Investigating Health Self-Management among Different Generation Immigrant College Students with Depression

Jordan Dodson[1], Jenni Thang[2], Naika Saint Preux[3], Christopher Frye[4], Linh Ly[5], Julissa Murrieta[6], Linda Sun[4], Elizabeth V. Eikey[7]

1. The University of North Carolina at Chapel Hill, NC, USA, jordodson@gmail.com
2. Indiana University Bloomington, IN, USA, jennysui22@gmail.com
3. The College of Westchester, NY, USA, naikasp4@gmail.com
4. University of Pittsburgh, PA, USA, ccf15@pitt.edu; lindaxsun@gmail.com
5. University of Washington, WA, USA, linhly8015@gmail.com
6. University of Maryland, College Park, MD, USA, jmurriet@umd.edu
7. University of California, Irvine, CA, USA, eikeye@uci.edu

Abstract. Digital tools for health hold a lot of promise in terms of empowering individuals to take control over their health and improving access to care. This may be especially critical for marginalized individuals, such as immigrant college students, and those who face stigmatizing conditions, such as depression. However, research is limited on how these tools fit into users' existing practices around health management. In order to address this gap, we first investigate existing practices by focusing on a specific population: college students with depression ranging from immigrant generation 1 to 2.5. This group is important to study as they are at an increased risk for depression but may be less likely to access traditional treatment. We present results about their practices around health self-tracking and digital tools specific to depression management. Based on a survey of 83 participants, we found that although students with depression across these various immigrant generations engage in health self-tracking (94%), few track mental health indicators and most do not use mobile apps (81.9%) or other online resources (86.7%) to help with their depression. Those that do use apps and online resources offer insights into their depression management needs.

Keywords: Mental Health, Depression, mHealth, Mobile App, Self-Tracking, Self-Management, Digital Tools, College Student, Immigrants

1 Introduction

Increasingly, people are turning to technology to track their health and get access to health information [1]. With the prevalence of smartphones, it is becoming easier to not only look up health information online, but also utilize digital tools to track and monitor a number of health indicators, such as sleep, mood, exercise, and even illness symptoms. Younger individuals, in particular, are showing an increased interest in using digital technology for health [2, 3]. According to Pew Research Center, 72% of all adults ages 18-29 look online for health information [2]. In a study of 1,604 mobile phone users in the U.S., researchers found over half use mobile health apps [3]. Digital tools for health hold a lot of promise in terms of empowering individuals to take control over their health and increasing access to resources and care. This may be especially

critical for marginalized individuals, such as immigrant college students, and those who face stigmatizing conditions, such as depression, because they may be less likely to access traditional healthcare services [4–6].

However, what is not yet fully understood is how these digital tools fit into individuals' lives, particularly those who marginalized and stigmatized. In order to investigate this, we first must understand what tools users are currently using. We look at one example: college students with depression symptoms from varying immigrant generations. We focus on students who were born in a country other than the U.S. and moved to the U.S. (sometimes referred to as generation 1 to 1.75) as well as those born in the U.S. but whose parent(s) were born in a country other than the U.S. (sometimes referred to as generation 2 and 2.5) [7–9]. Although there are differences across immigrant generations, some research has shown similar rates of depression. For example, Peña et al. [10] found no statistically significant differences in depression symptoms across first, second, or later generations of Latino immigrant adolescents. Additionally, because we found no statistically significant differences across our sample's generation groups on depression scores, acculturation scores, or digital tools used to manage depression, we combine them and refer to them as immigrants.

This population is important to study because they are at an increased risk for depression as both college students and immigrants [11–13], and they are a rapidly growing population [14, 15]. In addition to dealing with stressors as a college student, immigrant college students face additional challenges, such as navigating the college process and balancing personal goals with those of their family [16]. A shared experience of acculturation, which occurs when people try to adapt to new and diverse cultures, often exists across different immigrant generations [17]. Immigrants often face acculturation stress, and many face pressures in balancing more than one culture, which may lead to feelings of distress and poor health [18]. Additionally, they are more likely to go undiagnosed [19] and less likely to access professional mental health services due to financial barriers [19], stigma within their communities [6], language barriers [20] and lack of providers from similar ethnic and cultural backgrounds [21, 22].

In order to understand if digital tools are appropriate or effective for this population, we need to first understand their existing practices around health and depression management. Using college students with depression from different immigrant generations 1 to 2.5[1] as a case study, we conducted a survey focusing on what health indicators are already being tracked (using analog and digital tools) and then aimed to understand what digital tools (apps and online resources) they use to aid specifically in their depression management. We identified 2 main research questions:

[1] ***Immigrant generation status:***
1 = moved to U.S. after age 17
1.25 = moved to U.S. between ages 13-17
1.5 = moved to U.S. between ages 6-12
1.75 = moved to U.S. before age 6
2 = born in U.S. and both parents born outside of U.S.
2.5 = born in U.S. and one parent born outside of U.S. [33]

RQ1: What health indicators are college students with depression from different immigrant generations already tracking?
RQ2a: Are college students with depression from different immigrant generations using digital tools (apps, online resources) to help with depression?

- *RQ2b: If so, then what tools are they using?*

2 Methodology

2.1 Questions, Measures, and Analysis

In order to characterize our sample, we used a Qualtrics questionnaire to obtain information about demographics, acculturation, and depression. To assess symptoms, we included the 21-item Beck's Depression Inventory II (BDI-II) [23], which is a reliable tool [24]. Questions cover a range of depressive symptoms, including feelings of worthlessness, loss of focus, difficulty sleep, appetite levels, and loss of energy. Each item is scored on a 0-3 range and then added together to get the overall score symptoms (higher scores indicate greater severity) [23]. These scores can also be grouped into categories to convey the severity of depression symptoms: minimum = 0-13, mild = 14-19, moderate = 20-28, and severe = 29-63.

To answer our research questions, we asked 3 main survey questions: "What aspects (if any) of your health do you track?" [RQ1]; "Do you use any mobile applications or apps to help with your depression?" [RQ2a]; and "Do you use any other online resources or websites to manage your depression or get information about depression?" [RQ2a]. If participants answered yes to either of the questions for RQ2a, then they were asked an additional question about what apps or online resources they use [RQ2b]. We used Excel and JASP to organize and analyze our data. Qualitative data was inductively coded and grouped into broader categories.

2.1 Recruitment, Eligibility, and Participants

We recruited participants through Amazon Mechanical Turk (mTurk). Investigating health self-tracking and information seeking was part of a larger survey examining immigrant students' perceptions of digital tools, including social media and apps. We limited participation to only within the U.S. Our participants were compensated $2 for approximately 20 minutes of their time. Eligibility criteria included: currently reside in the U.S.; identify as an immigrant (either they were born in another country and moved to the U.S. or one or both of their parents were born in another country but they were born in the U.S.) [7]; 18 to 24 years old; currently an undergraduate; use at least one social media platform; speak English; and have experienced depression symptoms within the last 12 months. Participants were excluded if they have a history of a manic episode, schizophrenia, or bipolar disorder.

In our final analysis, we had 83 participants (139 responses; 28 removed for being incomplete, and 28 excluded based on quality checks). In our sample, 33 participants identified as female and 50 as male. Their age ranged from 18 to 24 (mean=21.5; SD=12.54). Based on reported birth country, parents' birth countries, and age moved to the U.S., we categorized participants into 6 generation groups: 1 (n=6, 7.2%), 1.25 (n=8, 9.6%), 1.5 (n=13, 15.7%), 1.75 (n=15, 18.1%), 2 (n=26, 31.3%), 2.5 (n=15, 18.1%). In terms of diagnosis and treatment, the majority (n=64) had not

received a clinical diagnosis or sought professional treatment. Based on the BDI-II, the mean depression score among our participants was 21.25 (SD=12.54), which is significantly higher than norms of undergraduates in the U.S. (norms: mean=9.14, SD=8.45; our participants: mean=21.25, SD=12.54) [25] Although there are no clinical cut-off points, Dozois et al. [26] suggest 13 or higher may be considered depressed, and 74.7% (*n*=62) of our participants reached this threshold. However, scores less than 13 may not necessarily mean not depressed but rather lower symptom severity, especially given that all participants identified as experiencing depression.

3 Findings

3.1 RQ1: General Health Self-Tracking

Our findings indicate that health self-tracking is very common among immigrant college students. In fact, out of our 83 participants, only 5 did not track any health indicators. Most commonly, participants reported tracking exercise (*n*=42) and food, calories, and nutrition (*n*=40), as shown in Figure 1[2]. Despite all participants identifying as having depression, few participants reported tracking indicators specific to mental and emotional health, such as their mood (*n*=11) and stress (*n*=16).

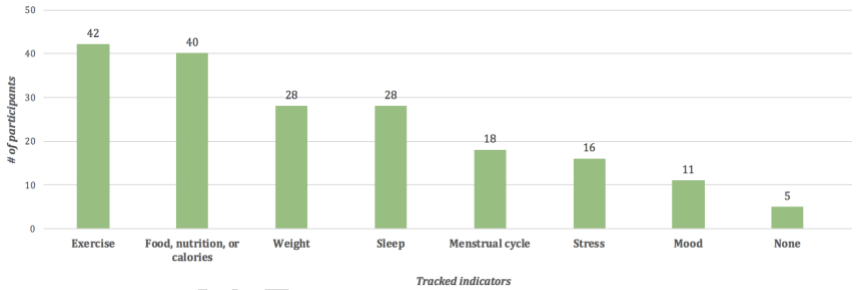

Fig. 1. General health self-tracking

3.2 RQ2: Digital Tools for Depression Management

We asked participants about digital tools, specifically mobile apps and online resources, they use for depression management, including non-depression specific tools. Out of 83 participants, the majority did not report using any apps (*n*=68) or online resources (*n*=72) to help them with their depression symptoms, as shown in Figure 2. Table 1. shows the types of apps and online resources participants used. Only 15 participants used apps to aid in the management of their depression. These apps included apps specific and not specific to mental health, such as MoodTools (*n*=1), Positive Thinking (*n*=1), Uplift (*n*=2), Mindfulness Meditation (*n*=1), Calm (*n*=1), Headspace (*n*=1), Spotify (*n*=1), Daylio (*n*=1), Notes (*n*=1), Google Fit (*n*=1), and Lose It (*n*=1). Only 11

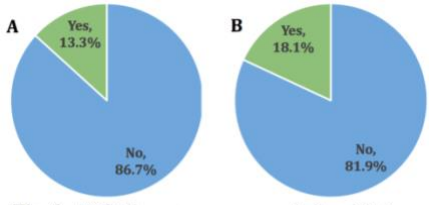

Fig. 2. A) Online resources or websites; B) Apps

[2] Many participants reported tracking more than one health indicator.

participants reported using other online resources and websites, which included general healthcare resources and those specific to depression, such as Rethink Depression (*n*=1), Students Against Depression (*n*=2), WebMD (*n*=1), Mayo Clinic (*n*=1), Beyondblue Healthcare (*n*=1), Google Search (*n*=1), DepressionForums.org (*n*=1), and Depressed Help (*n*=1).

Table 1. Types of apps and online resources

App Type	Depression and Anxiety-Specific Apps (*n*=1)	Positivity Apps (*n*=3)	Meditation / Mindfulness Apps (*n*=3)	Music Apps (*n*=2)	Diet and Fitness Apps (*n*=3)
Online Resource Type	Depression / Mental Health Websites (*n*=4)	General Online Medical Resources (*n*=4)	Depression Forums (*n*=2)	Online Counseling (*n*=1)	Self-Help Websites (*n*=1)

4 Discussion

Our findings show college students with depression from different immigrant generations are not commonly using apps or other digital tools to manage their depression, even though they show an interest and engage in general health self-tracking. While we are not claiming there is necessarily one singular depression app or tool that should be used, we do know there are many depression-related digital resources available, so it is interesting that so few of our participants use them. These findings are somewhat in opposition to prior research on the prevalence of health self-management and online health information seeking among young people [2, 3]. This suggests that a potential distinction needs to be made between health management and information seeking and *mental* health management and information seeking. Our findings are consistent with prior work on mental health tracking among college students, which shows tracking indicators like exercise and weight are more common than tracking mental health [27]. For example, Kelley et al. [27] found many college students whose self-tracking is related to mental illness monitor behavioral proxies related to mental health rather than mental health indicators directly. It is possible that using digital tools for general health-management is common among college students, but using apps and online resources specific to depression may be much less common, especially for those who are of minority and ethnically diverse backgrounds, due to cultural stigma around mental health issues [6, 28, 29].

Most of our participants never sought a diagnosis nor treatment despite many reporting moderate to severe depression symptoms. While digital tools could improve access to resources and alternatives to treatment, we found many are not engaging with apps or online resources to help with their depression symptoms. This is problematic given that these tools may be effective in reducing depression symptoms [30], increasing social support [31], and improving mental health literacy [32]. Because many of them are not utilizing digital tools for depression management or care and not seeking professional mental health services, they may be utilizing very little if any depression resources and treatment.

Because this was part of a larger study, we know that this sample regularly uses digital tools; thus, access to technology is likely not an issue. For instance, all participants are social media users, and at least 77% (*n*=64) access social media on their

own smartphones. Therefore, more research is needed to understand why they are not utilizing tools to manage their depression. Is it lack of awareness, stigma, language barriers, or misconceptions about depression? Are they simply uninterested in managing their depression in this way? Answers to these questions can help us improve access to alternative depression treatment and support for immigrant students.

Those that did use technology for depression can offer us insights into the types of tools immigrant students want. The way in which we framed the question offers a unique advantage and served as a mechanism to understand how they envision digital tools serving them. For example, even among those who used apps to help with depression, the majority did not use depression-specific apps but rather more general apps that may have some impact on depression symptoms, such as mood tracking, meditation/mindfulness, and positivity apps. This suggests their idea of what an app should focus on to help with depression may be broader than simply translating traditional mental health services to the digital world. For online resources, on the other hand, immigrant students often sought and used depression-specific websites and online services as well as general health and medical websites to get information about depression. These sources tend to focus more on depression as a condition, and therefore, those using these resources may have a different level of depression literacy or conceptualization than those that reported using apps.

5 Limitations and Future Work

This paper focuses on health management of different immigrant generations; however, we found few differences across these generations or by symptom severity. It is possible that differences in use of apps and resources exist but were not uncovered as part of this study. Our findings shed light on *what* individuals are currently doing around depression management but do not explore *why* and *how* they use or do not use these tools. At this stage, we are not trying to create one-size-fits-all tool. To address these limitations, we are conducting a larger study assess college students' current practices around depression management, which will inform the design of digital tools.

6 Conclusion

In this paper, we examined health self-management among college students with depression from immigrant generations 1 to 2.5. We focused on health self-tracking and digital tools for depression. We found that while many students track some aspect of their health, the majority do not use apps or online resources to manage depression. This research acts as a foundation to understanding existing practices around mental health self-management among this group. This research leads to additional questions regarding why these tools are not used and how they could be used in the future.

Acknowledgements. We would like to thank iSchool Inclusion Institute (i3) Director Dr. Kayla Booth, Michael Depew, the 2017 cohort, our research advisor and i3 Assistant Director Dr. Elizabeth Eikey, and Team Dopamine. This work was supported by the National Center for Research Resources, the National Center for Advancing Translational Sciences, and the NIH (UL1 TR001414). It is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

References

1. Fox S, Duggan M (2013) Tracking for Health. Pew Internet 1–40 . doi: 10.1001/jamainternmed.2013.1221.2.
2. Susannah Fox (2014) The social life of health information | Pew Research Center. In: Pew Internet Res. http://www.pewresearch.org/fact-tank/2014/01/15/the-social-life-of-health-information/
3. Krebs P, Duncan DT (2015) Health App Use Among US Mobile Phone Owners: A National Survey. JMIR mHealth uHealth 3:e101 . doi: 10.2196/mhealth.4924
4. Abe-Kim J, Takeuchi DT, Hong S, Zane N, Sue S, Spencer MS, Appel H, Nicdao E, Alegría M (2007) Use of mental health-related services among immigrant and US-born Asian Americans: Results from the National Latino and Asian American Study. Am J Public Health 97:91–98 . doi: 10.2105/AJPH.2006.098541
5. Corrigan P (2004) How stigma interferes with mental health care. Am Psychol 59:614–625 . doi: 10.1037/0003-066X.59.7.614
6. Nadeem E, Lange JM, Edge D, Fongwa M, Belin T, Miranda J (2007) Does Stigma Keep Poor Young Immigrant and U.S.-Born Black and Latina Women From Seeking Mental Health Care? Psychiatr Serv 58:1547–1554 . doi: 10.1176/ps.2007.58.12.1547
7. Trevelyan E, Gambino C, Gryn T, Larsen L, Acosta Y, Grieco E, Harris D, Walters N (2016) Characteristics of the U.S. Population by Generational Status: 2013 Current Population Survey Reports
8. Ramakrishnan SK (2004) Second-generation immigrants? The "2.5 Generation" in the United States. Soc. Sci. Q. 85:380–399
9. Rumbaut RG (2006) Ages, Life Stages, and Generational Cohorts: Decomposing the Immigrant First and Second Generations in the United States1. Int Migr Rev 38:1160–1205 . doi: 10.1111/j.1747-7379.2004.tb00232.x
10. Peña JB, Wyman P a, Brown CH, Matthieu MM, Telva E, Hartel D, Zayas LH (2009) Immigration Generation Status and its Association with Suicide Attempts, Substance Use, and Depressive Symptoms among Latino Adolescents in the USA. Prev Sci 9:299–310 . doi: 10.1007/s11121-008-0105-x.Immigration
11. Cho YB, Haslam N (2010) Suicidal ideation and distress among immigrant adolescents: The role of acculturation, life stress, and social support. J Youth Adolesc 39:370–379 . doi: 10.1007/s10964-009-9415-y
12. Lyubomirsky S, Kasri F, Zehm K (2003) Dysphoric Rumination Impairs Concentration on Academic Tasks. Cognit Ther Res 27:309–330 . doi: 10.1023/A:1023918517378
13. Mejía OL, McCarthy CJ (2010) Acculturative Stress, Depression, and Anxiety in Migrant Farmwork College Students of Mexican Heritage. Int J Stress Manag 17:1–20 . doi: 10.1037/a0018119
14. Keller G (2001) The New Demographics of Higher Education. Rev High Educ

24:219–235 . doi: 10.1353/rhe.2001.0004
15. Schwartz SJ, Kim SY, Whitbourne SK, Zamboanga BL, Weisskirch RS, Forthun LF, Vazsonyi AT, Beyers W, Luyckx K (2013) Converging identities: Dimensions of acculturation and personal identity status among immigrant college students. Cult Divers Ethn Minor Psychol 19:155–165 . doi: 10.1037/a0030753
16. Deenanath V (2014) First-generation Immigrant College Students: An Exploration of Family Support and Career Aspirations Thesis Submitted to the Faculty Of The Graduate School Of University Of Minnesota By Veronica Deenanath in Partial Fulfillment of the Requirements For T. University of Minnesota
17. Berry JW (2005) Acculturation: Living successfully in two cultures. Int J Intercult Relations 29:697–712 . doi: 10.1016/j.ijintrel.2005.07.013
18. Schwartz SJ, Waterman AS, Umaña-Taylor AJ, Lee RM, Kim SY, Vazsonyi AT, Huynh QL, Whitbourne SK, Park IJK, Hudson M, Zamboanga BL, Bersamin MM, Williams MK (2013) Acculturation and well-being among college students from immigrant families. J Clin Psychol 69:298–318 . doi: 10.1002/jclp.21847
19. Pitkin Derose K, Bahney BW, Lurie N, Escarce JJ (2009) Immigrants and health care access, quality, and cost
20. Sentell T, Shumway M, Snowden L (2007) Access to mental health treatment by English language proficiency and race/ethnicity. J Gen Intern Med 22:289–293 . doi: 10.1007/s11606-007-0345-7
21. Kirmayer LJ, Narasiah L, Munoz M, Rashid M, Ryder AG, Guzder J, Hassan G, Rousseau C, Pottie K (2011) Common mental health problems in immigrants and refugees: General approach in primary care. Cmaj 183:1–9 . doi: 10.1503/cmaj.090292
22. Kirmayer LJ, Rousseau C, Jarvis GE (2008) Assessment Introduction : The Cultural Matrix. Assessment
23. Beck AT, Steer RA, Brown GK Beck Depression Inventory -II. In: 1996
24. Wang YP, Gorenstein C (2013) Psychometric properties of the Beck Depression Inventory-II: A comprehensive review. Rev Bras Psiquiatr 35:416–431 . doi: 10.1590/1516-4446-2012-1048
25. Whisman MA, Richardson ED (2015) Normative Data on the Beck Depression Inventory - Second Edition (BDI-II) in College Students. J Clin Psychol 71:898–907 . doi: 10.1002/jclp.22188
26. Dozois, D. J. A., Dobson, K. S., & Ahnberg JL (1998) A psychometric evaluation of the Beck Depression Inventory–II. Psychol Assess 10:83–89
27. Kelley C, Lee B, Wilcox L (2017) Self-tracking for Mental Wellness. In: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems - CHI '17. pp 629–641
28. Chen JA, Shapero BG, Trinh NHT, Chang TE, Parkin S, Alpert JE, Fava M, Yeung AS (2016) Association between stigma and depression outcomes among Chinese immigrants in a primary care setting. J Clin Psychiatry 77:e1287–e1292 . doi: 10.4088/JCP.15m10225
29. Nadeem E, Lange JM, Miranda J (2009) Perceived Need for Care among Low-

Income Immigrant and U.S.-Born Black and Latina Women with Depression. J Women's Heal 18:369–375 . doi: 10.1089/jwh.2008.0898

30. Arean PA, Hallgren KA, Jordan JT, Gazzaley A, Atkins DC, Heagerty PJ, Anguera JA (2016) The use and effectiveness of mobile apps for depression: Results from a fully remote clinical trial. J Med Internet Res 18: . doi: 10.2196/jmir.6482
31. Griffiths KM, Mackinnon AJ, Crisp DA, Christensen H, Bennett K, Farrer L (2012) The Effectiveness of an Online Support Group for Members of the Community with Depression: A Randomised Controlled Trial. PLoS One 7: . doi: 10.1371/journal.pone.0053244
32. Brijnath B, Protheroe J, Mahtani KR, Antoniades J (2016) Do Web-based Mental Health Literacy Interventions Improve the Mental Health Literacy of Adult Consumers? Results From a Systematic Review. J Med Internet Res 18:e165 . doi: 10.2196/jmir.5463
33. Moffett D (2018) Is an Immigrant Considered First or Second Generation? https://www.thoughtco.com/first-generation-immigrant-defined-1951570. Accessed 12 Dec 2018