing and other non-medical forms of intervention. Social prescribing addresses patients' social needs by implementing community-based interventions and encouraging social connection [10]. Examples include supporting patients with exercise and fitness routines, hobbies such as art classes, advice on financial stressors, and friend groups to maintain social networks. The absence of these programs in patients' care puts their cognitive health and emotional well-being at risk.

The aforementioned gaps are further exacerbated by geographic and socioeconomic disparities that determine whether patients can access specialized care or supportive services. Rural populations experience reduced access to specialty care providers, pre-hospital emergency services, and local hospital services due to frequent closures [11] in comparison to urban residents. Simultaneously, minority populations also experience disparities in diagnosis, access to treatment, and caregiving resources due to linguistic barriers and a lack of culturally competent healthcare providers [12]. Structural barriers continue to exist and widely shape dementia outcomes and patient well-being as a whole.

Addressing these systemic gaps not only requires elaborate policy reform but also an intentional focus on social support and healthcare infrastructure. It is necessary to develop an inclusive national data infrastructure that tracks dementia care access and patient outcomes. Additionally, to reduce caregiver burnout while improving patient outcomes, caregiver support necessitates expanded investment. These policies offer the opportunity to build a more equitable and effective dementia care system in a world where dementia continues to grow as a global health crisis.

References

1. Shah, R., Salek, M. S., Ali, F. M., Nixon, S. J., Otwombe, K., Ingram, J. R., & Finlay, A. Y. (2024). Dementia and its profound impact on family members and partners. Alzheimer Disease and Associated Disorders, 38(4), 338–343. https://doi.org/10.1097/WAD.0000000000000647
2. Alzheimer's disease facts and figures. (n.d.). Alzheimer's Association. Retrieved March 12, 2026, from https://www.alz.org/alzheimers-dementia/facts-figures
3. Kern, L. M., Riffin, C., Phongtankuel, V., Aucapina, J. E., Banerjee, S., Ringel, J. B., Tobin, J. N., Fisseha, S., Meiri, H., Bell, S. K., & Casale, P. N. (2024). Gaps in the coordination of care for people living with dementia. Journal of the American Geriatrics Society, 72(10), 3119–3128. https://doi.org/10.1111/jgs.19105
4. 10 types of dementia care specialists(+ memory care options). (2024, September 19). https://sunflowercommunities.org/types-of-dementia-care-specialists/
5. Timmins, L., Kern, L. M., O'Malley, A. S., Urato, C., Ghosh, A., & Rich, E. (2022). Communication gaps persist between primary care and specialist physicians. The Annals of Family Medicine, 20(4), 343–347. https://doi.org/10.1370/afm.2781
6. Cipriani, G., Danti, S., Picchi, L., Nuti, A., & Fiorino, M. D. (2020). Daily functioning and dementia. Dementia & Neuropsychologia, 14(2), 93–102. https://doi.org/10.1590/1980-57642020dn14-020001
7. Black, B. S., Johnston, D., Leoutsakos, J., Reuland, M., Kelly, J., Amjad, H., Davis, K., Willink, A., Sloan, D., Lyketsos, C., & Samus, Q. M. (2019). Unmet needs in community-living persons with dementia are common, often non-medical and related to patient and caregiver characteristics. International Psychogeriatrics, 31(11), 1643–1654. https://doi.org/10.1017/S1041610218002296
8. Hellis, E., & Mukaetova-Ladinska, E. B. (2022). Informal caregiving and alzheimer's disease: The psychological effect. Medicina, 59(1), 48. https://doi.org/10.3390/medicina59010048
9. Schulz, R., Eden, J., Adults, C. on F. C. for O., Services, B. on H. C., Division, H. and M., & National Academies of Sciences, E. (2016). Family caregiving roles and impacts. In Families Caring for an Aging America. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK396398/
10. What are "social prescriptions" and how should they be integrated into care plans? (2023). AMA Journal of Ethics, 25(11), E795-801. https://doi.org/10.1001/amajethics.2023.795
11. Rethinking rural health. (n.d.). AAMC. https://doi.org/10.15766/rai_xmxk6320
12. Eken, H. N., Dee, E. C., Powers, A. R., & Jordan, A. (2021). Racial and ethnic differences in patients' perception of providers' cultural competence amongst patients with depression and anxiety symptoms. The Lancet. Psychiatry, 8(11), 957–968. https://doi.org/10.1016/S2215-0366(21)00285-6

Adaptive Tools, Dignity, and Child Development

by Autumn Tienauchariya, Psychology '29

When a child with cerebral palsy steers a power wheelchair independently for the first time, something more than mobility occurs. A sense of agency takes hold — an experience of the self as capable, autonomous, and present in the world. Adaptive medical tools and assistive technologies are typically evaluated for their physical effectiveness, but a growing body of research suggests that their psychological consequences are equally profound. For children with disabilities, devices such as wheelchairs, communication aids, and customized orthoses do not merely compensate for physical limitation; they actively shape identity formation, self-esteem, and social participation during the most formative developmental years.

Movement is how children learn they matter. A systematic review by Livingstone and Field examined power mobility outcomes — the measurable physical, cognitive, and social gains children make when given access to devices like motorized wheelchairs — for infants, children, and adolescents with mobility limitations. They found consistent evidence that early powered mobility supports not only physical independence but also cognitive exploration, social engagement, and overall quality of life [1]. Children who gain independent mobility at younger ages demonstrate improved capacity to interact with their environments, initiate social contact, and grow into kids who know they can make things happen. These findings underscore that the timing and quality of assistive device provision are not simply clinical decisions — they are, in a meaningful sense, developmental ones.

The design of those devices matters as much as access to them. Research on 3D-printed assistive tools demonstrates that personalized devices — particularly those developed collaboratively with child users — show higher adoption rates, better functional performance, and stronger integration into school and social life [2]. When children have agency in choosing and shaping their devices, those tools become expressions of identity rather than reminders of limitation.

But what does that independence actually do to a child on the inside? McNicholl, Desmond, and Gallagher's systematic review found that the effects run deeper than mobility or academic access — they reshape how children see themselves [3]. Across measures of competence, adaptability, and self-esteem, students using well-matched devices showed enhanced self-confidence and meaningfully improved emotional well-being. Think about what it means for a child to speak through a device for the first time, or to navigate a hallway without asking for help. The psychological record isn't just promising — it's a portrait of kids becoming more fully themselves.

Yet these benefits aren't guaranteed. Device abandonment remains a persistent problem, and the reasons are not purely mechanical. Hocking argued that abandonment frequently stems from the psychological dissonance that arises when a device conflicts with a child's self-concept or social identity [4]. For children especially sensitive to peer perception, the visibility of a disability aid can become a source of shame rather than empowerment. Poor device fit, lack of child input in selection, and absence of peer education all contribute to this dynamic. The school environment is where these dynamics most visibly play out. Fernández-Batanero and colleagues found that while assistive technology significantly increases inclusion and academic accessibility, its benefits are frequently undermined by inadequate teacher training and attitudinal barriers from peers and educators [5]. Inclusive deployment is not just about providing devices — it requires trained professionals, informed classmates, and institutional cultures that treat adaptive tools as normal. When that support is absent, even sophisticated devices fail.

These findings call for a fundamental reframing. The dominant model treats assistive technology primarily as a functional intervention — a prosthesis for a deficit. But this is incomplete. A child's wheelchair is also a statement about who they are and who they can become. Design choices like color, weight, and customization carry psychological weight that engineers and clinicians cannot afford to ignore.

Children with disabilities don't just need devices that work. They need devices that affirm their dignity, expand their agency, and support their emergence as full participants in their own lives. Adaptive tools, at their best, are not compensation for what a child lacks. They are instruments of who a child is becoming.

Artwork by Andrew Mo

References

1. Livingstone, R., & Field, D. (2014). Systematic review of power mobility outcomes for infants, children and adolescents with mobility limitations. Clinical Rehabilitation, 28(10), 954–964. https://doi.org/10.1177/0269215514531262
2. Bañuls-Lapuerta, F., Marti-Miralles, V., Gónzalez-García, R. J., et al. (2025). Effectiveness of 3D printed custom assistive devices in the school environment. Scientific Reports, 15, 39520. https://doi.org/10.1038/s41598-025-23325-z
3. McNicholl, A., Casey, H., Desmond, D., & Gallagher, P. (2021). The impact of assistive technology use for students with disabilities in higher education: A systematic review. Disability and Rehabilitation: Assistive Technology, 16(2), 130–143. https://doi.org/10.1080/17483107.2019.1642395
4. Hocking, C. (1999). Function or feelings: Factors in abandonment of assistive devices. Technology and Disability, 11(1–2), 3–11. https://doi.org/10.3233/TAD-1999-111-202
5. Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Assistive technology for the inclusion of students with disabilities: A systematic review. Educational Technology Research and Development, 70(3), 1–25. https://doi.org/10.1007/s11423-022-10127-7

How Community Workers Are Bridging Maternal Health Gaps

Emma Davila, Global and Public Health Sciences '26

According to the U.S Department of Health and Human Services, the United States has the highest maternal mortality rate among high-income countries [1]. In 2023, the maternal mortality ratio was 197 deaths per 100,000 live births globally, according to the World Health Organization [2]. It is clear that significant improvements are needed in maternal healthcare quality and access, and community health workers (CHW) may be a potential solution. CHWs are trusted, local community members who offer a uniquely personal and meaningful link between patients and access to high-quality and culturally-competent medical care [3]. In the context of maternal health care, CHWs offer a potential solution as they help bridge the gap between pregnant and postpartum women, especially disadvantaged, high-risk women, and their access to quality medical care, including prenatal care, trusted support, and comprehensible medical information. This support often appears through continuous emotional support and educational efforts that target pregnancy care, birth options, and postpartum recovery. In the United Kingdom, CHWs often take on the promotion of healthy behaviors in pregnant women and new mothers by encouraging quitting smoking, breastfeeding, safe sexual health, and physical activity [4]. On the other hand, a study with CHWs in rural Bangladesh showed that one strategy of successful CHWs in the promotion of better maternal nutrition and breastfeeding patterns was to adjust the delivery and narrative of their messages to appeal to the patient's values and priorities, such as health of the baby, reduced medical costs, and speedy recoveries [5]. This highlights how the success of CHWs in maternal care uniquely relies on the development of trusting relationships with patients and a true understanding of their community, as both maximize patient receptiveness to educational and behavioral change efforts, increasing their health outcomes.

Multiple studies have empirically shown the positive impact that CHWs have on maternal health markers. A study of mother-infant dyads found that participation in a program involving home visits from CHWs was significantly associated with a reduced risk of preterm birth, low birth weight, and an increase in adequate prenatal and postpartum care [6]. Furthermore, a study of Black pregnant women in Detroit found that participation in a program involving CHWs was associated with significantly lower rates of admission to the NICU and longer gestational length [7]. This study suggested the effectiveness of CHWs in mitigating racial disparities in maternal health as well as improving prenatal care and health outcomes among mothers and children experiencing a disproportionate risk of poverty, external stressors, inequities, and inadequate access to resources [7]. Furthermore, a study in Tennessee found that Hispanic mothers enrolled in a program MIHOW, that involved the support of a CHW, more frequently reported supportive and nurturing home environments for their child, including greater amounts of safe sleeping practices and reading aloud to their child. This result highlights how the benefits of CHWs in maternal health may stretch beyond improved birth outcomes and health for the mother, and have an additional positive impact on the rearing of the child and their health [8].

A systematic review found that the majority of studies reviewed involved CHWs who functioned as health educators as well as conducted home visits, suggesting these are two highly common responsibilities of successful CHWs [9]. An interesting adjustment to maximize the widespread usefulness and accessibility of home visits involves secure virtual meetings online that allow CHWs to meet pregnant women and new mothers with convenience, decreasing the likelihood of diminished benefits of collaborating with CHWs due to missed meetings.

Additionally, some studies have pointed towards the importance of integrating the use of CHWs within a larger program targeted towards improved maternal care. One study of CHWs in New York found that CHWs with higher levels of anxiety and lower job satisfaction had a higher risk of burnout and compassion fatigue. This highlights the need for team-based support with adequate communication channels and social recognition in programs with community health workers [10]. Without the support of a larger care team consisting of physicians, nurses, physician assistants, social workers, and more, the positive impacts of CHWs are limited, so modeling future programs with a similar structure to

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the WIN Network is essential, as demonstrated in one Detroit study [7]. This program's success was largely due in part to its ability to link together larger healthcare institutions, social services, and clinical services, maximizing the various resources mothers and their infants have access to. This team-based approach includes measures to protect the mental well-being and capacities of CHWs, thus protecting maternal health outcomes by maintaining a consistent high quality of care for patients. The ability of community health workers to create positive impacts in maternal care is well documented in various clinical settings and with differing maternal populations. However, achieving the full benefits of CHWs in maternal health requires more beyond their mere presence – future integrations must include a larger care team and program, culturally competent training, and relational skills to ultimately maximize the positive impacts brought to the mothers they serve.

References

1. Affairs (ASPA), A. S. for P. (2022, April 11). Maternal Health [Page]. https://www.hhs.gov/healthcare/maternal-health/index.html
2. UNICEF. (2025, April). Maternal Mortality. UNICEF Data; UNICEF. https://data.unicef.org/topic/maternal-health/maternal-mortality/
3. APHA. (n.d.). Community Health Workers. Retrieved March 1, 2026, from https://www.apha.org/apha-communities/member-sections/community-health-workers
4. Gupta, A., & Khan, S. (2024). Importance of Community Health Workers for Maternal Health Care Management. Public health reviews, 45, 1606803. https://doi.org/10.3389/phrs.2024.1606803
5. Grandner, G. W., Rasmussen, K. M., Dickin, K. L., Menon, P., Yeh, T., & Hoddinott, J. (2022). Storytelling for persuasion: Insights from community health workers on how they engage family members to improve adoption of recommended maternal nutrition and breastfeeding behaviours in rural Bangladesh. Maternal & Child Nutrition, 18(4), e13408. https://doi.org/10.1111/mcn.13408
6. Meghea CI, Raffo JE, Yu X, et al. Community Health Worker Home Visiting, Birth Outcomes, Maternal Care, and Disparities Among Birthing Individuals With Medicaid Insurance. JAMA Pediatr. 2023;177(9):939–946. doi:10.1001/jamapediatrics.2023.2310
7. Straughen JK, Clement J, Schultz L, Alexander G, Hill-Ashford Y, Wisdom K (2023) Community health workers as change agents in improving equity in birth outcomes in Detroit. PLoS ONE 18(2): e0281450. https://doi.org/10.1371/journal.pone.0281450
8. Lutenbacher, M., Elkins, T., & Dietrich, M. S. (2023). Using Community Health Workers to Improve Health Outcomes in a Sample of Hispanic Women and Their Infants: Findings from a Randomized Controlled Trial. Hispanic Health Care International, 21(3), 129–141. https://doi.org/10.1177/15404153221107680
9. Scharff, D., Enard, K. R., Tao, D., Strand, G., Yakubu, R., & Cope, V. (2022). Community Health Worker Impact on Knowledge, Antenatal Care, And Birth Outcomes: A Systematic Review. Maternal and child health journal, 26(1), 79–101. https://doi.org/10.1007/s10995-021-03299-w
10. Rahman, R., Ross, A. M., Huang, D., Kirkbride, G., Chesna, S., & Rosenblatt, C. (2023). Predictors of burnout, compassion fatigue, and compassion satisfaction experienced by community health workers offering maternal and infant services in New York State. Journal of Community Psychology, 51(4), 1820–1838. https://doi.org/10.1002/jcop.22967

Food Deserts in Low-Income Communities

by Jizelle Dumayas, Biological Sciences ‘27

It is a typical Sunday morning, and you decide to find a grocery store on your way back from work. This is unfamiliar territory to you, but you are sure that you will encounter a market within the next 3-5 minutes. However, to your surprise, 10 minutes, 15 minutes, and now 20 minutes go by, and still you find yourself circling the same side of town looking for any place that would sell fresh, healthy produce. You manage to spot a liquor store, McDonald’s, Burger King, Taco Bell, and Wendy’s on nearly every corner. Despite seeing many restaurants from leading fast food chains, you are hit with the disappointing realization that the nearest grocery store is 5 miles away.

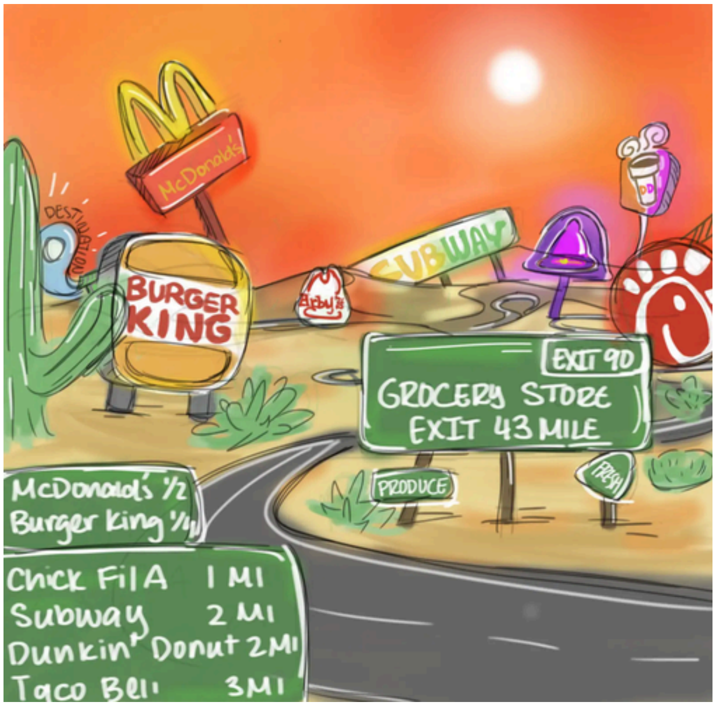
In this community, liquor stores and fast food restaurants are built on every corner, but that’s not bad luck; that’s by design. Communities like these consist of low to low-medium income, predominantly black individuals [1]. The scenario described above is a reality that around 18.8 million Americans living in underprivileged and under-resourced communities constantly face [2]. The scarcity of markets with fresh, nutritious foods and produce that are readily available in a community is known as a food desert [3].

Food deserts have been a problem in the United States for generations, dating back to redlining and institutionalized racism intended to keep black and low-income communities impoverished and struggling [3]. Food deserts are an indignity to human life. They have been directly linked to high rates of obesity amongst adolescents in the U.S., increased risk for heart disease, higher occurrence of type II diabetes, and even shorter life expectancy [4].

The abundance of fast food restaurants that sell cheap, and quickly made meals in low-income communities, and the prevalence of stores like Albertsons, Vons, Whole Foods, Sprouts, etc., in affluent communities, is all part of a greedy marketing strategy. It intentionally targets areas predicted to have demographically ‘ideal’ customers who are the most frequent buyers [3].

According to Morland et al., “...the wealthier neighborhoods contain fewer smaller grocery stores, convenience stores (without gas stations), and specialty foods stores compared to the lowest-wealth neighborhoods” [1]. As supermarkets with fresh and nutritious foods become sparse in low-wealth neighborhoods, it is more likely that these individuals have limited means of transportation and cannot conveniently commute to distant parts of town. This continues to perpetuate the cycle of food insecurity. This is part of the reason why, in recent years, the U.S. has seen the worst levels of hunger in decades [5].

Who set this system up? The major culprits are America’s leading food monopolies seeking the highest profit with little to no regard for who they impact along the way. One of the complications of corporate greed includes the emergence of corporate consolidation. Corporate consolidation, the merging of multiple companies to create a single entity, has had a major influence on food accessibility [6]. In the past, nearly all neighborhoods had accessible grocery stores. But, after the abolishment of the Robinson-Patman Act in the 1980s, corporate consolidation made a dominant return. Essentially, there was no reinforcement against price discrimination, in which a seller, in this case, a food supplier, charges different customers different prices for identical products [7]. This price discrimination has done nothing but put millions of Americans at a socioeconomic and health-related disadvantage [8].



Artwork by Ava Shi

References

1. Morland, K., Wing, S., Diez Roux, A., & Poole, C. (2002). Neighborhood characteristics associated with the location of Food Stores and Food Service Places. American Journal of Preventive Medicine, 22(1), 23–29. https://doi.org/10.1016/s0749-3797(01)00403-2
2. Team, E. (2025, June 26). Food Deserts: An Analysis of their Prevalence in the U.S.https://www.escoffier.edu/blog/world-food-drink/food-deserts-an-analysis-of-their-prevalence-in-the-us/
3. Cassidy, J. (2024, June 10). Hungry in America: Exploring the Food Desert Crisis. The Seattle Times. https://www.seattletimes.com/life/food-drink/hungry-in-america-exploring-the-food-desert-crisis/
4. Massey, J., McCullough, M., & Jemal, Dr. A. (2023, June 28). Living in Food Deserts is Associated with Shorter Life Expectancy in the US, New Research Shows. American Cancer Society. https://pressroom.cancer.org/releases?item=1237
5. Ney, J. (2022, January 25). Food Deserts and Inequality. Social Policy Data Lab. https://www.socialpolicylab.org/post/grow-your-blog-community
6. Milani, K., & Parker, C. (2026, January 28). Mapping food deserts and grocery consolidation | Independent Business. ILSR: Institute for Local Self-Reliance. https://ilsr.org/article/independent-business/grocerygaps/
7. Chesnes, M., & Nguyen, S. T. (2024, December 12). Price Discrimination: Robinson-Patman Violations. Federal Trade Commission. https://www.ftc.gov/advice-guidance/competition-guidance/guide-antitrust-laws/price-discrimination-robinson-patman-violations
8. Beaulac, J., Kristjansson, E., & Cummins, S. (2009, July). A systematic review of food deserts, 1966-2007. Preventing Chronic Disease. https://pmc.ncbi.nlm.nih.gov/articles/PMC2722409/

Miles to Care: Addressing Rural Healthcare Disparities

by Lexi Waite, Biological Sciences '26

Imagine a cattle farmer in a rural community working in the fields, when they suddenly suffer a medical emergency. An ambulance rushes the farmer to the nearest hospital, but the facility lacks the resources for proper treatment. Now the question becomes: can medical staff arrange a transfer to a more equipped facility in time? While extreme, this scenario highlights the current disparities that exist between urban and rural healthcare centers due to gaps in healthcare access, leaving many essential populations vulnerable.

Rural populations face limited access to healthcare due to geographical limitations, staffing shortages, and funding constraints. Proper access to healthcare combines a person's ability to identify, find, and use healthcare services to have their needs met [1]. One critical factor that affects healthcare access is staffing problems. In rural hospitals, 65% of providers reported experiencing "a great deal" of job stress, and approximately 33% reported burnout. Greater job stress was also associated with reduced job satisfaction, increased stress, and a chaotic work environment [2]. In addition to the impact burnout has on physicians and the quality of care they can provide, rural settings also struggle with recruiting new staff. Currently, 20% of Americans live in rural areas, but only 9% of physicians practice in these areas, and this issue is further exacerbated as a large number of these physicians are reaching retirement age. Medical students from rural areas are the most likely to return to rural areas to practice, though in recent years, this has been declining [3]. Together, these issues compound, which may lead to reduced quality of care or increased rates of leaving rural settings, along with greater difficulties in recruiting more staff. These challenges go hand in hand, contributing to decreased access and quality of healthcare in rural areas.

Finances are another crucial factor that limits healthcare access, affecting not just patients but providers as well. Rural healthcare clinics treat smaller patient populations and subsequently perform fewer high-cost procedures. Hospitals are then unable to cover operational costs, resulting in a greater number of healthcare closures in rural settings [3]. Reduced funding also leaves rural clinics unable to update infrastructure or provide supplemental care [3]. From a patient standpoint, rural settings tend to have more poverty and a decreased ability to afford insurance premiums and healthcare costs [4]. Financial restraints continue to add to the problem faced by rural healthcare clinics and residents, as both seem to lack sufficient resources to have full healthcare access. Factoring in finances along with staffing issues creates significant barriers to health and has major implications for patient care. Rural communities are more likely to face poorer health outcomes, with a severe lack of access to preventative care and health education training, leading to higher rates of chronic conditions [5]. Understanding the needs of the populations is essential to foster solutions that will allow for greater access and better patient care quality.

Finding ways to mitigate these negative effects will be essential for providing quality healthcare to rural populations. Telehealth, the use of technology to remotely deliver healthcare through message and video call, has become increasingly popular with rural communities, as it is a viable and cost-effective approach for a provider to be able to reach a patient, without the limits of transportation or far travel [1]. This technology can be used in a multitude of ways, such as video conferences or even text messaging with providers to help with diagnoses and care [1]. Although this does come with its drawbacks, requiring access to the internet and technology capable of connecting patients and providers, it has nonetheless been a useful tool in extending specialty care to rural populations. Furthermore, many institutions are working to address staffing issues. Many universities and higher education programs located in rural areas have emphasized recruiting students who show an interest in working with rural or underserved populations. Finally, programs such as the Health Resources and Services Administration (HRSA) offer loan repayment programs that set specific criteria for healthcare professionals to work for a specified length of time in a medically underserved area in order to have their educational loans reimbursed [6].

Ultimately, rural healthcare disparities are not only the result of geography, but of systemic challenges that require solutions. Addressing these staffing shortages and financial instabilities demands collaboration between policymakers, healthcare institutions, and communities. Investing in new approaches will begin to close the gap between rural and urban healthcare to ensure the health and well-being of all populations, regardless of where they live.

Artwork by Eileen Cho

References

1. Coombs, N. C., Campbell, D. G., & Caringi, J. (2022). A qualitative study of rural healthcare providers' views of social, cultural, and programmatic barriers to healthcare access. BMC Health Services Research, 22(1), 438. https://doi.org/10.1186/s12913-022-07829-2.
2. Bethea, A., Samanta, D., Kali, M., Lucente, F. C., & Richmond, B. K. (2020). The impact of burnout syndrome on practitioners working within rural healthcare systems. The American Journal of Emergency Medicine, 38(3), 582–588. https://doi.org/10.1016/j.ajem.2019.07.009
3. Maganty, A., Byrnes, M. E., Hamm, M., Wasilko, R., Sabik, L. M., Davies, B. J., & Jacobs, B. L. (2023). Barriers to rural health care from the provider perspective. Rural and Remote Health, 23(2). https://doi.org/10.22605/RRH7769
4. Anderson, D., Abraham, J. M., & Drake, C. (2019). Rural-Urban Differences In Individual-Market Health Plan Affordability After Subsidy Payment Cuts. Health Affairs, 38(12), 2032–2040. https://doi.org/10.1377/hlthaff.2019.00917
5. Kerna, N. A. (2025). Bridging the Gap: Examining Innovative and Sustainable Solutions for Addressing Rural Healthcare Disparities. European Journal of Innovative Studies and Sustainability, 1(3), 182–194. https://doi.org/10.59324/ejiss.2025.1(3).14
6. Loan Repayment | NHSC. (n.d.). Retrieved March 1, 2026, from https://nhsc.hrsa.gov/loan-repayment

Community Health Workers: the Future of Primary Healthcare

by Reese Visaya, Biological Sciences '27

When clinics are hours away and doctors are scarce, how do rural communities get essential medications, vaccinations, and treatments? Many rural communities in Sub-Saharan Africa face barriers to receiving quality primary healthcare services due to distance to health facilities, rising care costs, and physician shortages [1]. Primary care is essential for maintaining good health, preventing illness, and diagnosing and treating diseases. Without access to primary care, minor health concerns can be exacerbated to more severe and even life-threatening problems. Infectious diseases such as malaria, tuberculosis, and HIV, as well as non-communicable diseases like diabetes, hypertension, and anemia, require timely intervention and ongoing management and are highly prevalent in regions with limited access to care [2]. Additionally, lack of consistent pre and postnatal care contributes to the elevated maternal and infant mortality rates in the region [3].

Community Health Workers (CHW) are trained, trusted members of a community, primarily women, who bring basic health services and education to communities [1]. They provide a variety of primary health services, including medication distribution, health education, maternal and prenatal support, immunizations, infectious disease prevention, chronic disease monitoring, and more [4,5]. By delivering care directly within communities, CHWs expand access to primary healthcare where traditional systems fall short and serve as a bridge between health services and the community [6].

CHWs have profoundly influenced community health in rural areas of Africa where they are deployed. Evidence from systematic reviews of the impact of community health workers in Africa suggests that CHWs have reduced waiting times, decreased healthcare costs, and increased disease management without compromising patient outcomes or quality. A 14 year longitudinal study in the Gambia found a 33% reduction in child mortality during the initial period of greatest investment in CHWs [7]. Care retention rates in Zambia, Uganda, and Rwanda have improved due to adherence counseling from CHWs [4]. CHW based approaches to maternal care were effective in reducing maternal mortality in Nigeria, Zambia, Tanzania and the Democratic Republic of Congo by up to 64% [3]. During the COVID 19 pandemic, community health workers played a critical role in surveillance and contact tracing [8]. These findings underscore the importance of CHWs as a cost-effective solution for strengthening primary care access in Sub-Saharan Africa.

Community Health Workers are a unique and critical element of the health system in rural Africa and it is vital that these frontline workers are receiving adequate compensation and appropriate training. The current shortage of community health workers in Africa is estimated to be between 580,000 and 954,500 [8,9]. Additionally, CHWs are rarely equipped to deliver to their highest potential due to limited resources and funding [1]. In order to build more resilient and equitable health infrastructures in underserved regions of the world, it is imperative to recognize the invaluable contribution of CHWs and invest in strengthening their impact.

Community Health Workers are a growing global strategy to close primary care gaps where formal health systems fall short. Achieving universal health care will require novel and tailored solutions in order to reach rural and underserved communities. The future of primary care in underserved regions may not begin in hospitals, but in homes, villages, and trusted community relationships.

Artwork by Jane Wang

References

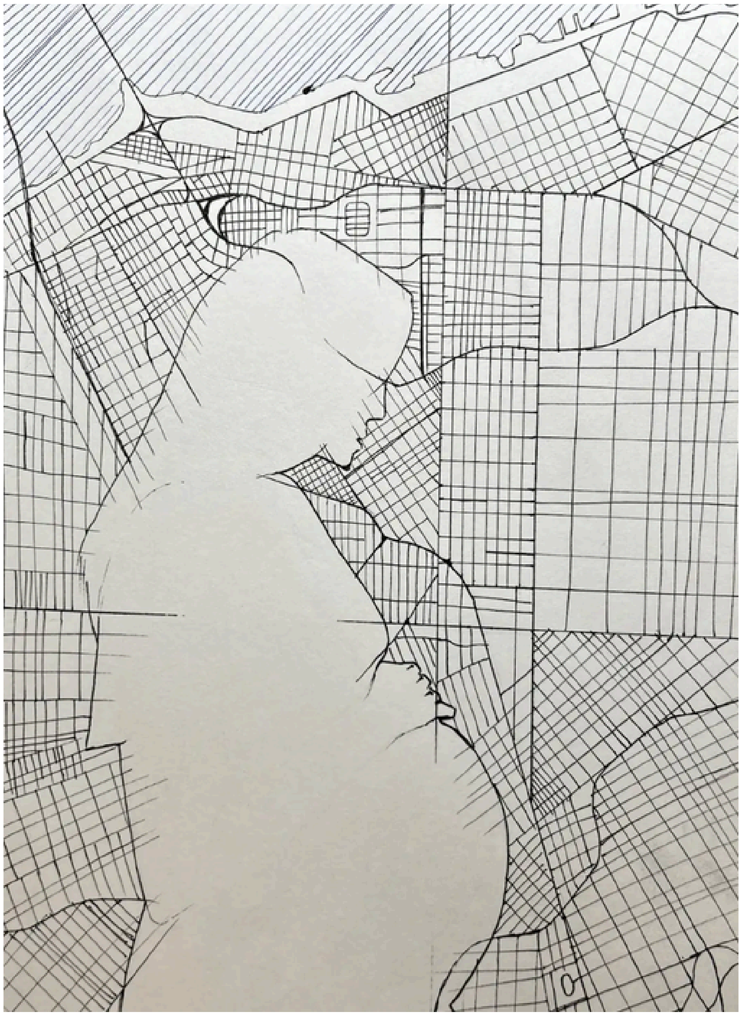
1. These are the community health workers who are the heartbeat of global primary health care. UNICEF. https://www.unicef.org/stories/community-health-workers-heartbeat-global-primary-health-care
2. Jeet G, Thakur JS, Prinja S, Singh M (2017) Community health workers for non-communicable diseases prevention and control in developing countries: Evidence and implications. PLoS ONE 12(7): e0180640. https://doi.org/10.1371/journal.pone.0180640
3. Orjingene, O. and Morgan, J. (2020) Effectiveness of Community Based Interventions in Reducing Maternal Mortality in Sub-Saharan Africa: A Systematic Review. International Journal of TROPICAL DISEASE & Health, 41 (9). pp. 9-21. ISSN 2278-1005
4. Mwai, G.W., Mburu, G., Torpey, K., Frost, P., Ford, N. and Seeley, J. (2013), Role and outcomes of community health workers in HIV care in sub-Saharan Africa: a systematic review. Journal of the International AIDS Society, 16: 18586. https://doi.org/10.7448/IAS.16.1.18586
5. Idriss-Wheeler D, Ormel I, Assefa M, Rab F, Angelakis C, Yaya S, Sohani S. Engaging Community Health Workers (CHWs) in Africa: Lessons from the Canadian Red Cross supported programs. PLOS Glob Public Health. 2024 Jan 18;4(1):e0002799. doi: 10.1371/journal.pgph.0002799. PMID: 38236795; PMCID: PMC10796059.
6. Ngongo N, Dereje N, Teriaky ME, Fallah MP, Shaweno T, Abdulaziz M, et al. (2024) Reinforcing community health workers program in africa for universal health coverage and global health security: A call for concerted efforts. PLOS Glob Public Health 4(9): e0003727. https://doi.org/10.1371/journal.pgph.0003727
7. Christopher, J.B., Le May, A., Lewin, S. et al. Thirty years after Alma-Ata: a systematic review of the impact of community health workers delivering curative interventions against malaria, pneumonia and diarrhoea on child mortality and morbidity in sub-Saharan Africa. Hum Resour Health 9, 27 (2011). https://doi.org/10.1186/1478-4491-9-27
8. Ngongo N, Dereje N, Teriaky ME, Fallah MP, Shaweno T, Abdulaziz M, Raji T, Guwani JM, Folayan MO, Ndembi N, Kaseya J. Reinforcing community health workers program in africa for universal health coverage and global health security: A call for concerted efforts. PLOS Glob Public Health. 2024 Sep 17;4(9):e0003727. doi: 10.1371/journal.pgph.0003727. PMID: 39288127; PMCID: PMC11407658.
9. Asamani JA, Okoroafor SC, Mwinga K. Community Health Worker Requirements to Accelerate Progress Towards Universal Health Coverage in Africa: An Overview of Contemporary Estimates and Implications of Full-Time Versus Part-Time Working Arrangements. Inquiry. 2025 Jan-Dec;62:469580251323381. doi: 10.1177/00469580251323381. PMID: 39991889; PMCID: PMC11851756.

Birthing on Rural America's Margins: Maternal Health Disparities

by Sumedha Shastry, Human Biology, Health, and Society '28

Giving birth takes an immense toll on a woman's life. Not only does it require a significant amount of time to properly prepare for the baby, but it also takes a toll on her body. With all the check-up appointments, pre-birth classes, post-birth lactation consultations, and other such appointments, the mother-to-be must essentially put her life on hold for nine months in preparation for the day that the baby comes. After the stressful couple of months surrounding the newborn phase have passed, the extensive lengths that the mother had to go to prepare for the baby seem worth it. However, this picture-perfect reality is not the case for many Indigenous women in America.

In Indigenous populations, there is evidence of higher maternal mortality and morbidity rates compared to other ethnic populations in the United States [1]. According to the Eunice Kennedy Shriver National Institute of Child Health and Human Development, maternal mortality refers to the death of a woman following complications of pregnancy or childbirth, and it spans the length of pregnancy up to six months postpartum [2]. Additionally, maternal morbidity refers to any short- or long-term health problems that result from a woman being pregnant or giving birth [2]. According to 2007-2016 CDC data, the pregnancy-related mortality ratio (the number of pregnancy-related deaths per 100,000 live births) was 12.7 in white women and 16.7 in the general population. Meanwhile, it was 29.7 in indigenous women [3]. This statistic is alarming for two main reasons. One, it shows that current maternal mortality and morbidity trends have persisted for many years. Two, the disproportionate nature of this rate is indicative of system-wide inequities.



Artwork by Joshua Choi

This trend is even more pronounced for rural Indigenous women, who suffer from maternal mortality and morbidity at even higher rates than non-rural Indigenous women. A 2020 study looking at maternal morbidity and mortality among Indigenous women compared with non-Hispanic White women found two important findings: the incidence of maternal morbidity and mortality was greater among Indigenous women (2.0%) compared to White women (1.1%) and incidence was higher in rural Indigenous women (2.3%) compared to urban Indigenous women (1.8%) [1]. Rural Indigenous women, therefore, will be the focus of this piece. Despite the advancements that have been made in terms of technology in the medical field, it is clear there are still equity issues that must be addressed.

There are many possible reasons for this trend in rural Indigenous women. Some include poor social determinants of health that lead to pre-existing, chronic conditions complicating childbirth, low access to obstetric services and weak incentives for provider retention in rural areas, and a lack of insurance coverage.

Social determinants of health, according to the World Health Organization, refer to the conditions in which people are born, grow up, live, work, and age and they influence one's health and contribute to health inequities [4]. Access to healthcare, availability of healthy foods, and the ability to stay physically active are significant social determinants of health that can influence a woman's health prior to pregnancy and childbirth. When these determinants are not ideal, conditions that complicate pregnancy and childbirth develop, including diabetes, infection, and hypertensive (high blood pressure) disorders [5]. Access to obstetric services is declining in rural areas and combined with the fact that Medicaid coverage deters some providers from working in rural areas, it is very difficult for rural Indigenous women to access quality healthcare [10]. This further complicates their pregnancy and childbirth, leading to adverse outcomes like maternal mortality and morbidity.

As alluded to earlier, many rural Indigenous women are Medicaid beneficiaries. In fact, three-quarters of the women in the 2020 study had childbirth hospitalizations paid for by Medicaid [1]. This becomes an important fact when considering that Medicaid has strict insurance coverage periods for pregnant women. Specifically, it limits the covered period as the time from conception to 60 days postpartum, making long-term conditions that affect pregnancy and childbirth difficult to properly address. If a woman has been suffering from diabetes for many years, it is unlikely that targeting complications only nine months before birth will be effectively cared for. Beyond the issue of limited insurance coverage, continuous insurance remains an issue for rural Indigenous populations, who had the lowest prevalence of continuous insurance (62%) compared to urban Indigenous (68%), White rural (78%), and White urban (82%) populations [6].

In addition to insurance issues, another systemic issue that harms Indigenous women is the ineffective Indian Health Service (IHS) [6]. The IHS was created to fulfill a treaty made between U.S. tribes and the federal government by providing health care to Indigenous people who are enrolled members of federally recognized tribes. However, IHS' lack of delivered quality healthcare, limitations on services, and participation in reproductive injustices, such as forced sterilization, call into question how reliable the service is in caring for Indigenous pregnant women [6].

Taken together, these barriers make pregnancy and childbirth disproportionately dangerous for many rural Indigenous women. Ensuring safe, equitable maternal care is not only a matter of health, but of dignity, reproductive justice, and the well-being of future generations in Indigenous communities.

References

1. Kozhimannil, K. B., Interrante, J. D., Tofte, A. N., & Admon, L. K. (2020). Severe Maternal Morbidity and Mortality Among Indigenous Women in the United States. Obstetrics and Gynecology, 135(2), 294–300. https://doi.org/10.1097/AOG.0000000000003647
2. Eunice Kennedy Shriver National Institute of Child Health and Human Development. (2021). Maternal Morbidity and Mortality. https://www.nichd.nih.gov/health/topics/maternal-morbidity-mortality
3. Petersen E. E., Davis N. L., Goodman D. (2019). Racial/Ethnic Disparities in Pregnancy-Related Deaths— United States, 2007–2016. MMWR Morb Mortal Wkly Rep, 68:762–765. http://dx.doi.org/10.15585/mmwr.mm6835a3
4. World Health Organization. Social determinants of health. https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1
5. National Council of Urban Indian Health. Maternal Health. https://ncuih.org/maternal-health/
6. Liddell, J. L., Interrante, J. D., Sheffield, E. C., Baker, H. A., Kozhimannil, K. B. (2024). Health Insurance Type and Access to the Indian Health Service Before, During, and After Childbirth Among American Indian and Alaska Native People in the United States. Women's Health Issues, 34(6), 562–571. https://doi.org/10.1016/j.whi.2024.08.002

Same Biology, Different Results: Bias in Medicine

by Suri Wang, Biology and Society '29

"Of all the forms of inequality, injustice in health is the most shocking and most inhuman because it often results in physical death." — Dr. Martin Luther King Jr. (1966)

While healthcare is seen as a benevolent and nonjudgemental field, health professionals often exhibit implicit biases (unconscious biases based on perceptions and stereotypes) against patients that are part of marginalized groups based on race, economic status, and gender.

Medical bias has existed for hundreds of years. In the third century BCE, Aristotle described the female body as faulty, defective, and deficient. The illnesses of female patients were commonly related back to the reproductive organs [1]. In the 1800s, physicians followed the advice of Benjamin Rush, who believed that Indigenous Americans and Africans did not suffer from insanity and tuberculosis due to their "uncivilized" and active lifestyle and diets. It was instead believed that the cultivation of civilization and abolition of slavery left these populations vulnerable to disease [2].

As time went on, minority groups were excluded from medical education, exacerbating the prevalence of bias within medical schools with a lack of diversity within the student population. After the 1910 Flexner Report, which standardized resources for medical schools, medical schools for Black students faced closures. Continuing from this, medical school was seen as a privilege reserved for wealthy males. Those from lower economic classes, often minority races, were diverted into public health and sanitation careers [3]. These historical barriers laid the foundation for biases that persist in modern-day healthcare.

Bias in Healthcare Today

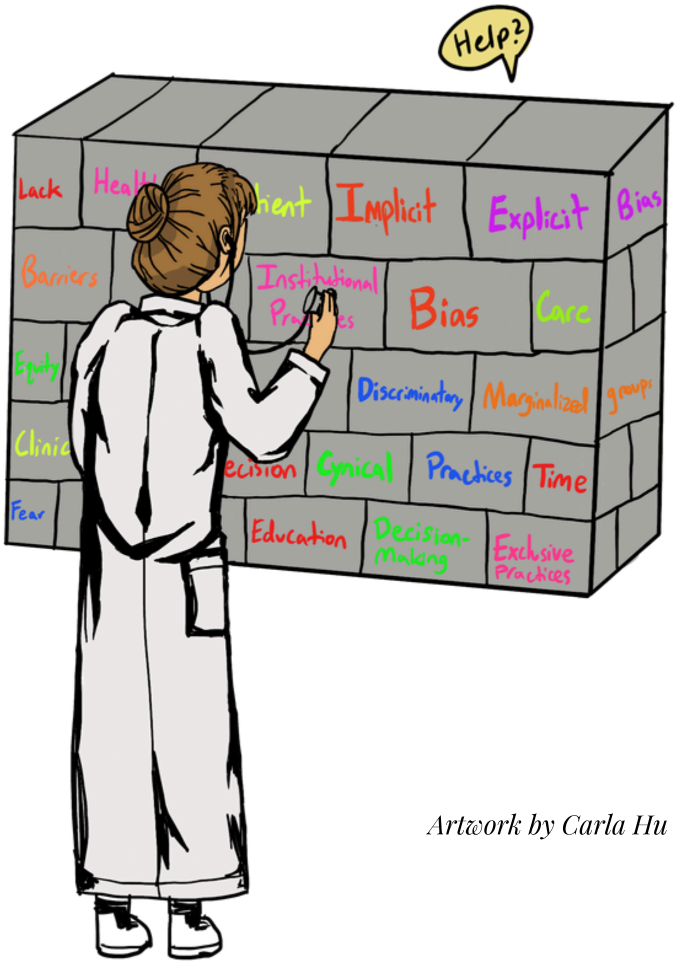
Modern day society is often viewed as progressive, especially when it comes to understanding various biases. However, implicit biases are still prevalent. A study conducted in 2007 found that physicians underestimate the pain of Black patients by twice as much across different care settings, even when education and insurance status were controlled for [4]. Moreover, Black patients are less likely to be prescribed medications, and when they are, tend to receive lower dosages. Black patients are also 17% less likely to receive analgesics for fractures in the emergency room. In a study done on white medical students, it was found that half held false beliefs about African Americans, including 60% believing that the skin of Black individuals is thicker or have nerve endings that are less sensitive [5].

Moreover, the opioid crisis began largely with poor, rural white citizens in Appalachia, many of whom participated in manual labor to make a living and were thus prescribed such medications. As the epidemic grew, it was largely overlooked until opioid use rose in affluent suburban communities [6]. The discrepancy in public attention highlights how socioeconomic status influences which populations receive medical attention and policy responses, highlighting bias in healthcare systems.

In the case of gender, men are presented as stoic and holding high pain tolerance. Meanwhile, women are pictured as sensitive, hysterical, and said to be fabricators. Additionally, women are often judged by their physical appearances and encouraged by healthcare providers to put their family and household foremost, even when suffering from pain. They also face more ineffective healthcare, including being recommended coping strategies, reduced pain medication (including opioids), increased antidepressant prescriptions, and more frequent mental health referrals [7].

The Feedback Loop

In the Tuskegee study which began in 1932 and lasted forty years, 399 black men were unwillingly subjected to an experiment on syphilis by the United States Public Health Service. Officials forced them to suffer, with no treatment, with the supposed goal to observe the natural history of untreated syphilis. Its most prominent result, however, was a heavy amount of medical distrust in African American communities [8].



Artwork by Carla Hu

Patient mistrust in physicians leads to barriers in equitable participation in clinical trials, amplifying bias. Inclusive clinical research is essential for generalizable and applicable data, promoting health equality. However, incidents such as the Tuskegee study have led to low participation from minority groups, including Black and Latinx individuals, averaging 4%-6% per study [9]. Additionally, those with lower financial resources face barriers to participation, often due to lack of invitation from physicians, who hold implicit biases.

Many of these individuals hold high levels of mistrust in the medical system and feel as if they will not benefit from research or as if their communities are being exploited. For instance, it was found that those in rural Appalachia (with a majority low-income, white population) feel high levels of medical mistrust due to lack of interaction with healthcare organizations. This leads to a feedback loop, in which a lack of available data results in continued implicit bias [10].

What Can Be Done?

New training practices and direct community partnerships may help mitigate these outcomes. Structural inequalities inside the healthcare system, including racism, sex, and gender discrimination, must be addressed through core training for public health officials and healthcare providers. Additionally, diverse student bodies and greater gender equality among medical school faculty can help mitigate implicit biases. Physicians should focus on ensuring that participation in clinical trials is suggested to individuals of a variety of socioeconomic backgrounds. Regardless, it is clear that implicit bias in medicine is detrimental to patient outcomes, and the goals of medicine itself [11]. If systemic changes are not made to address medical biases in the healthcare system, we risk perpetuating disparities in patient care, further eroding trust between patients and providers. However, with intentional reform, increased awareness, and a commitment to equity, meaningful change is possible.

References

1. Cleghorn, E. (2021, June 17). *Medical myths about gender roles go back to Ancient Greece. Women are still paying the price today*. Time. https://time.com/6074224/gender-medicine-history/
2. Jones, D. S., Hammonds, E., Gone, J. P., & Williams, D. (2024). Explaining Health Inequities — The Enduring Legacy of Historical Biases. *The New England Journal of Medicine*, *390*(5). https://doi.org/10.1056/nejmp2307312
3. Science, in, Laurencin, C. T., Morgan, R. C., & Bright, C. M. (2025, January 21). *Historical Roots of Medical Mistrust*. Nih.gov; National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK611595/
4. Staton, L. J., Panda, M., Chen, I., Genao, I., Kurz, J., Pasanen, M., Mechaber, A. J., Menon, M., O'Rorke, J., Wood, J., Rosenberg, E., Faeslis, C., Carey, T., Calleson, D., & Cykert, S. (2007). When race matters: disagreement in pain perception between patients and their physicians in primary care. *Journal of the National Medical Association*, *99*(5), 532. https://pmc.ncbi.nlm.nih.gov/articles/PMC2576060/?page=5
5. Hoffman, K. M., Trawalter, S., Axt, J. R., & Oliver, M. N. (2016). Racial Bias in Pain Assessment and Treatment recommendations, and False Beliefs about Biological Differences between Blacks and Whites. *Proceedings of the National Academy of Sciences*, *113*(16), 4296–4301. https://doi.org/10.1073/pnas.1516047113
6. Frakt, A., & Monkovic, T. (2019, November 25). A "Rare Case Where Racial Biases" Protected African-Americans. *The New York Times*. https://www.nytimes.com/2019/11/25/upshot/opioid-epidemic-blacks.html
7. Samulowitz, A., Gremyr, I., Eriksson, E., & Hensing, G. (2018). "Brave Men" and "Emotional Women": A Theory-Guided Literature Review on Gender Bias in Health Care and Gendered Norms towards Patients with Chronic Pain. *Pain Research and Management*, *2018*(1), 1–14. https://doi.org/10.1155/2018/6358624
8. McVean, A. (2019, January 25). *40 Years of Human Experimentation in America: The Tuskegee Study*. Office for Science and Society; McGill University. https://www.mcgill.ca/oss/article/history/40-years-human-experimentation-america-tuskegee-study
9. Oyer, R. A., Hurley, P., Boehmer, L., Bruinooge, S. S., Levit, K., Barrett, N., Benson, A., Bernick, L. A., Byatt, L., Charlot, M., Crews, J., DeLeon, K., Fashoyin-Aje, L., Garrett-Mayer, E., Gralow, J. R., Green, S., Guerra, C. E., Hamroun, L., Hardy, C. M., & Hempstead, B. (2022). Increasing Racial and Ethnic Diversity in Cancer Clinical Trials: An American Society of Clinical Oncology and Association of Community Cancer Centers Joint Research Statement. *Journal of Clinical Oncology*, *40*(19), 2163–2171. https://doi.org/10.1200/jco.22.00754
10. Thomas, M., Amstutz, C., Orr-Roderick, D., Horter, J., & Holben, D. H. (2023). Medical Mistrust Among Food Insecure Individuals in Appalachia. *Family & Community Health*, *46*(3), 192–202. https://doi.org/10.1097/fch.0000000000000362
11. Vela, M. B., Erondu, A. I., Smith, N. A., Peek, M. E., Woodruff, J. N., & Chin, M. H. (2022). Eliminating explicit and implicit biases in health care: Evidence and research needs. *Annual Review of Public Health*, *43*(1), 477–501. https://doi.org/10.1146/annurev-publhealth-052620-103528

The Impact of Falls on Our Elders

by Carla Hu, Human Biology, Health, and Society '26

Falls at a young age are often dismissed as minor accidents, yet for older adults, they can be a turning point that reshapes their independence, confidence, and quality of life. More than one in four adults over age 65 fall each year, making falls one of the most common and serious threats to healthy aging [1]. Even more concerning, falls are the leading cause of injury-related deaths for older adults, and mortality rates due to falls have steadily increased over time 41% from 2012 to 2021 [2]. In 2021, the mortality rate from falls was 78 out of every 100,000 older adults [2]. Despite these concerning statistics, falls are not an inevitable part of aging, and many are preventable. Understanding why they occur and how our healthcare system addresses falls reveals a complex public health challenge that goes beyond simple accident prevention.

Healthcare providers play a central role in reducing falls by performing clinical screenings that allow professionals to evaluate mobility, balance, and bone density before an accident occurs. Interventions for falls often include strength and balance training, medications, and home safety modifications such as installing grab bars or improving lighting [3]. These preventative approaches highlight that falls can result from multiple causes, including physiological decline, medication side effects, and environmental hazards. One important yet often overlooked contributor to falls is osteoporosis, a medical condition that does not cause falls directly but can greatly amplify their consequences.

Artwork by Ariana Desai

Osteoporosis is a widespread bone disease characterized by weakened bone tissue, reduced bone structure, where the formation of new bone cannot keep up with the loss of old bone [4]. This often makes fractures far more likely to occur even in low-impact falls [4]. Among all adults, osteoporosis prevalence is higher in women than in men, and in 2017-2018, 55.7% of adults aged 50 and older had osteoporosis or low bone mass [4]. For these older adults, a fracture could mean hospitalization, loss of independence, or permanent disability. Thus, bone health can determine whether falls become a temporary setback or a life-altering event. This often leads to healthcare providers frequently prescribing medications to strengthen bones and reduce fracture risk. Bisphosphonates, one of the most common drugs for osteoporosis, have been shown to improve bone density and reduce fracture risk, improving long-term outcomes after a fall [5]. These preventative medications allow older adults to recover from falls without sustaining fractures that could significantly impact their quality of life, illustrating how medical intervention is key to protecting healthy aging.

However, medications are not without trade-offs. Researchers have found that osteoporosis medications may be associated with increased rates of depression and anxiety, suggesting potential unintended psychological side effects [5]. In one analysis, depressive adverse drug reactions were more than 14-fold higher in patients under age 65 taking alendronate and more than fourfold higher in patients over 65 than in controls [5]. These findings complicate a straightforward clinical decision. Physicians and patients must consider not only the risks for fractures, but also mental health and overall well-being. This dilemma highlights a broader issue in geriatric medicine, where interventions designed to solve one problem may unintentionally create another, making careful risk evaluations and individualized care essential.

Osteoporosis medications can reduce fracture risk, but they may also carry important side effects that physicians must weigh carefully. Some drugs have been associated with psychological adverse effects such as depression and anxiety, while newer medications raise other safety concerns. Romosozumab, a treatment option for severe osteoporosis, takes a unique approach by increasing bone formation to reduce fracture risk and is a major advancement in treating osteoporosis [6]. However, emerging research found that Romosozumab is also associated with increased risk for cardiovascular events like heart attacks and atrial fibrillation [6]. This reflects the delicate balance in clinical decision-making where medications can prevent debilitating fractures but may simultaneously increase cardiovascular risk. Therefore, physicians making decisions for fall prevention must also consider their patients' other medical conditions and the risks and benefits of prescribing newer osteoporosis treatments.

These trade-offs reveal that preventing falls cannot solely rely on medication. Thus, physicians may instruct older adults with cardiovascular conditions to take a non-pharmacological approach, such as environmental modifications and physical therapy programs that build muscle strength and improve balance. This strategy may be safer than being exposed to the risk of medication side-effects. Yet for individuals with severe osteoporosis or very high fracture risk, medication remains essential in addition to lifestyle and environmental changes.

Ultimately, falls in older adults are more than isolated incidents. They reveal how well the healthcare system supports an aging population through prevention and individualized care rather than standard treatment alone. Successfully addressing falls in this population requires holistic preventative measures and close collaboration between healthcare providers and older adults to ensure quality care later in life.

References

1. Riddle, H. (2024, April 20). 11 Surprising Foods That Contain High Fructose Corn Syrup. Mashed. https://www.mashed.com/1551880/surprising-foods-high-fructose-corn-syrup/
2. Marie, C. (2020, August 14). 50 foods with hidden high fructose corn syrup (HFCS). https://thejeansfit.com/foods-high-fructose-corn-syrup/
3. Bray, G. A., Nielsen, S. J., & Popkin, B. M. (2004). Consumption of high-fructose Corn Syrup in Beverages May Play a Role in the Epidemic of Obesity. The American Journal of Clinical Nutrition, 79(4), 537–543. https://doi.org/10.1093/ajcn/79.4.537
4. Ferder, L., Ferder, M. D., & Inserra, F. (2010). The Role of High-Fructose Corn Syrup in Metabolic Syndrome and Hypertension. Current Hypertension Reports, 12(2), 105–112. https://doi.org/10.1007/s11906-010-0097-3
5. Philpott, T. (2019, July 26). The secret history of why soda companies switched from sugar to high-fructose corn syrup. Mother Jones. https://www.motherjones.com/food/2019/07/the-secret-history-of-why-soda-companies-switched-from-sugar-to-high-fructose-corn-syrup/
6. Goyal, S. K., Samsher, & Goyal, R. K. (2009). Stevia (Stevia rebaudiana) a bio-sweetener: a review. International Journal of Food Sciences and Nutrition, 61(1), 1–10. https://doi.org/10.3109/09637480903193049
7. Best (and Worst) Ways To Sweeten Your Food. (2023, June 14). Cleveland Clinic. https://health.clevelandclinic.org/best-and-worst-sugar-substitutes
8. Healthy Eating: Government-wide solutions for promoting healthy diets, food safety, and food security. (2022). https://www.gao.gov/assets/gao-22-106078.pdf
9. Assistance, N. Y. S. O. of T. and D. (2023). Supplemental Nutrition Assistance Program (SNAP). New York State Office of Temporary and Disability Assistance. https://otda.ny.gov/programs/snap/

The Warfarin Problem: Why Pharmacogenetic Testing is Necessary

by Lauren Wilkes, Biological Sciences '27

How could we know that two individuals, even seemingly physically similar individuals may have a completely different reaction to the same prescribed drug or drug therapy? What this truly comes down to is how one's body metabolizes the drug in question. The next question becomes how do we detect or predict, if an individual will metabolize a drug a certain way, or in a way that is different from other individuals receiving the same drug? The field of pharmacogenomics studies the way in which genetic variation in patients affects drug response in the body [1]. This field is vital for identifying genetic markers (DNA sequences with a known physical location on a chromosome) that indicate differences in the way people metabolize drugs, as well as for developing genetic tests that can help predict how patients will respond to these drugs. In so many of the drugs and therapies that are prescribed and provided, even as prominent as chemotherapy, there are cases in which patients have an adverse reaction. These patients may actually have a genetic marker that could have helped identify the risk of said reaction sooner, with premature pharmacogenetic testing.

While this may seem niche or a worry far from many, this phenomena can be seen in drugs that are much more common than one may think. Warfarin (or Coumadin) is one of the most widely prescribed blood-thinning drugs in the world to treat and prevent thromboembolisms, or in other terms, blood clots that form and block blood flow, as well as break off and travel to block blood flow elsewhere. Warfarin is an anticoagulant that decreases the clotting ability of the blood [2]. As of a 2025 report, Warfarin prescriptions account for approximately eight million prescriptions in the United States annually [3].

Warfarin works by antagonizing vitamin K. In the human body, the gene, VKORC1 is a necessary enzyme for activating vitamin K. Warfarin, through its antagonist mechanism, inhibits VKORC1 in order to limit the vitamin K production, which results in less clotting factors being produced. In this way, the decrease in clotting factors thins the blood [4]. The body responds to Warfarin by metabolizing the drug, meaning Warfarin is broken down and processed by the body [5]. Warfarin metabolism is primarily mediated through the CYP2C9 gene [4].

While it is well known and common that there are external factors that respond to Warfarin dosing and treatment such as age, weight, sex, diet, etc., a significant underlying factor is the pharmacogenetic component. The CYP2C9 and VKORC1 genes have multiple variants within the population, making it "polymorphic." In other words, some individuals may have one variant of VKORC1, while another individual may have a different VKORC1 variant in the same population, despite the genes still having the same function. This is where the importance of pharmacogenetics enters the picture. These variants between the same gene can, in actuality, drastically impact the metabolism response by the body to Warfarin. For example, for the two variants of CYP2C9, Warfarin metabolism is reduced by 40% in patients with one variant and by 90% in those with the other [6].

In reality, patients with a VKORC1 or CYP2C9 variant could have a higher anti-coagulant, or "blood-thinning" response leading to increased bleeding. Thus, patients with CYP2C9 variants or a VKORC1 variant require a lower dose. Both of these are potentially dangerous responses and this is precisely an example of why in 2007, the "US Food and Drug Administration (FDA) required that the warfarin package insert carry information about initial dosing based on CYP2C9 and VKORC1 testing" [7]. Pharmacogenetic testing has the ability to explore the genetic factors in patients that may be pertinent indicators of an adverse or varied metabolic response to certain drugs, such as Warfarin. Having premature testing to observe variant genotypes in patients can significantly impact the decision to prescribe or not prescribe a specific drug to a patient. In this way, pharmacogenetic testing contributes to the appeal and safety that the field of personalized medicine accomplishes. In general, it is observed that patients whose dosage was determined using pharmacogenetic algorithms as opposed to traditional clinical algorithms maintained therapeutic normalized blood clotting levels more consistently. Further, comparatively, patients whose doctor(s) used CYP2C9 and VKORC1 pharmacogenetic testing to determine the proper warfarin dosage had a 31% lower hospitalization rate [8].

It would be remiss to not acknowledge the presence of few problems with pharmacogenetic testing. While testing can produce successful results indicating genetic markers, interpretation of said results will always be a viable concern [9]. This being said, a concern such as this is a risk with any form of genetic testing, the results of which physicians are analyzing to determine the best course of action.

Artwork by Edsel Ou

In the context of drug metabolism, especially with Warfarin, the risk of ignoring variable markers that could have detrimental effects on metabolism makes pharmacogenetic testing something worth requiring and regulating.

References

1. Loucks, C. M., Groeneweg, G., Roy, C., Lee, D. K., Rieder, M. J., Lebel, D., Ito, S., Ross, C. J., & Carleton, B. C. (2020). Pharmacogenomic testing: Enhancing personalized medication use for patients. Canadian family physician Medecin de famille canadien, 66(4), 241–243.
2. Warfarin (Oral Route) Description and Brand Names - Mayo Clinic. (n.d.). Www.mayoclinic.org. https://www.mayoclinic.org/drugs-supplements/warfarin-oral-route/description/drg-20070945
3. Hong, H., Wilson, A. S., Jones, A. E., Vazquez, S. R., Gilbert, S., Malone, D. C., Chaiyakunapruk, N., King, J. B., Barnes, G. D., Sylvester, K. W., Dube, G., Irving, N. V., Chan, L., Ragheb, B., Delate, T., & Witt, D. M. (2025). Overcoming Barriers to Warfarin Patient Self-Management (PSM) in the US Healthcare System: Implementation Trial Study Protocol. medRxiv : the preprint server for health sciences, 2025.08.18.25333912. https://doi.org/10.1101/2025.08.18.25333912
4. Patel, S., Preuss, C. V., Bhutani, J., & Patel, N. (2024). Warfarin. Nih.gov; StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK470313/
5. Susa, S. T., Preuss, C. V., & Hussain, A. (2023, August 17). Drug Metabolism. Nih.gov; StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK442023/
6. Health, I. of M. (US) R. on T. G.-B. R. for. (2010). Pharmacogenomic Testing to Guide Warfarin Dosing. In www.ncbi.nlm.nih.gov. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK52750/
7. Rouse, M., Cristiani, C., & Teng, K. A. (2013). Q: Should we use pharmacogenetic testing when prescribing warfarin? Cleveland Clinic Journal of Medicine, 80(8), 483–486. https://doi.org/10.3949/ccjm.80a.12184
8. Lee, M. T., & Klein, T. E. (2013). Pharmacogenetics of warfarin: challenges and opportunities. Journal of human genetics, 58(6), 334–338. https://doi.org/10.1038/jhg.2013.40
9. Mueller, A. (2021, January 27). The problem with pharmacogenetic testing. Stanford Cardiovascular Institute. https://med.stanford.edu/cvi/mission/news_center/articles_announcements/2021/the-problem-with-pharmacogenetic-testing.html

Stress to Chronic Pain: Closing the Access Gap

by Rhea Josyula, Biological Sciences '29

A staggering 20.9% of US adults suffer from chronic pain, a condition that can significantly impact everyday activities and quality of life [1]. Chronic pain is defined as an unpleasant sensory experience leading to potential tissue damage that is present for three or more months. This can span a variety of types including neuropathic, nociceptive, inflammatory, and mechanical. In addition to its detrimental physical effects like tissue damage, it can lead to adverse mental health effects such as depression, suicidal tendencies, and decreased quality of life [2]. There is a large degree of overlap between chronic pain and stress as 12% of US individuals report feeling high levels of both, and 28% report experiencing moderate levels of both. These numbers are nearly double in lower socioeconomic status populations with less than $35,000 in income [3]. This is in part due to stressful working conditions like manual labor, combined with decreased access to adequate food and shelter. Without affordable and accessible healthcare solutions, the discrepancy is further exacerbated and individuals are not able to seek the proper care that they need.

During an acute stress response, the hypothalamic-pituitary-adrenal (HPA) axis is activated and hormones like cortisol are released. When this stress response is prolonged, there is a constant release of cortisol which can lead to dysfunctions in memory, emotional regulation, and immune function. Over time, this dysregulation can sensitize the nervous system by lowering the threshold for pain, which leads to ordinary, daily stimuli causing pain sensations. These additional pain stimuli can lead back to chronic stress, creating a vicious cycle that patients cannot escape. Both chronic stress and chronic pain can have detrimental effects on the limbic system, comprising the hippocampus, amygdala, and ventromedial prefrontal cortex [4]. Due to the comorbidity of chronic stress and pain, treatment that targets one or the other is not sufficient in breaking patients out of this cycle. Instead, therapies and pharmacological treatments should focus on addressing both issues.

Artwork by Sandy Kong

Despite the large scale of this problem, there is a large market for high-cost pharmacological treatments and a lack of affordable and accessible treatments, especially for individuals with lower socioeconomic status. A 2024 NHIS survey showed that lower income individuals experience a higher incidence of chronic pain and stress and are overprescribed strong medications like opioids compared to higher income groups [5]. This disparity is largely due to the greater degree of physical job strain, which leads to a greater incidence of pain and stress. These individuals in turn have limited access to specialized care or financial aid. This limits the alternative care treatments available to these individuals, leading to an overprescription of the cheaper solution: opioids [6]. Overprescribing opioids, however, can lead to a dangerous cycle of addiction and long-term dependency. In contrast, higher income groups do not experience great financial burdens and have the ease of access for non-invasive treatments like yoga and meditation.

Due to the strong tie between socioeconomic status and access to proper care, it is critical to consider and devise therapies that are both cost-effective and widely accessible. One such therapy is music therapy, which can directly target the neurological mechanisms underlying chronic pain and chronic stress. Studies have shown that exposure to music can increase the rate of neurogenesis in the hippocampus, the memory center of the brain that is often damaged from increased cortisol levels. Additional research suggests that listening to music increases cerebral plasticity which offers promise in improving pain and healing brain damage [7]. Simultaneously, amygdala activity is dampened which leads to increased regulation of the release of stress hormones and a decrease in stress levels [8]. Music therapy is currently being used in the treatment of Alzheimer's disease and to enhance brain development in children, showing its promise in neurological development and treatment across age groups and populations [9, 10]. Additionally, without a need for prescriptions and its low-cost community led nature, it is applicable to lower-income populations looking for easy access and affordable treatments. By bringing the community together to produce and enjoy music, the quality of life of these individuals will simultaneously increase, decreasing their stress levels.

This multifaceted issue requires a multifaceted solution and it is critical to also increase education for both providers and patients about the value and accessibility of alternative therapies such as music therapy. Increasing awareness can reduce the stigma and increase the acceptance and credibility surrounding non-pharmacological options and creative solutions. For providers, this would look like incorporating music therapy into curriculums and training physicians on the importance and effectiveness of this solution. On the other hand, community health workers should be aware and educated on the neuroscience behind music therapy and be encouraged to recommend this therapy form to patients. Though this therapy form is low-cost, costs would further decrease if insurance companies were exposed to this therapy form and encouraged to cover it in healthcare plans for chronic diseases. By improving education at both the provider and community levels, and further decreasing cost of treatment, we can promote this equitable and targeted approach to chronic diseases. While this solution alone will not bridge this access gap, it has promise in devising forms of care that are more equitable and holistic.

References

1. Rikard, S. M., Strahan, A. E., Schmit, K. M., & Guy, G. P. (2023). Chronic pain among adults — United States, 2019–2021. MMWR. Morbidity and Mortality Weekly Report, 72(15), 379–385. https://doi.org/10.15585/mmwr.mm7215a1
2. Stretanski, M. F. (2025, September 28). Chronic pain. StatPearls [Internet]. https://www.ncbi.nlm.nih.gov/books/NBK553030/#:~:text=Continuing%20Education%20Activity,suicide%2C%20and%20other%20adverse%20outcomes
3. Rios, R., & Zautra, A. J. (2011). Socioeconomic disparities in pain: The role of economic hardship and daily financial worry. Health Psychology, 30(1), 58–66. https://doi.org/10.1037/a0022025
4. Mbiydzenyuy, N. E., & Qulu, L.-A. (2024). Stress, hypothalamic-pituitary-adrenal axis, hypothalamic-pituitary-gonadal axis, and Aggression. Metabolic Brain Disease, 39(8), 1613–1636. https://doi.org/10.1007/s11011-024-01393-w
5. NCHS Data Brief ■ no. 518 ■ November 2024. (n.d.). https://www.cdc.gov/nchs/data/databriefs/db518.pdf
6. Shaw, W. S., Roelofs, C., & Punnett, L. (2020). Work environment factors and prevention of opioid-related deaths. American Journal of Public Health, 110(8), 1235–1241. https://doi.org/10.2105/ajph.2020.305716
7. Fukui, H., & Toyoshima, K. (2008). Music facilitate the neurogenesis, regeneration and repair of neurons. Medical Hypotheses, 71(5), 765–769. https://doi.org/10.1016/j.mehy.2008.06.019
8. Music & Mental Health: What's the link? (n.d.). https://www.lucidtherapeutics.com/blog/music-mental-health-what-is-the-link#:~:text=Music%20can%20moderate%20brain%20structure,the%20increased%20release%20of%20endorphins
9. Matziorinis, A. M., & Koelsch, S. (2022). The promise of music therapy for alzheimer's disease: A Review. Annals of the New York Academy of Sciences, 1516(1), 11–17. https://doi.org/10.1111/nyas.14864
10. Wan, C. Y., & Schlaug, G. (2010). Music making as a tool for promoting brain plasticity across the life span. The Neuroscientist, 16(5), 566–577. https://doi.org/10.1177/1073858410377805

The Cost of Confusion: Insurance Access in America

by Sophie Rinzler, Health Care Policy '29

Health policy discourse in the United States has long centered on insurance expansion as the primary mechanism for improving access to care. From the Affordable Care Act to Medicaid expansion initiatives, coverage rates are often treated as the central metric of progress. Yet obtaining insurance does not automatically translate into meaningful access. A growing body of evidence suggests that health insurance literacy – the ability to find, evaluate, select, and effectively use health insurance coverage – plays a critical and underrecognized role in shaping health behaviors, financial outcomes, and inequities in care.

Health insurance literacy extends beyond general health literacy. General health literacy refers to the ability to obtain, process, and understand basic health information needed to make appropriate health decisions. It encompasses understanding core insurance concepts such as premiums (monthly payments), deductibles (what patients must pay before coverage begins), and provider networks (which doctors and hospitals are covered). It also involves applying that knowledge in real-world decision-making contexts, including selecting plans during open enrollment and navigating care after enrollment. In a system characterized by plan variation and administrative complexity, these competencies are not trivial.

Empirical evidence demonstrates that insurance literacy is associated with measurable differences in health-seeking behavior. Individuals with lower health insurance literacy are significantly more likely to delay or forego medical care because of perceived cost, even when insured [1]. They also experienced higher levels of financial burden from medical bills, indicating that misunderstanding coverage structures can translate directly into economic hardship [2]. Similarly, research indicates that individuals with higher insurance literacy are more likely to utilize preventive and primary care services appropriately, suggesting that comprehension influences not only financial outcomes but patterns of care utilization [3].

Importantly, low health insurance literacy is widespread. National surveys indicate that only approximately one in five US adults report high confidence in their ability to understand and use their health insurance plan [4]. Although 75% say they understand terms like deductible, copay, and coinsurance, 30% report difficulty calculating out-of-pocket costs for plans they are enrolled in that rely on those same cost-sharing mechanisms [4]. These findings suggest that insurance literacy gaps are widespread rather than isolated.

Disparities in insurance literacy reinforce its relevance to equity. Evidence shows that racial and ethnic minorities, individuals with lower educational attainment, and those with limited English proficiency consistently score lower on measures of insurance literacy [5]. These disparities persist even after controlling for income, indicating that literacy is not simply a proxy for economic disadvantage [5]. Additional research suggests low insurance literacy is associated with challenges in selecting and using health plans and with reduced engagement in care, outcomes that may compound disparities tied to education and socioeconomic status [6].

Taken together, present literature supports conceptualizing health insurance literacy as a social determinant of health. Social determinants are typically defined as the conditions in which people are born, grow, work, and age that shape health outcomes [7]. If limited understanding of insurance structures systemically constrains access to care, increases financial vulnerability, and disproportionately burdens marginalized communities, then it operates similarly to other recognized determinants.

Framing insurance literacy as a determinant shifts the analytic focus from individual responsibility to system design. Health insurance markets are characterized by complexity: plans that differ in what they cover, how much patients must pay out of pocket, and which providers are included. Individuals often struggle to compare plan attributes even when detailed plan information is available, particularly when decisions require forecasting future health care use and out-of-pocket costs across multiple possible scenarios [8]. In this context, confusion is not evidence of individual failure and rather a predictable outcome of the structural framework.

Artwork by Grace Liu

Policy responses should therefore operate on two levels: literacy enhancement and structural simplification. Targeted educational interventions – especially plain-language materials and brief teach-back-style counseling, alongside broader health literacy practices – have shown promise in improving patient understanding and confidence in carrying out needed care [9]. Community-based navigators, for example, are trained individuals (often based in hospitals or community organizations) who help patients enroll in insurance, understand their benefits, and navigate care by addressing logistical and language barriers [10]. For individuals seeking to improve their own insurance literacy, free resources such as hospital-based financial counseling services can provide practical starting points. Expanding access to these tools and integrating them into school or workplace financial literacy programs could help build foundational competencies at scale.

However, educational interventions alone are insufficient if underlying complexity remains unaddressed. Standardizing terminology across plans, simplifying explanation-of-benefits statements, improving real-time cost transparency tools, and limiting excessive variation in benefit design could reduce cognitive burden at the point of decision-making. Policymakers might also consider incorporating insurance literacy metrics into health equity assessments, formally recognizing its role in shaping disparities.

As coverage expansion efforts continue, evaluating success solely through enrollment statistics risks overlooking an essential aspect of access. A patient who avoids filling a prescription due to misunderstanding their deductible, or who delays preventative screening out of uncertainty about cost-sharing, remains effectively constrained by the system despite being insured.

Health insurance literacy highlights a broader lesson for health policy: access is not binary. It depends not only on formal coverage status but also on the ability to translate coverage into usable care. Recognizing insurance literacy as a social determinant of health emphasizes how equitable policy design must address both eligibility and comprehensibility. Coverage may be the entry point to the system, but understanding determines whether that entry results in meaningful care.

References

1. Tipirneni, R., Politi, M. C., Kullgren, J. T., Kieffer, E. C., Goold, S. D., & Scherer, A. M. (2018). Association Between Health Insurance Literacy and Avoidance of Health Care Services Owing to Cost. JAMA Network Open, 1(7), e184796. https://doi.org/10.1001/jamanetworkopen.2018.4796
2. Wiltshire, J., Liu, E., Dean, C. A., Colato, E. G., & Elder, K. (2021). Health Insurance Literacy and Medical Debt in Middle-Age Americans. HLRP: Health Literacy Research and Practice, 5(4). https://doi.org/10.3928/24748307-20211102-01
3. Kakar, R., Combs, R. M., Hoepf Young, M., Ali, N., & Muvuka, B. (2022). Health Insurance Literacy Perceptions and the Needs of a Working-Class Community. HLRP: Health Literacy Research and Practice, 6(2). https://doi.org/10.3928/24748307-20220309-01
4. 14 stats that highlight the significance of health insurance literacy. (2025). Cigna Healthcare Newsroom. https://newsroom.cigna.com/stats-that-highlight-the-significance-of-health-insurance-literacy
5. Health Insurance Literacy: Disparities by Race, Ethnicity, and Language Preference. (n.d.). AJMC. https://www.ajmc.com/view/health-insurance-literacy-disparities-by-race-ethnicity-and-language-preference
6. Liu, E. (2025). Empowering Informed Choice: Advancing Health Insurance Literacy in a Complex and Costly System. HLRP: Health Literacy Research and Practice, 9(4). https://doi.org/10.3928/24748307-20250612-02
7. World Health Organization. (2025). Social determinants of health. World Health Organization. https://www.who.int/health-topics/social-determinants-of-health
8. Hero, J. O., Sinaiko, A. D., Kingsdale, J., Gruver, R. S., & Galbraith, A. A. (2019). Decision-Making Experiences Of Consumers Choosing Individual Market Health Insurance Plans. Health Affairs (Project Hope), 38(3), 464–472. https://doi.org/10.1377/hlthaff.2018.05036
9. DeWalt, D. A. and J. McNeill. 2013. Integrating Health Literacy with Health Care Performance Measurement. NAM Perspectives. Discussion Paper, National Academy of Medicine, Washington, DC. https://doi.org/10.31478/201307f
10. Natale-Pereira, A., Enard, K. R., Nevarez, L., & Jones, L. A. (2011). The role of patient navigators in eliminating health disparities. Cancer, 117(S15), 3541–3550. https://doi.org/10.1002/cncr.26264

Reshaping our Definition of “Diet Culture”

by Srijita Kommaraju, Global and Public Health Sciences ‘28

Artwork by Kaitlyn Toung

Diet culture is advertised as the solution to many chronic health problems, including obesity, diabetes, and heart disease, but a lot of research suggests it can actually increase the rates of chronic disease instead of preventing it. But how can dieting, a phenomenon so glorified in society, actually be harmful to human health?

By pushing repeated dieting, glorifying thinness, and normalizing judgment of larger bodies, diet culture creates conditions that work against long-term health. A key problem with diet culture is weight cycling, or “yo-yo dieting.” People are told that intentional weight loss is good for health, but most people who lose weight through restrictive dieting end up regaining it, often more than they lost in the first place [1]. This pattern of losing and regaining is not just frustrating; it is linked to higher risk of type 2 diabetes and other cardiometabolic problems [2].

A meta-analysis by Kakinami et al found that people whose weight went up and down over time had a significantly higher chance of developing type 2 diabetes than people whose weight stayed more stable, even after controlling for their starting BMI [3]. In that sense, constantly going on and off of diets may be more damaging than staying at a higher but steady weight [3].

Diet culture also harms health through weight stigma. In a society that rewards thinness as proof of discipline and good health, people who have larger body types are often blamed and shamed for their size. This kind of stigma acts as a chronic stressor that causes physical impairments on the body over time [4]. A study of U.S. adults showed that people who reported being discriminated against because of their weight were about twice as likely to have high allostatic load compared to those who did not report weight-based discrimination. [5] Allostatic load is a measure of “wear and tear” across multiple organ systems, including blood pressure, cholesterol, blood sugar, and inflammation. Higher scores indicate that bodies are working harder just to maintain basic functions [5]. This link between weight stigma and allostatic load stayed constant even after controlling for BMI and other types of discrimination, which suggests that the experience of being judged for weight adds its own biological strain [3].

This constant stress shows up in the body’s physiology. When someone is repeatedly exposed to stigma, their stress response systems are more likely to stay activated. Over time, this can lead to elevated cortisol and more abdominal fat, which are both tied to diabetes and cardiovascular disease [6].

Diet culture also shapes behavior in harmful ways. Individuals who use negative language regarding healthy eating assume that shame and fear will push people toward “better” choices, but research suggests that this stigma actually leads to more disordered eating and less consistent self-care [2]. People who experience weight stigma report more binge eating, emotional eating, and avoidance of exercise [7]. This cycle of strict dieting, feelings of failure, and then overeating is exactly the kind of pattern that ruins a person’s relationship with food [7].

On top of that, diet culture affects how and whether people interact with the healthcare system [8]. Many larger patients avoid medical appointments because they are afraid of being judged or having every concern blamed on their size. This avoidance means conditions like diabetes or high blood pressure may be caught later, when they are harder to manage [8]. For those who do go to the doctor, repeated experiences of bias and dismissal can make it hard to trust providers and get the treatment they deserve.

Overall, these patterns show that diet culture’s focus on thinness and weight loss can increase chronic disease risk in several ways. Therefore, many public health and medical scholars argue for weight-inclusive, behavior-focused alternatives. Instead of making weight loss the primary goal, these approaches focus on sustainable habits, like flexible eating, active, enjoyable movement, adequate sleep, and stress reducers. They also treat weight stigma itself as a health issue, by emphasizing respectful, nonjudgmental care so that people feel safe seeking help. Early research suggests that these models can not only improve metabolic markers, but also mental well-being.

If the goal is truly to prevent chronic disease, then it is important to consider these factors, and for society to start shifting away from traditional diet culture and its obsession with thinness. Incorporating more weight-inclusive, behavior-centered care is not just kinder, but instrumental to the longitudinal health of a patient.

References

1. MacLean, P. S., Bergouignan, A., Cornier, M.-A., & Jackman, M. R. (2011). Biology's response to dieting: the impetus for weight regain. American Journal of Physiology-Regulatory, Integrative and Comparative Physiology, 301(3), R581–R600. https://doi.org/10.1152/ajpregu.00755.2010
2. The Dangers of Yo-Yo Dieting | American Diabetes Association. (2020, December 3). Diabetesfoodhub.org. https://diabetesfoodhub.org/blog/dangers-yo-yo-dieting
3. Kakinami, L., Knäuper, B., & Brunet, J. (2020). Weight Cycling Is Associated with Adverse Cardiometabolic Markers in a cross-sectional Representative US Sample. Journal of Epidemiology and Community Health, 74(8), jech-2019-213419. https://doi.org/10.1136/jech-2019-213419
4. Brown, A., Flint, S. W., & Batterham, R. L. (2022). Pervasiveness, Impact and Implications of Weight Stigma. EClinicalMedicine, 47(101408), 101408. https://doi.org/10.1016/j.eclinm.2022.101408
5. Rodriquez, E. J., Kim, E. N., Sumner, A. E., Nápoles, A. M., & Pérez-Stable, E. J. (2019). Allostatic Load: Importance, Markers, and Score Determination in Minority and Disparity Populations. Journal of Urban Health, 96(S1), 3–11. https://doi.org/10.1007/s11524-019-00345-5
6. Tomiyama, A. J., Epel, E. S., McClatchey, T. M., Poelke, G., Kemeny, M. E., McCoy, S. K., & Daubenmier, J. (2014). Associations of weight stigma with cortisol and oxidative stress independent of adiposity. Health Psychology, 33(8), 862–867. https://doi.org/10.1037/hea0000107
7. Salvia, M. G., Ritholz, M. D., Craigen, K. L. E., & Quatromoni, P. A. (2023). Women's perceptions of weight stigma and experiences of weight-neutral treatment for binge eating disorder: A qualitative study. EClinicalMedicine, 56, 101811. https://doi.org/10.1016/j.eclinm.2022.101811
8. Phelan, S. M., Burgess, D. J., Yeazel, M. W., Hellerstedt, W. L., Griffin, J. M., & van Ryn, M. (2015). Impact of Weight Bias and Stigma on Quality of Care and Outcomes for Patients with Obesity. Obesity Reviews : An Official Journal of the International Association for the Study of Obesity, 16(4), 319–326. https://doi.org/10.1111/obr.12266

Survived, But at What Cost?

by Victoria Wroblewski, Applied Economics and Managment '28

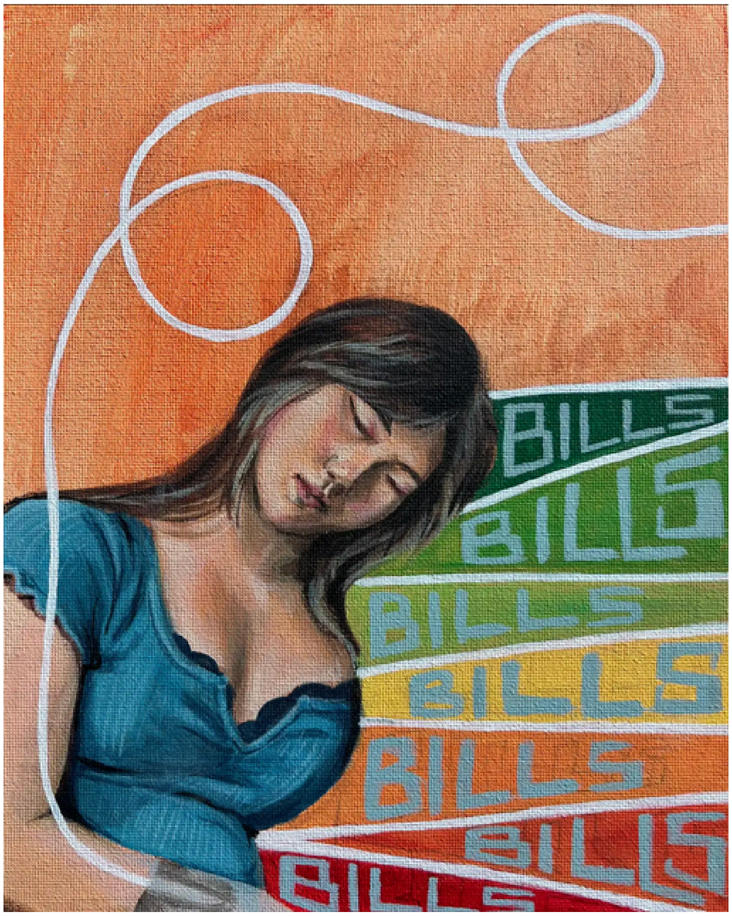
A single mother, struggling to take care of her children, paying rent and medical bills recently opens her pay check to missing money. She was punished for needing medical care. Is it fair for people to involuntarily lose part of their paycheck for getting sick? Right now, most hospitals or debt collectors in several states across the U.S. can go to court and legally take money directly from someone's paycheck if they do not sufficiently pay their medical bills. This is wage garnishment, a mandatory and involuntary deduction from wages, commissions, or bonuses.

Thousands of Americans face the consequences of wage garnishment because of unpaid medical bills. Under the Trump Administration, this number is rising as a consequence of growing health care costs, gaps in insurance coverage, and lack of healthcare accessibility due to high deductibles. In fact, medical debt is a pressing issue that is causing over 550,000 people to file for bankruptcy each year. 66.5% of people who file for bankruptcy blame medical bills as the primary cause [1]. It is becoming more difficult to pay off medical debt while also balancing economic fluctuations and inflammatory prices worldwide. This forceful action leaves individuals stranded and unable to prioritize basic human needs, utilities, or their own lives.

Many patients are being targeted erroneously. Such errors have the potential to pivot someone's life for the worse and force innocent individuals to face the burden of a significant loss of income, creating financial instability. This was the case for Nicole Silva who received a medical bill for an ambulance that was necessary for the survival of her daughter. She is a preschool teacher with six children, already facing large costs for taking care of her family. Upon a life-threatening incident that required ambulance assistance, she faced wage garnishment from a $3,000 bill. It was inaccurately sent to her family, since Medicaid was supposed to cover the costs. However, upon challenging the bill in court, the case ruled that $500 per month be taken directly out of her paycheck. For households managing tight budgets, facing wage garnishment makes it difficult to pay off expenses that sustain daily activities. Consequently, Silva's electricity was turned off from inability to pay, not only making life difficult in the moment, but this also made the family fear asking for help from medical services in the future [2]. It is becoming evident that many Americans are hesitant to seek medical care because they fear the financial consequences. Specifically, 45% of the American public is concerned that a major health event could result in personal bankruptcy, sacrificing their health [3].

In response, state legislators in eight states, notably Colorado and Michigan, are proposing new laws to limit the impact of wage garnishment and eventually eliminate it completely. Colorado taking part in this action is significant because over 14,000 wage garnishment requests have been approved annually for several years. Now, the Colorado legislature is implementing a 4% price ceiling to prevent payment plans from exceeding garnishment of further weekly net income [4]. Michigan similarly aims to reduce medical debt, the number one cause of bankruptcy in the state,R by prohibiting wage garnishment for those that qualify for financial assistance and prohibits denying or requiring payment before providing emergency services due to outstanding medical debt [5]. This regulates aggressive and unjust collection practices while simultaneously providing debt relief measures.

Healthcare systems today have a reputation for prioritizing debt collections and financial due diligence over human dignity. While states are heading in the right direction and fighting to protect families that hope to seek medical care without fear of long-term financial consequences, Silva's story emphasizes how important it is for this change to be made. Wage garnishment can truly have a devastating impact on a family's financial reality.



Artwork by Jane Wang

References

1. August, J. (2024, October 21). Healthcare insights: How medical debt is crushing 100 million Americans. Cornell University ILR School Scheinman Institute. https://www.ilr.cornell.edu/scheinman-institute/blog/john-august-healthcare/healthcare-insights-how-medical-debt-crushing-100-million-americans
2. Bichell, R. E. (2025, October 2). Workers' wages siphoned to pay medical bills, despite consumer protections. KFF Health News. https://www.kffhealthnews.org/news/article/colorado-wage-garnishment-health-care-medical-debt-collections-medicaid/
3. Ellrich, M., & Stevens, L. (2019, April 2). Americans fear personal and national healthcare cost crisis. Gallup. https://news.gallup.com/opinion/gallup/248108/americans-fear-personal-national-healthcare-cost-crisis.aspx
4. Bichell, R. E. (2026, March 2). Colorado joins effort to limit garnishing wages over medical debt. The Colorado Sun. https://coloradosun.com/2026/03/02/garnishing-wages-over-medical-debt/
5. Anthony, S. (2026, March 11). Senate passes bipartisan legislation to protect Michiganders burdened by medical debt. Michigan Senate Democrats. https://senatedems.com/anthony/2026/03/11/senate-passes-bipartisan-legislation-to-protect-michiganders-burdened-by-medical-debt/

Teaching the Immune System to Fight Lung Cancer

by Abigail Chang, Global and Public Health Sciences '26

Lung cancer remains the leading cause of cancer-related death worldwide. While its rapid growth contributes to its severity, an equally important factor is its ability to evade the immune system. Rather than escaping detection by chance, lung tumors actively suppress immune responses that would normally identify and destroy them. This ability to "turn off" the immune system allows cancer to persist and spread. As a result, understanding and reversing immune suppression has become a central goal in modern oncology. One promising strategy is neoadjuvant immunotherapy, which involves using immune checkpoint inhibitors before surgical tumor removal. By intervening early, this approach aims not only to shrink tumors but also to retrain the immune system to recognize and fight cancer over the long term.

Immune Suppression in Lung Cancer

Under normal conditions, the immune system plays a critical role in detecting abnormal cells. $CD8^+$ T cells, in particular, are responsible for recognizing and killing cancerous cells by identifying unusual proteins, or antigens, on their surface. Lung cancer, however, can often disrupt this process.

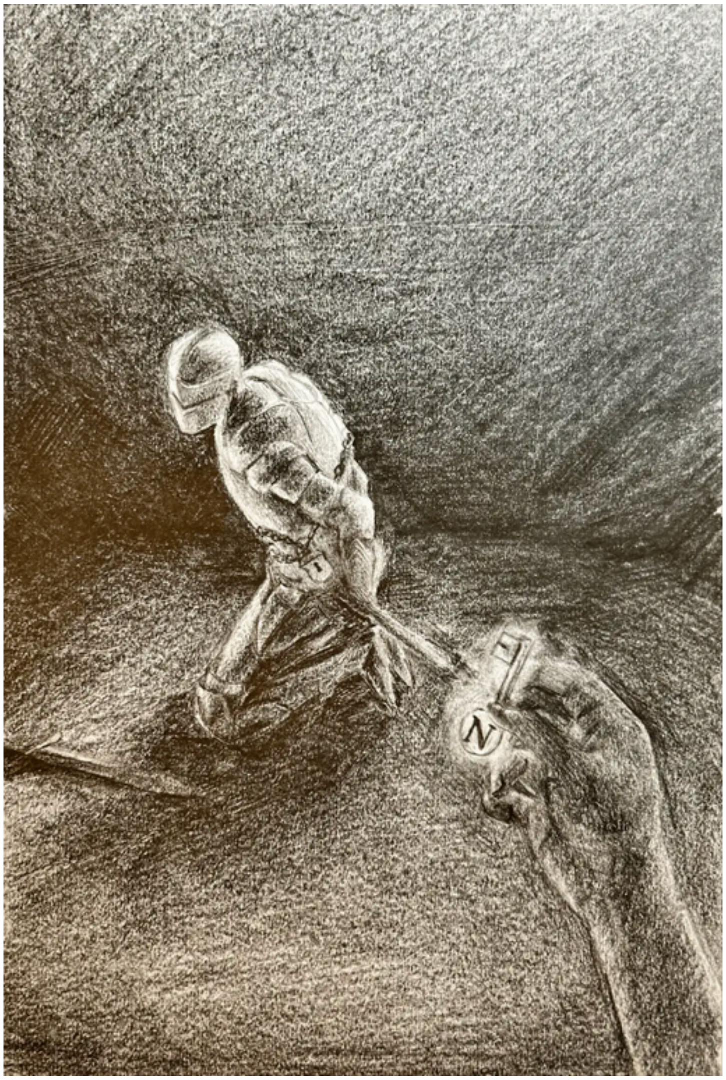
A key mechanism of "immune evasion" involves the interaction between two molecules: PD-1, found on T cells, and PD-L1, expressed by many tumor cells. When PD-L1 binds to PD-1, it sends an inhibitory signal that reduces T cell activity. This signal limits the ability of T cells to multiply, produce signaling molecules, and carry out their cytotoxic functions, effectively shutting down the immune response [1]. Over time, repeated exposure to tumor antigens can push T cells into a state known as exhaustion, in which they become less effective at responding to threats. This exhausted state is reinforced by long-lasting changes in gene regulation, including modifications that increase PD-1 expression and maintain immune suppression [2].

To overcome this, researchers have developed immune checkpoint inhibitors, a class of drugs designed to block these inhibitory signals. Nivolumab (Opdivo) is one such therapy that targets the PD-1 receptor. By binding to PD-1, it prevents interaction with PD-L1 and restores T cell activity [3]. Once reactivated, T cells can expand in number and regain their ability to kill tumor cells. Interestingly, tumors with a high number of genetic mutations tend to respond better to this treatment, likely because they produce more abnormal proteins that the immune system can recognize [4]. Clinical evidence supports the effectiveness of this approach. In patients with advanced non-small cell lung cancer, nivolumab has been shown to improve overall survival compared to traditional chemotherapy. Long-term follow-up studies demonstrate that some patients experience durable responses, remaining alive for years after treatment begins [5]. These findings highlight the potential of immunotherapy to produce lasting benefits.

Rationale for Neoadjuvant Treatment

While immunotherapy has shown success in advanced disease, there is growing interest in using it earlier in treatment. Neoadjuvant immunotherapy, given before surgery, offers several important advantages. When the tumor is still present, it serves as a rich source of antigens, allowing the immune system to mount a broader and more effective response. This exposure helps generate T cells that are specifically trained to recognize the tumor.

Importantly, these activated T cells can persist even after the tumor is surgically removed. This creates a form of immune memory that enables the body to detect and eliminate any remaining cancer cells, including those that may have spread but are too small to detect. In this way, immunotherapy complements



Artwork by Joshua Choi

surgery by addressing disease that cannot be seen through imaging or pathology. The success of neoadjuvant treatment is often measured using major pathological response (MPS), defined as 10 percent or less viable tumor remaining after therapy. This measure has emerged as a strong predictor of long-term survival in lung cancer patients [6]. Studies have shown that neoadjuvant PD-1 blockade significantly increases rates of major pathological response compared to traditional approaches [7].

Compared to chemotherapy, immunotherapy also offers a different side effect profile. Chemotherapy targets rapidly dividing cells, which can lead to damage in healthy tissues such as bone marrow, the digestive tract, and hair follicles. This results in well-known side effects like fatigue, nausea, and hair loss. In contrast, checkpoint inhibitors work by enhancing the body's natural immune response rather than directly killing cells. As a result, patients often experience fewer severe side effects (adverse effects). However, because these therapies activate the immune system, they can sometimes cause immune-related side effects that require careful monitoring and management [5].

Future Directions

Despite its promise, immunotherapy is not effective for all patients. Some tumors are resistant from the outset, while others develop resistance over time. In addition, immune-related side effects remain an important consideration. Ongoing research is focused on identifying biomarkers that can predict which patients are most likely to benefit, optimizing treatment timing and duration, and developing combination therapies that improve outcomes.

Ultimately, the goal is to create personalized immunotherapy treatment regimes that maximize effectiveness while minimizing adverse effects (AEs). Neoadjuvant immunotherapy represents a critical step toward this vision by integrating immune-based treatment into earlier stages of disease. Already, immunotherapy has transformed cancer care, shifting the focus towards training the immune system as a central component of treatment.

References

1. Topalian, S. L., et al. (2012). Safety, activity, and immune correlates of anti–PD-1 antibody in cancer. New England Journal of Medicine, 366(26), 2443–2454. https://doi.org/10.1056/NEJMoa1200690
2. Youngblood, B., et al. (2011). Chronic virus infection enforces demethylation of the locus that encodes PD-1 in antigen-specific CD8$^+$ T cells. Immunity, 35(3), 400–412. https://doi.org/10.1016/j.immuni.2011.06.015
3. Chen, D., et al. (2019). The FG loop of PD-1 serves as a hotspot for therapeutic monoclonal antibodies. iScience, 14, 113–124. https://doi.org/10.1016/j.isci.2019.03.011
4. Rizvi, N. A., et al. (2015). Mutational landscape determines sensitivity to PD-1 blockade in non-small cell lung cancer. Science, 348(6230), 124–128. https://doi.org/10.1126/science.aaa1348
5. Borghaei, H., et al. (2021). Five-year outcomes from CheckMate 017 and CheckMate 057: Nivolumab versus docetaxel in previously treated non-small cell lung cancer. Journal of Clinical Oncology, 39(7), 723–733. https://doi.org/10.1200/JCO.20.01605
6. Hellmann, M. D., et al. (2018). Pathological response as a surrogate endpoint in neoadjuvant trials of non-small cell lung cancer. Journal of Thoracic Oncology, 13(1), S8–S9. https://doi.org/10.1016/j.jtho.2017.11.007
7. Forde, P. M., et al. (2018). Neoadjuvant PD-1 blockade in resectable lung cancer. New England Journal of Medicine, 378(21), 1976–1986. https://doi.org/10.1056/NEJMoa1716078

“To be or not to be a doctor”

by Mary Wall, Human Biology, Health, and Society ‘28

I. Introduction.

There’s an age-old adage that goes something like “a new AI development a day, keeps future doctors away.” In a recent episode of Peter Diamandis’ Moonshots podcast, Elon Musk boldly claimed that attending medical school three years from now is “pointless,” implying that artificial intelligence will soon eclipse the need for human physicians. As an undergraduate aspiring to attend medical school, I found this rather concerning. So, I thought I would do my due diligence as a pre-med writer for this journal and investigate the claim myself. Is a future career in medicine truly “pointless”?

II. Current AI Capabilities.

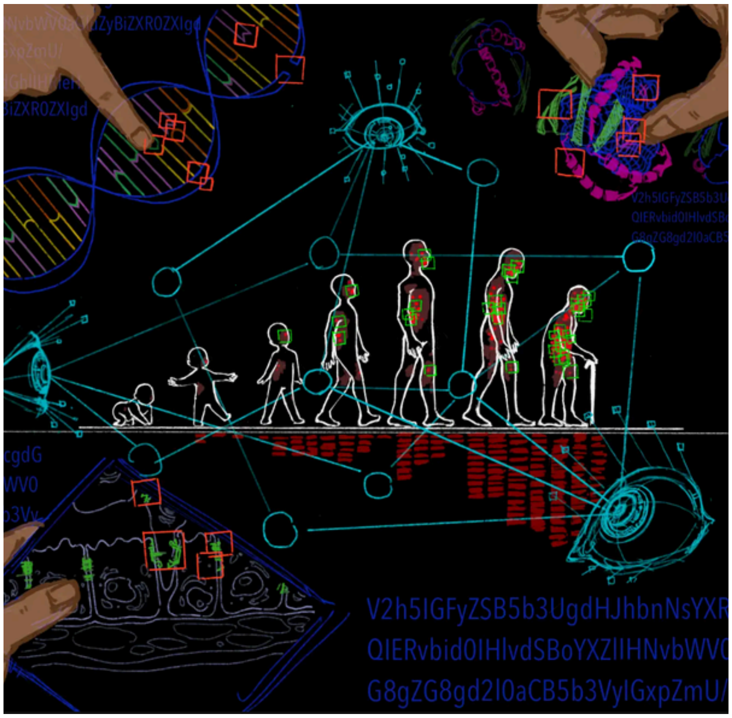
The impact of artificial intelligence on healthcare is undeniable. Today, AI systems can interpret radiologic images with near-expert accuracy, flag subtle abnormalities in pathology slides, predict patient deterioration through continuous vital-sign monitoring, and optimize treatment pathways using vast datasets that exceed human cognitive capacity [1]. Machine-learning models already assist in cancer detection, cardiac risk stratification, and population-level disease forecasting.

AI excels at identifying patterns before disease manifests, tailoring interventions to individual risk profiles, and providing patients with data-driven insights. Yet, medicine has never been solely about pattern recognition [2].

In the past few decades, as telehealth gained popularity, people feared it would completely alter the nature of medicine: in-person visits would cease, and virtual visits would become the norm. While telehealth has expanded access to healthcare for underrepresented or at-risk groups, reduced unnecessary emergency room visits, and saved patients time and money, it has not prevented physicians from providing traditional care.

Studies have shown that certain telehealth visits may be insufficient. For instance, in situations such as a patient’s first visit to a physician, a visit that requires conversational nuance from the physician, or a hands-on clinical assessment, telehealth is considered inappropriate [3]. But even more than “hands-on” clinical assessment, just plain and simple physical observation is a tenet of standard medical practice. In “The power of observation in clinical medicine”, Dr. Fabrizia Faustinella shares a case in which a patient complained of fatigue, weight loss, and abdominal pain [4]. The possible sources of these ailments are wide-ranging. Dr. Faustinella diagnosed the patient with adrenal insufficiency. What led her to this conclusion? Her first clue was hyperpigmentation in the patient’s knuckles.

Furthermore, researchers conducted an observational study examining how findings from the physical examination influenced the course of patient care [5]. After reviewing one hundred cases, they found that twenty-six patients had pivotal findings. Seven of these were classified as Class I findings, meaning they were critical observations that directly affected diagnosis or management.



Artwork by Alex Song

These examples illustrate that what clinicians directly observe informs how they apply their clinical knowledge to each patient.

III. Role of a Physician

In *What Does It Mean to Be a Physician?*, Dr. Thomas Schwenk describes medicine as the unification of science and humanism for the benefit of patients [6]. Artificial intelligence is extraordinarily well-suited for the scientific half of that equation. But humanism, which involves moral judgment, empathy, trust, and responsibility, cannot be automated [7].

Medicine is not practiced in controlled environments with perfect inputs. Patients are complex, frightened, inconsistent, and often present ambiguously. They withhold information. They contradict themselves. Identifying the most accurate intervention does not always answer whether or how it should be applied [8].

It is also worth remembering that the foundational sciences that pre-medical students study, such as chemistry, biology, and physics, are the very disciplines that enable these technological advances. AI does not emerge in isolation; it is built, trained, validated, and constrained by human expertise. If humans are the architects of artificial intelligence, they must remain stewards of its use.

This is especially true in a field where the stakes are existential. In standard consumer technology, failure is inconvenient. In medicine, failure can be fatal [9]. Regulatory frameworks such as FDA approval, malpractice liability, and ethical oversight exist precisely because healthcare demands accountability [10].

When things go wrong, as they inevitably will, patients want a responsible, well-trained professional, not a black-box system, to be accountable for decisions made [11].

Consider this: would you feel comfortable boarding a pilotless commercial flight? Even if autonomous systems outperform humans under ideal conditions, most of us still want a trained pilot in the cockpit when turbulence hits. Medicine is no different [12].

IV. Conclusion

The future of healthcare is not physician versus AI. It is physicians with AI. Artificial intelligence can take over routine tasks such as charting and data analysis, allowing physicians to devote their time to clinical judgment, patient communication, and the uniquely human aspects of care that technology cannot replace. Far from making doctors obsolete, AI will raise expectations for what physicians must be able to do [13].

In fact, this may be the most exciting time in history to pursue medicine. We are on the cusp of curing diseases once thought untreatable, personalizing treatments with unprecedented precision, and shifting healthcare from reactive to preventive [14]. So to the pre-meds enduring the pain that is Cornell chemistry and wondering if their effort will matter, don’t fret. As long as people care deeply about their health and that of those they love, there will be a need for thoughtful, compassionate, and well-trained physicians.

References

1. Dai, J., Xu, H., Chen, T., et al. (2025). Artificial intelligence for medicine 2025: Navigating the endless frontier. The Innovation Medicine, 3, 100120.
2. Sooknanan, J., & Seemungal, T. (2019). Not so elementary—the reasoning behind a medical diagnosis. Medical Education Projects, 8. https://doi.org/10.15694/mep.2019.000234.1
3. Cole, T. R., Crooks, V. A., Sorensen, J., et al. (2025). “Nothing is going to replace an in-person visit”: Canadian long-term care providers’ and recipients’ perspectives on when telehealth for physician visits is not appropriate. BMC Digital Health, 3, 77. https://doi.org/10.1186/s44247-025-00219-8
4. Faustinella, F. (2020). The power of observation in clinical medicine. International Journal of Medical Education, 11, 250–251. https://doi.org/10.5116/ijme.5fb9.1c9b
5. Reilly, B. M. (2003). Physical examination in the care of medical inpatients: An observational study. The Lancet, 362(9390), 1100–1105. https://doi.org/10.1016/S0140-6736(03)14464-9
6. Schwenk, T. L. (2020). What does it mean to be a physician? JAMA, 323(11), 1037–1038. https://doi.org/10.1001/jama.2020.014
7. Reeves, K. A. (2025). Updating the definition for humanism in healthcare: Kind, safe, and trustworthy. SAGE Open Medicine. https://doi.org/10.1177/23743735251340506
8. Li, Y., Jie, X., Ruan, W., Zhang, X., Zhu, H., Gao, Y., Du, C., & Liu, R. (2026). Beyond idealized patients: Evaluating LLMs under challenging patient behaviors in medical consultations. arXiv preprint. https://doi.org/10.48550/arXiv.2603.29373
9. Sears, R. (2025). Artificial intelligence in healthcare: No longer optional but neither is patient safety. American Journal of Healthcare Strategy, 1(3), 1–10. https://doi.org/10.61449/ajhcs.2025.15
10. Jost, T. S. (1988). The necessary and proper role of regulation to assure the quality of health care. Houston Law Review, 25, 525–558.
11. Riedl, R., Hogeterp, S. A., & Reuter, M. (2024). Do patients prefer a human doctor, artificial intelligence, or a blend, and is this preference dependent on medical discipline? Frontiers in Psychology, 15. https://doi.org/10.3389/fpsyg.2024.1422177
12. Ong, A. Y., Merle, D. A., Pollreisz, A., Wagner, S. K., Sevgi, M., Keane, P. A., Huemer, R., Oehling, J., Jäger, M., & Huemer, J. (2026). Flight rules for clinical AI: Lessons from aviation for human–AI collaboration in medicine. npj Digital Medicine, 9. https://doi.org/10.1038/s41746-026-02410-1
13. Coker, E., Lockspeiser, T., & Hilgenberg, S. L. (2026). Artificial intelligence healthcare industry expert perspectives: How artificial intelligence will impact physician roles and medical education. Academic Pediatrics, 26(3). https://doi.org/10.1016/j.acap.2026.103225
14. Johnson, K. B., Wei, W., Weeraratne, D., Frisse, M. E., Misulis, K., Rhee, K., Zhao, J., & Snowdon, J. L. (2021). Precision medicine, AI, and the future of personalized health care. Clinical and Translational Science, 14(1), 86–93. https://doi.org/10.1111/cts.12884

Overcoming Peanut Allergies: Oral Immunotherapy

by Max Turtz, Biology and Society '28

Growing up with a peanut allergy profoundly shaped my life long before I understood science. At three years old, after my mother ate a peanut butter cookie and kissed me, I broke out in hives. From that moment on, vigilance became routine. I sat at a separate allergen-free table in elementary school, read every food label for cross-contamination, and carried an EpiPen in case of accidental exposure. Annual skin and blood tests initially showed persistently high sensitivity levels. However, by middle school, my levels began to decline, and I eventually began oral immunotherapy (OIT), consuming tiny but increasing doses of peanut powder mixed into chocolate pudding under hospital supervision. Over the course of a year, I reached a maintenance dose of eating eight peanuts a day indefinitely. After two years at this level, I passed a challenge where I consumed three times my maintenance dose with no reaction, effectively ending my allergy. This personal journey illustrates the transformative potential of OIT for individuals with peanut allergies and highlights the importance of research to guide its safe implementation.

Peanut allergies affect approximately 1–2% of children in the United States and are a leading cause of food-induced anaphylaxis, contributing to significant anxiety and public health burden [1]. Reactions can range from mild symptoms, such as hives, to life-threatening systemic responses that require immediate epinephrine administration, such as anaphylactic shock that causes immense breathing difficulty [2]. Historically, allergy management has relied on avoidance of peanut-containing foods and readiness to respond to accidental exposures. While this approach can prevent harm, it places a substantial and ongoing burden on patients and their families. Avoidance is complicated not only by high-risk environments like schools, but also by broader challenges such as inconsistent food labeling, cross-contamination during food preparation, and limited public understanding of allergy severity. Dining out, traveling, and navigating social situations further increase uncertainty, as individuals often have little control over ingredients or preparation methods. Together, these factors make strict avoidance difficult to sustain and contribute to significant stress.

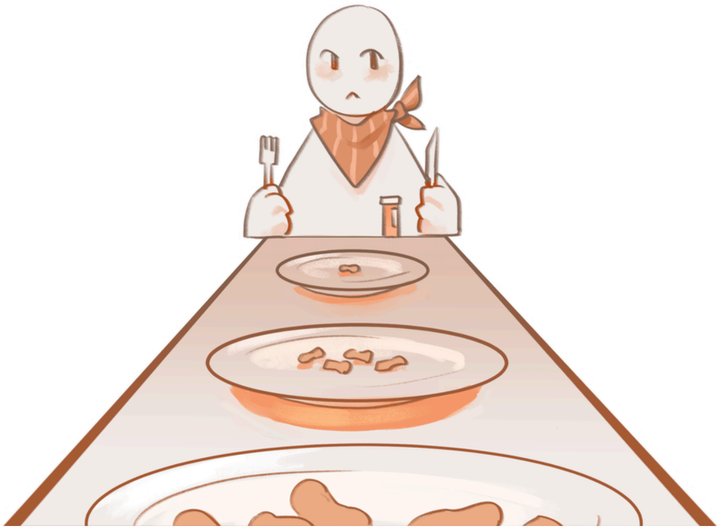
Oral immunotherapy has emerged as a promising intervention to increase tolerance to peanut protein through gradual, medically supervised exposure [3]. Randomized, controlled trials indicate that OIT can significantly increase the threshold of peanut protein tolerated by patients, thereby reducing the risk of severe reactions after accidental ingestion [2]. Evidence further suggests that children undergoing OIT experience improved quality of life, with greater confidence in consuming potentially cross-contaminated foods and participating in social activities [4].

Despite its promises, OIT carries risks. Adverse events, including gastrointestinal symptoms and systemic allergic reactions, are more frequent in OIT-treated patients than in controls, occasionally requiring epinephrine administration [5]. Long-term safety remains an area of active investigation, as do optimal dosing protocols and strategies to maintain adherence over time.

Additionally, accessibility challenges exist. OIT is primarily offered in specialized clinics, with geographic and economic barriers limiting widespread availability. Disparities in access may prevent some populations from benefiting from this potentially life-changing intervention [2, 3].

Emerging research explores strategies to mitigate these limitations. Adjunct therapies, which combine with OIT, have shown promise in reducing adverse events and accelerating desensitization [3]. Early initiation in childhood also appears to increase the likelihood of sustained tolerance, highlighting the importance of timely intervention [6]. Additionally, efforts to train primary care providers in administering OIT protocols aim to broaden access and reduce disparities [5].

In conclusion, oral immunotherapy represents a transformative approach to managing peanut allergies, offering the potential to improve both safety and quality of life. While my personal experience demonstrates the freedom and confidence OIT can provide, research is essential to define its efficacy, long-term safety, and accessibility. Continued investigation will guide evidence-based protocols, improve patient outcomes, and ultimately expand the reach of OIT to children and families affected by peanut allergies.



Artwork by Kain Wang

References

1. Sicherer, S. H., & Sampson, H. A. (2018). Food allergy: A review and update on epidemiology, pathogenesis, diagnosis, prevention, and management. Journal of Allergy and Clinical Immunology, 141(1), 41–58. https://doi.org/10.1016/j.jaci.2017.11.003
2. Khan, N. A., et al. (2025). Efficacy and Safety of Oral Immunotherapy for Peanut Allergy: A GRADE-Assessed Systematic Review and Meta-Analysis of Randomized Controlled Trials. International archives of allergy and immunology, 1–14. Advance online publication. https://doi.org/10.1159/000548282
3. Tian, X., Liu, S., Li, L. et al (2025). Comparative Efficacy of Combined and Standalone Oral Immunotherapies for Peanut Allergy: a Bayesian Network Meta-Analysis of RCTs. Clinic Rev Allerg Immunol 68, 113. https://doi.org/10.1007/s12016-025-09118-2
4. Mahase, E. (2022). Peanut allergy: One in five children achieved lasting remission after oral immunotherapy, study reports. BMJ, 376, o164. https://doi.org/10.1136/bmj.o164
5. Landry, V., Lewis, R., Lewis, W. et al. (2024). Safety and adherence of early oral immunotherapy for peanut allergy in a primary care setting: A retrospective cross-sectional study. Allergy Asthma Clin Immunol 20, 57. https://doi.org/10.1186/s13223-024-00916-5
6. National Institutes of Health (NIH). (2022). Oral immunotherapy induces remission of peanut allergy in some young children. NIH. https://www.niaid.nih.gov/news-events/oral-immunotherapy-induces-remission-peanut-allergy-some-young-children

Will AI Replace Radiologists?

by Mina Kanburlar, Global and Public Health Sciences '28

Artwork by Caitlin Sweeney

The integration of artificial intelligence (AI) into emergency radiology represents one of the most significant shifts in modern diagnostic medicine. As emergency departments face increasing pressures from high patient volumes, time-sensitive diagnoses, and limited specialist availability, AI tools have emerged as promising technologies that can enhance the capabilities of radiologists and improve patient outcomes. This article explores the current applications of AI in emergency radiology, the opinions of medical professionals and trainees toward these technologies, the ethical and regulatory frameworks governing their use, and the technical foundations that make them possible.

Emergency radiology encompasses some of the most urgent and high-stakes diagnostic scenarios in medicine, including the detection of intracranial hemorrhage, pulmonary embolism, aortic dissection, and traumatic injuries [1]. By automatically flagging critical findings and prioritizing urgent cases for radiologist review, AI algorithms can help ensure that life-threatening conditions are not delayed behind lower-acuity cases. Beyond triage, AI has shown promise in the automated detection of specific pathologies. Computer-aided detection systems can spot brain bleeds on CT scans, pneumothorax on chest X-rays, and fractures on bone images, often matching or even exceeding human performance under time pressure. Increasingly, such tools are being deployed as “safety nets” designed not to replace radiologists, but to reduce the rate of missed diagnoses in high-volume, time-constrained environments [1]. The potential to curtail diagnostic errors in emergency settings carries profound implications for patient safety and outcomes.

The technological engine driving most contemporary AI applications in radiology is deep learning, a subfield of machine learning based on multilayered artificial neural networks. Convolutional neural networks (CNNs), in particular, excel at image recognition tasks by automatically learning hierarchical feature representations directly from raw pixel data, eliminating the need for the extensive manual feature engineering required by traditional machine learning approaches [2]. This capacity to process complex medical images, such as CT scans, MRIs, and radiographs, with minimal preprocessing, has made deep learning dominant in AI-assisted diagnostics.

Despite the technical promise of AI in radiology, its adoption is shaped in large part by the attitudes of the medical professionals who would work alongside these systems. A survey of French radiologists spanning residents, public hospital, and private practice settings found that only a small proportion had integrated any AI solution into their daily workflow, suggesting the field is still in its early stages [3]. Notably, residents responded to the survey at twice the rate of senior radiologists, reflecting greater engagement among younger practitioners, a pattern consistent with the broader trend of newer generations being more receptive to AI's transformative potential. Nevertheless, nearly all respondents indicated they would attend dedicated AI training if made available to them, and a majority expressed willingness to pursue technically advanced coursework covering programming and neural network training. Radiologists overwhelmingly agreed that foundational AI education should be incorporated into medical school curricula, a view reflected in subsequent policy changes mandating AI workshops for radiology residents in France [3]. Despite media claims, a survey showed that medical students are not concerned that AI will replace radiologists [4]. Instead, they recognize AI’s potential applications and broader implications for radiology and medicine. Given this awareness, radiology as a field should take a proactive role in educating students about emerging AI technologies and their integration into clinical practice.

The deployment of AI in clinical radiology raises important ethical and regulatory questions that must be addressed before widespread adoption can be considered responsible. Existing regulatory frameworks in both Europe and the United States were largely designed for traditional medical devices and may not adequately address the unique properties of AI systems, most notably their capacity to learn and change over time following deployment [5]. In the European Union, AI-based diagnostic tools fall under the Medical Device Regulation, while in the United States, they are subject to oversight by the Food and Drug Administration (FDA). Both frameworks require evidence of safety and efficacy, but differ in their approaches to post-market surveillance and the handling of algorithmic updates. Beyond regulation, the ethical dimensions of AI in radiology are considerable. Questions of accountability when AI-assisted diagnoses prove incorrect, the potential for algorithmic bias to produce disparate outcomes across patient populations, and the protection of patient data used in model training all require careful consideration [5]. In emergency radiology specifically, where diagnostic errors can carry immediate and severe consequences, these concerns are particularly pressing.

Artificial intelligence holds considerable promise for transforming emergency radiology by enhancing diagnostic speed, reducing missed findings, and optimizing radiologist workflows. However, realizing this potential requires navigating substantive challenges, including the concerns of practicing radiologists, the preparation of future physicians, and the establishment of robust ethical and regulatory safeguards. A collaborative approach, one that centers the radiologist as an informed and empowered user of AI tools, will be essential to ensuring that these technologies ultimately improve the quality of emergency care.

References

1. Katzman, B. D., Van der Pol, C. B., Soyer, P., & Patlas, M. N. (2023). Artificial intelligence in emergency radiology: A review of applications and possibilities. Diagnostic and Interventional Imaging, 104(1), 6–10. https://doi.org/10.1016/j.diii.2022.07.005
2. Lee, J. G., Jun, S., Cho, Y. W., Lee, H., Kim, G. B., Seo, J. B., & Kim, N. (2017). Deep learning in medical imaging: General overview. Korean Journal of Radiology, 18(4), 570–584. https://doi.org/10.3348/kjr.2017.18.4.570
3. Waymel, Q., Badr, S., Demondion, X., Cotten, A., & Jacques, T. (2019). Impact of the rise of artificial intelligence in radiology: What do radiologists think? Diagnostic and Interventional Imaging, 100(6), 327–336. https://doi.org/10.1016/j.diii.2019.03.015
4. Pinto dos Santos, D., Giese, D., Brodehl, S., et al. (2019). Medical students' attitude towards artificial intelligence: A multicentre survey. European Radiology, 29, 1640–1646. https://doi.org/10.1007/s00330-018-5601-1
5. Pesapane, F., Volonté, C., Codari, M., & Sardanelli, F. (2018). Artificial intelligence as a medical device in radiology: Ethical and regulatory issues in Europe and the United States. Insights into Imaging, 9(5), 745–753. https://doi.org/10.1007/s13244-018-0645-y

Uncovering the Mystical Treatment of Deep Brain Stimulation

by Noah Goodman, Human Development '27

Artwork by Andrew Mo

According to recent estimates, there are more than 1 million Parkinson's patients in the United States, and over 90,000 new diagnoses are made each year [1]. Furthermore, Parkinson's disease can permeate nearly all aspects of a person's life. For example, many Parkinson's patients experience muscle tremors – leading to poor motor control – and atypical (e.g. slurred, soft, and muffled) speech – leading to difficulties communicating with friends and family [2]. Furthermore, many patients experience psychosocial and psychophysical comorbidities, such as anxiety and sensory deficiencies, respectively [2]. Moreover, in a study including almost 50,000 participants, researchers found that ten-year mortality rates (i.e. the chance of dying in the next ten years) were more than twice as high amongst Parkinson's patients compared to match (i.e. same age and same sex) control participants, with the leading cause of death amongst Parkinson's patients being nervous system disease [3]. Thus, there is a serious need for effective treatments and interventions geared at reducing the symptoms and progression of Parkinson's Disease. But how could such a pervasive disease be treated?

Parkinson's Disease is characterized (at least within the scope of this article) by a loss of dopamine-producing neurons in the midbrain [4]. While the exact mechanism may be more complex than described here, it is sufficient to consider dopamine to be a neurotransmitter involved in directing motor movements, and therefore, the lack of dopamine production in the midbrain yields motor irregularities. Dopamine also plays a critical role as the chemical messenger of the mesolimbocortical system, which modulates reward preferences and is likely heavily involved in mood regulation [5]. This provides a mechanistic basis for the psychological impacts of Parkinson's Disease.

Given that Parkinson's patients seem to suffer from dopamine insufficiencies, it is no surprise that the most common treatment is Carbidopa-levodopa (e.g. Sinemet), with levodopa being a chemical that is converted to dopamine upon reaching the brain, and carbidopa being a chemical that helps the levodopa reach its target cells [6]. While the drug is quite effective, many patients experience unpleasant side effects, ranging from nausea and fatigue to dyskinesias and hallucinations [7]. Thus, alternative interventions would be beneficial in order to treat patients who either (1) cannot tolerate levodopa, (2) experience unpleasant side effects from the drug, or (3) do not show drug-attributed improvements in their condition, symptoms, or progression.

One exciting alternative intervention for Parkinson's Disease is known as Deep Brain Stimulation (DBS). DBS involves a surgeon placing thin metal wires in the brain which send electrical impulses through target neurons to control motor movements [8]. While the exact mechanistic details of DBS are still being debated, the procedure has shown great promise as an effective Parkinson's intervention. For example, Benabid (2003) provided evidence to support the claim that DBS may be as effective as levodopa in improving Parkinson's-related muscle tremors, while avoiding many of the drug's disadvantageous side effects [9].

Mechanistically, Benadbid (2003) claimed that DBS disrupts the abnormal neural messages associated with Parkinson's disease, thereby mimicking levodopa's net effect on the brain [9]. Furthermore, according to Volkman (2004), DBS increases neural metabolism and cerebral blood flow, thereby improving synaptic functioning [10]. Shockingly, Alam et. al (2025) recently provided strong evidence supporting the notion that DBS may even be an effective intervention for treating Alzheimer's Disease (which has been thought to involve generalized plaque build-up in the brain, rather than targeted death of dopamine neurons), suggesting that Alzheimer's Disease's mechanistic properties may be even more complex than previous research had suggested [11].

While the mechanism of DBS is somewhat unclear, results of clinical trials seem to support its impressive efficacy [8, 11]. But where can we go from here?

I believe that the parallel development of sensitive fMRI analysis tools may provide an opportunity to improve upon current DBS procedures. Neuropsychological researchers should aim to localize subregions of the mesencephalon that seem to be responsible for Parkinson's symptoms. Specifically, studies should be run that correlate functional deficiencies in the Parkinson's-affected brain with specific symptoms. Thus, different Parkinson's patients who present different symptoms may receive DBS interventions that specifically target their area of deficiency and thereby (presumably) yield more consistent improvements in clinical condition. While fMRI does not have the resolution to track dopamine signaling per se, I do not think that such an ability is necessary or even particularly constructive.

MRI will track macroscopic (activational, as operationalized by Blood Oxygen Level Dependent contrasts) deficiencies in brain functioning due to Parkinson's disease, which is what DBS aims to treat. Thus, I believe that fMRI-based research on Parkinson's patients is an important future avenue for improving DBS treatments.

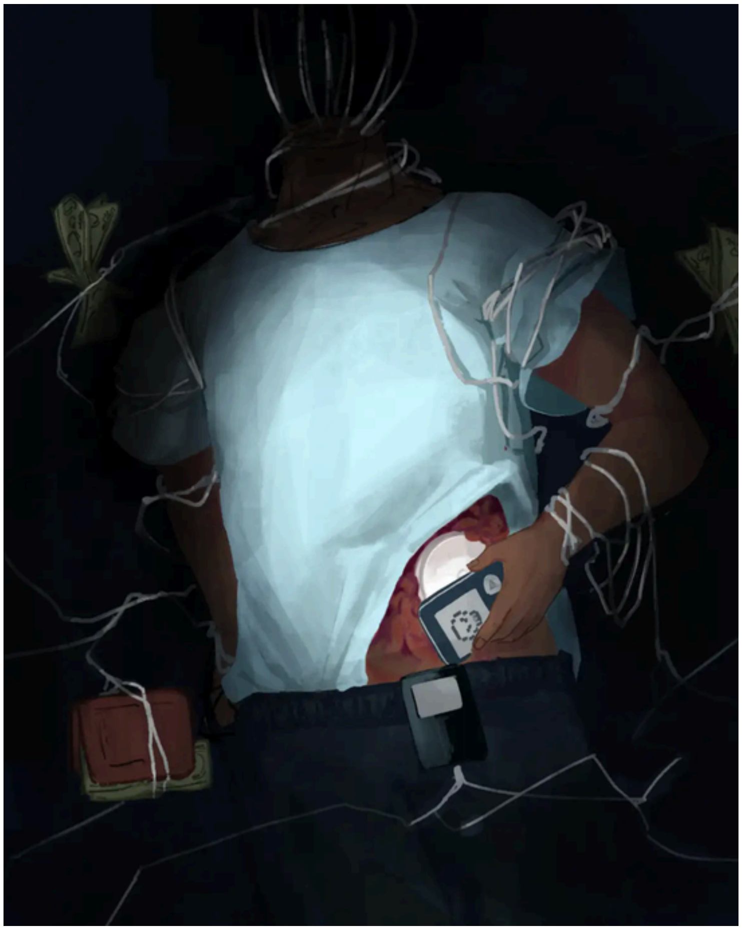
While Parkinson's Disease is an increasingly prevalent neurodegenerative disorder in the United States, recent improvements in interventional treatments such as DBS and research techniques, such as fMRI, provide a reason for optimism, as together, they provide a very promising treatment avenue.

References

1. Statistics. (2026). Parkinson's Foundation. https://www.parkinson.org/understanding-parkinsons/statistics
2. Mayo Foundation for Medical Education and Research. (2024a). Parkinson's disease. https://www.mayoclinic.org/diseases-conditions/parkinsons-disease/symptoms-causes/syc-20376055
3. Ryu, D. W., Han, K., & Cho, A. H. (2023). Mortality and causes of death in patients with Parkinson's disease: a nationwide population-based cohort study. Frontiers in Neurology, 14, 1236296.
4. Ramesh, S., & Arachchige, A. S. P. M. (2023). Depletion of dopamine in Parkinson's disease and relevant therapeutic options: A review of the literature. AIMS neuroscience, 10(3), 200.
5. Serafini, R. A., Pryce, K. D., & Zachariou, V. (2020). The mesolimbic dopamine system in chronic pain and associated affective comorbidities. Biological psychiatry, 87(1), 64-73.
6. Mayo Foundation for Medical Education and Research. (2024b). Parkinson's disease. https://www.mayoclinic.org/diseases-conditions/parkinsons-disease/diagnosis-treatment/drc-20376062
7. Rebecca Gilbert, M. (2024). Carbidopa/levodopa: Side effects, dosages, & faqs: APDA. American Parkinson Disease Association. https://www.apdaparkinson.org/article/common-questions-about-carbidopa-levodopa/
8. Deep Brain stimulation. (2026). The Michael J. Fox Foundation for Parkinson's Research. Parkinson's Disease. https://www.michaeljfox.org/deep-brain-stimulation
9. Benabid, A. L. (2003). Deep brain stimulation for Parkinson's disease. Current opinion in neurobiology, 13(6), 696-706.
10. Volkmann, J. (2004). Deep brain stimulation for the treatment of Parkinson's disease. Journal of clinical neurophysiology, 21(1), 6-17.
11. Alam, J., Bhattacharjee, S., Chakraborty, S., Rahman, S. Z., Hasan, A., Haseen, M. A., & Sarfraz, M. (2025). Neuromodulation via brain stimulation: A promising therapeutic perspective for Alzheimer's disease. In Artificial Intelligence in Biomedical and Modern Healthcare Informatics (pp. 257-266). Academic Press.

The Digitalization of Diabetes: Who is Left Behind?

by Syed Hasan, Human Biology, Health, and Society '26



Artwork by Alex Song

In a rapidly modernizing world, for the vast majority, the digitalization of blood glucose monitors has led to much better outcomes for diabetes patients. Particularly because it has allowed for the automated tracking of insulin injections and a reduction of needle usage. However, it has also left behind many who are unable to switch to digital devices. Reliance solely on online technology creates a gap in access to healthcare, especially for aging or lower-income communities, where the prevalence of disease is already higher. A stable wi-fi connection, electricity to charge a phone or laptop, and the ability to use handheld technology all create obstacles in prospective patients' access to new devices.

While this is not a major issue today, as older manual methods begin to get phased out and widespread implementation occurs, it will become increasingly difficult for vulnerable elderly populations to keep up. Without further interventions by public health representatives and care providers, disparities in access could widen to the point of leaving behind those who are not provided with the initiatives and step-by-step procedures needed for effective integration.

The efficacy of continuous glucose monitors as opposed to the original methods of pricking and test strips is widely praised, and a research study found that both blood glucose levels and BMIs in individuals with type 2 diabetes improved when using home monitors, and symptoms were managed much better when compared with pre-monitor regulation [1]. However, while monitors sound ideal in theory, their high costs and reliance on digital literacy build barriers faced most greatly by those who need this life-saving care the most. As one study expanding on both benefits and challenges states: "age-related comorbidities, especially cognitive and physical decline, can make technology use difficult in older adults," and these are the individuals facing the greatest burden of the diabetes disease [2]. With app interfaces that rely on touchscreen handling, specific language settings, and small, hard-to-read buttons, many are left with progress that is inaccessible to them without full outside assistance. These recent shifts have left those without children or caretakers who can facilitate usage completely helpless.

In addition to the limitations that arise with unequal broadband capability across the United States is the ability to afford the utility at all. The cost of smartphones that can run individualized applications that most new monitors utilize, the cost of a phone plan, and most notably, the cost of monitors range from hundreds to thousands of dollars. Depending on the frequency of insulin delivery, these become massive expenses! To those who can't get full insurance coverage, these prices are difficult to justify, even with proven health benefits. This results in a continuation of finger-pricking, not from the luxury of choice, but out of necessity.

However, in the long term, continuous glucose monitors reduce the healthcare burden of aging populations and provide room for growth. A study focused on the integration of technology found that "older people with diabetes benefit from technology in terms of glucose management, reductions in hypoglycaemic events, emergency department attendance and hospital admissions, and improvement in quality of life," [3]. This emphasizes the extent to which new leaps in medicine have huge proven benefits for diabetes patients. Although they require additional initiatives to encourage long-term implementation, the rise in artificial intelligence (AI) can fast-track the creation of educational modules that meet people where they are. In an article published by Science Direct on existing digital solutions, they highlight: "the algorithm predicts the future values of glucose for 1 hour ahead… send verbal (voice) or written messages," [4]. The usage of AI here emphasizes how algorithms can provide informed diet choices to diabetes patients, and in this case, provide further assistance and care to those who may be making these decisions alone otherwise. This illustrates the importance of viewing the other side of the influx of information that digital monitors bring, and their many benefits.

In a survey conducted on over 3,000 diabetes patients to view perspectives on the emerging digitalization of glucose management, they found that the vast majority of participants were extremely receptive to adopting new technologies and had positive attitudes towards this shift in the management of their disease [5]. While promising, these results exacerbate the notion that the success of these technologies relies most prominently on how effectively they are made accessible to the entire population facing disease, as they will be received well by the majority. In all cases, the need for policies that drive equitable interventions and the incorporation of AI to ease the switch to new technologies is required now more than ever. With these changes in mind, evidence across all studies shows the potential for significant improvements to both outcomes on patient lifespans and day-to-day glycemic control that digitalization offers.

References

1. Xiao, Yuping et al. “Effectiveness of Digital Diabetes Management Technology on Blood Glucose in Patients With Type 2 Diabetes at Home: Systematic Review and Meta-Analysis.” Journal of Medical Internet Research vol. 27 e66441. 3 Mar. 2025, doi:10.2196/66441 https://pmc.ncbi.nlm.nih.gov/articles/PMC11914849/
2. Toschi, Elena, and Medha N Munshi. “Benefits and Challenges of Diabetes Technology Use in Older Adults.” Endocrinology and metabolism clinics of North America vol. 49,1 (2020): 57-67. doi:10.1016/j.ecl.2019.10.001 https://pmc.ncbi.nlm.nih.gov/articles/PMC6983469/
3. Maltese, Giuseppe et al. “Ageing well with diabetes: the role of technology.” Diabetologia vol. 67,10 (2024): 2085-2102. doi:10.1007/s00125-024-06240-2 https://pmc.ncbi.nlm.nih.gov/articles/PMC11446974/
4. Neborachko, M. (2018, July). Current trends of Digital Solutions for diabetes management. Science Direct. https://www.sciencedirect.com/science/article/abs/pii/S1871402118303266
5. Kulzer, B., Heinemann, L., & Roos, T. (2021). Patients’ experience of new technologies and digitalization in diabetes care in Germany. Journal of Diabetes Science and Technology, 16(6), 1521–1531. https://doi.org/10.1177/19322968211041377

Artificial Intelligence in Dentistry

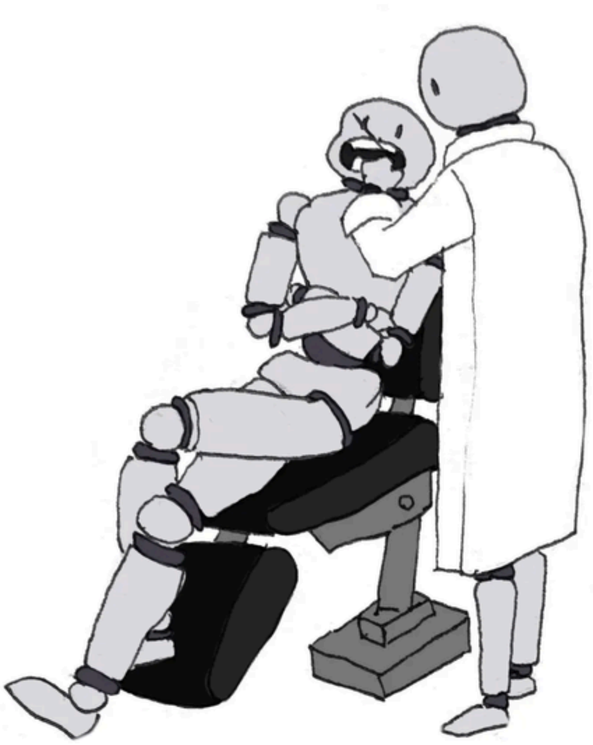
by Valentine Kim, Human Biology, Health, and Society '28

Dentistry is traditionally a specialty of handcraft and manual labor, but artificial intelligence is gradually reforming this structure. First, artificial intelligence is being utilized for diagnostics such as tooth decay detection. Tooth decay in its early stages have been ambiguous to detect by the human eye since its form is not consistent or noticeable. However, artificial intelligence-driven algorithms have been proving enhanced ability of detecting early decay symptoms [1]. In similar terms, larger illnesses can also be detected, such as oral cancer. One of the largest limitations of current diagnosis is that it depends on the eye of the dentist, which may involve biases and errors [2]. In fact, the diagnostic error in dentistry was estimated to be around 20%, which costs more pain and fees for the patients and also wastes time [2]. This can be reduced through an artificial intelligence model, which will only get better over time with more cases used as a data set.

Another strength of artificial intelligence is its ability to swiftly compile information and analyze data. Oftentimes, it is not easy for dentists to make personal treatment plans on the spot since they have to consider past medical records and the patient's unique context in treatment. AI can be much more efficient in performing this and can be utilized in various subspecialties such as orthodontics, implantology, and prosthodontics [3]. In procedures that involve the placement of prosthetic devices like the crown, a 3D simulation can also be created, giving the dentist a better idea [3]. In addition to diagnostics, the ultimate benefit of artificial intelligence can come in during the procedures. Combined with robotic technology, AI can be used to assist highly precise procedures like implant placement. Instead of the approximation that is currently done, real-time measurements can be made within the mouth and used for a more accurate procedure [3]. Marginal errors such as the tremble of human hands or the imperfect vision can all be solved with a mechanical assistant.

Disadvantages also exist from utilizing AI. At the moment, AI is costly to implement and technically unproven [4]. An increase in the cost will naturally be reflected in the price that customers have to pay. While theoretically perfect, AI is largely still unreliable in its field performance, meaning that it is not a viable option to rely on [4]. There are other problems such as legal matters where the law is ambiguous about who is responsible for the mistakes that AI makes [4]. Finally, it is also a question of how AI devices can be naturally incorporated into dental offices and become a part of the dental education for upcoming dentists. Will there be a period where there are AI-incorporated clinics vs. fully human clinics?

Overall, artificial intelligence is not the most groundbreaking change for dentistry just yet. However, given the fast development of AI in other fields as well as its visible potential in dentistry, it is no understatement to say that AI will eventually transform dentistry [5]. Throughout the years, the most critical thing is to remember that AI is a tool at the end of the day and that ethics and patient health are of utmost importance [5]. In an attempt to enhance efficiency/accuracy and dentist convenience, patient treatment must not be overlooked. The best method would be to bring in AI's elements slowly with natural adaptations in the clinic.



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References

1. Dhopte, A. (2023). Smart Smile: Revolutionizing Dentistry With Artificial Intelligence. Cureus, 15(6), 1-10. https://pmc.ncbi.nlm.nih.gov/articles/PMC10387377/
2. Tokede, B., Yansane, A., & Brandon, R. (2024). The burden of diagnostic error in dentistry: A study on periodontal disease misclassification. Journal of Dentistry, 148(1), 5-17. https://www.sciencedirect.com/science/article/pii/S0300571224003907
3. Bamashmous, M. (2025). The Role of Artificial Intelligence in Transforming Dental Public Health: Current Applications, Ethical Considerations, and Future Directions. The Open Dentistry Journal, 19(1), 1-7. https://opendentistryjournal.com/VOLUME/19/ELOCATOR/e18742106363413/FULLTEXT/
4. Ghaffari, M., Zhu, Y., & Shrestha, A. (2024). A review of advancements of artificial intelligence in dentistry. Dentistry Review, 4(2), 3-15. https://www.sciencedirect.com/science/article/pii/S277255962400004X
5. Mallineni, S. (2024). Artificial Intelligence in Dentistry: A Descriptive Review. Bioengineering, 11(12), 12-13. https://pmc.ncbi.nlm.nih.gov/articles/PMC11673909/

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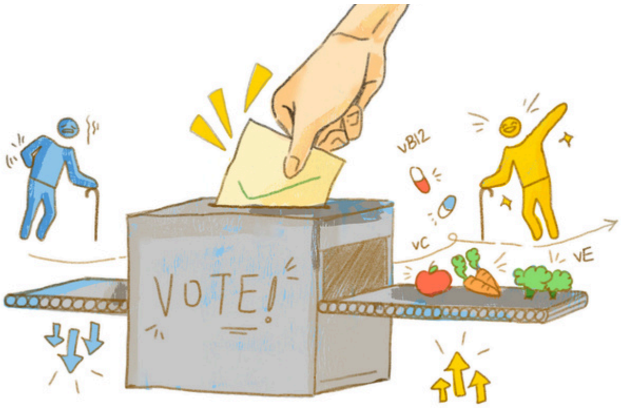

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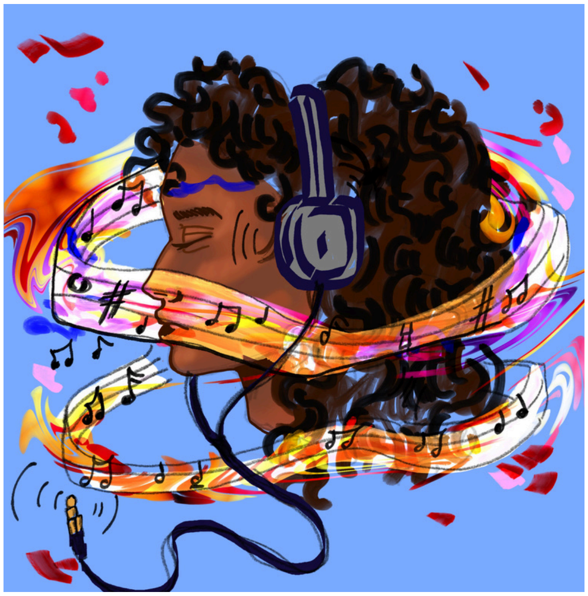

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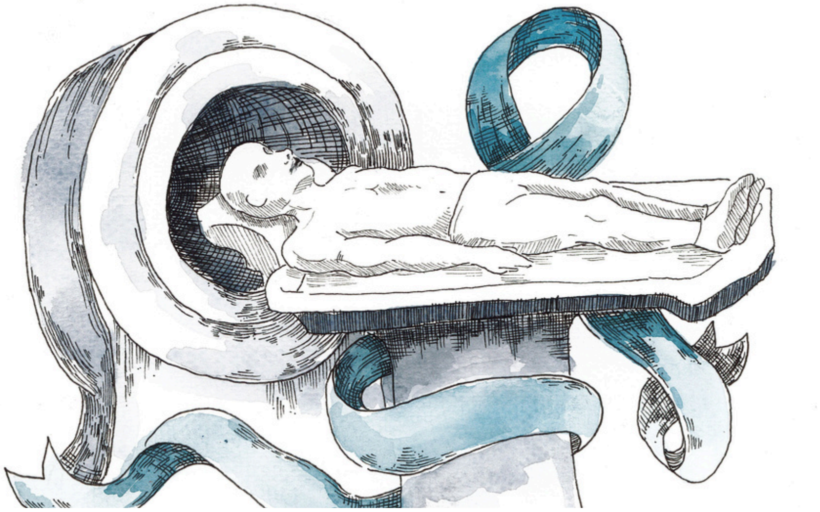

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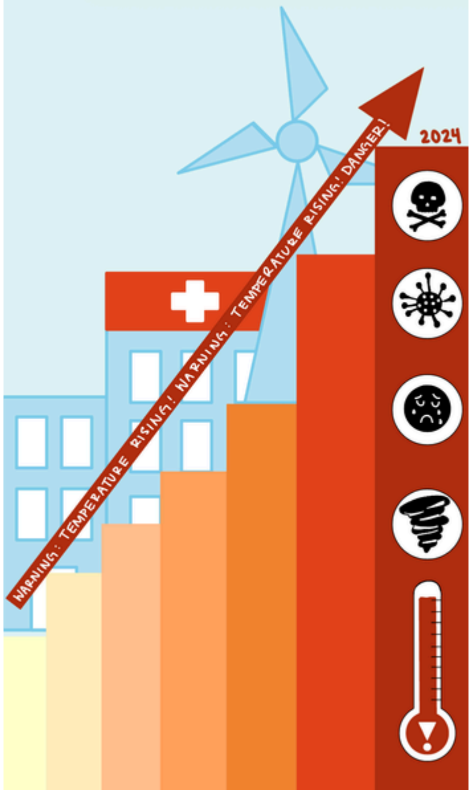

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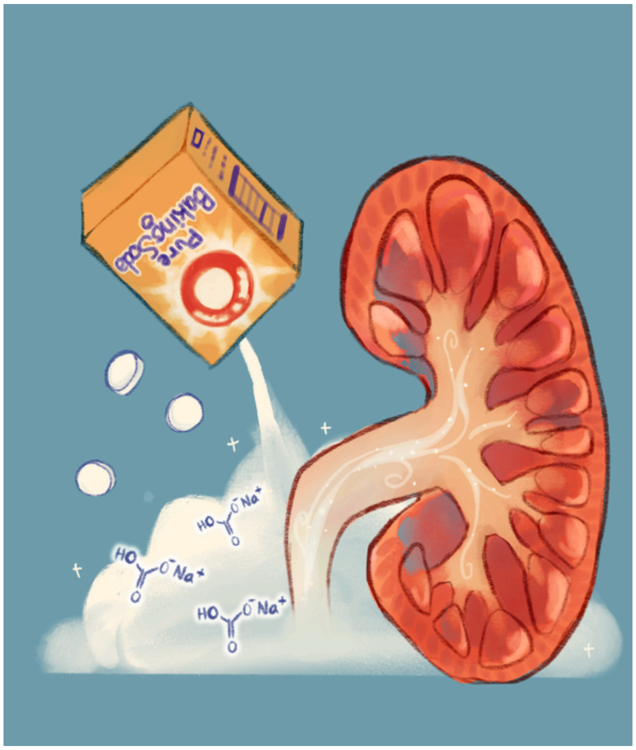

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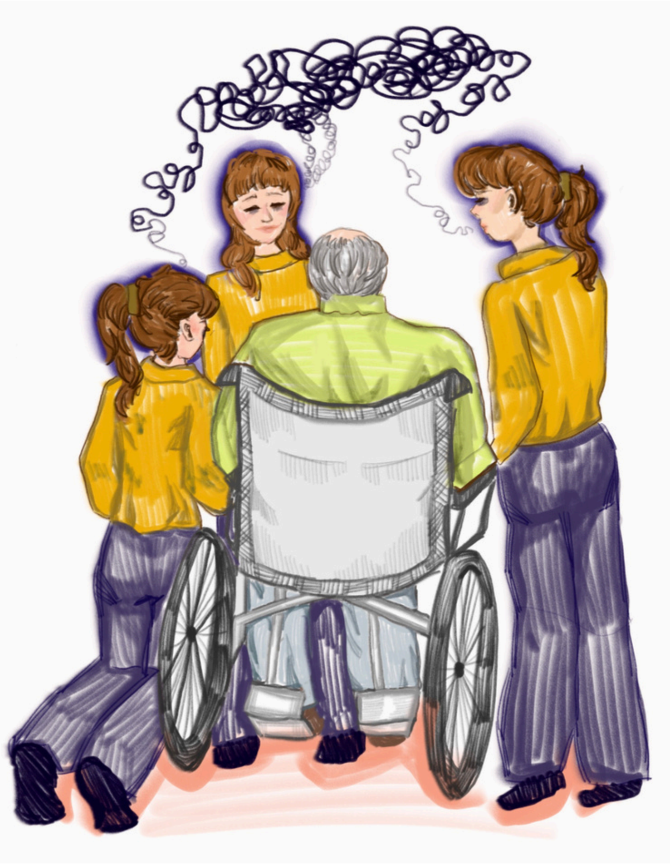

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