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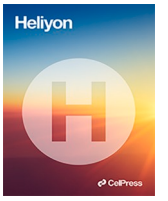

Research article

Retrospective review of food insecurity screening in an outpatient stroke clinic using electronic and paper-based surveys

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ABSTRACT

Objective: To assess the feasibility of administrating an electronic and paper-based food insecurity screener among patients presenting to a stroke clinic during the study period. We aimed to ensure a consecutive sample for our retrospective analysis and evaluate the prevalence and characteristics of food insecurity in this population.

Materials and methods: We conducted a retrospective review of patients with an initial telemedicine or in-person appointment to a stroke outpatient clinic between February 1 and July 31, 2021. Prior to their initial visit, patients were sent an electronic questionnaire to screen for food insecurity using the 2-item Hunger Vital Sign™ and to collect socio-demographic characteristics. Patients who were evaluated in-person were given a paper questionnaire if the electronic version was not completed upon clinic appointment. We collected data on patient demographics, screener completion rates, and the prevalence of food insecurity. The feasibility was evaluated by comparing the amount of missing data between electronic and paper-based screeners.

Results: Among 406 adult stroke survivors, 365 (89.9 %) completed the food insecurity screener, with 234 (64.1 %) completing it electronically and 131 (35.9 %) by paper. Overall, 14.3 % of the stroke patients experienced food insecurity. A higher prevalence of food insecurity was observed among patients who completed paper-based compared to electronic questionnaires (21.4 % vs 10.2 %, $p = 0.004$). Hispanic patients were more likely to complete paper-based questionnaires (32.1 %) compared to electronic questionnaires (18.0 %, $p = 0.011$). Patients with a 12^{th} grade education or less were more likely to complete paper-based (49.5 %) vs. electronic questionnaires (36.4 %, $p = 0.029$). Feasibility was evaluated by comparing the amount of missing data between the screener delivery modalities. A higher percentage of socio-demographic characteristics was missing in the paper-based questionnaires compared to electronic questionnaires (105.3 % vs. 14.11 %).

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Conclusions: Sample characteristics differ based on the mode of questionnaire delivery, suggesting that different screening modalities may be necessary to identify patients at the highest risk for food insecurity. Our study provides detailed insights into the feasibility of using electronic and paper-based screeners in a clinical setting, highlighting the importance of considering delivery methods in food insecurity assessments. It is important to note that the Spanish language electronic survey was only available during the last two months of the study, which may affect the findings regarding Hispanic patients' preference for paper surveys.

1. Introduction

The COVID-19 pandemic increased attention to the significant disparities in the prevalence of cardiovascular disease risk factors and their impact on health outcomes [1]. These disparities are often linked to long-standing structural inequities and the differential distribution of adverse social determinants of health among racial and ethnic groups [1]. One key adverse social determinant of health is food insecurity, which is defined as limited or uncertain access to adequate food due to economic hardship and lack of other resources [2]. The prevalence of food insecurity is higher in Black, Hispanic, and other minoritized racial groups [2]. Additionally, food insecurity impacts cardiovascular disease outcomes, and is highly prevalent in stroke survivors [3]. There are vast racial and ethnic disparities in stroke outcomes and the added burden of food insecurity in minoritized groups has potential to compound the risk for poor outcomes in these groups [4].

Food insecurity affects stroke survivors at a rate ranging from 8 % to 42 %, with the higher end being four times the national average of 10.2 % [3,5]. Stroke survivors who experience food insecurity are more likely to have poor health outcomes and mortality rate [6]. Furthermore, food insecurity can exacerbate existing chronic health conditions, such as high blood pressure, diabetes, and heart disease, which are all risk factors for stroke [7].

Additionally, racial disparities play a significant role in food insecurity and healthy food access [8]. Black and Hispanic individuals are more likely to experience food insecurity than White individuals and have been shown to have less access to healthy and affordable food options [9,10]. Racial inequalities and related food access have exacerbated existing racial disparities in stroke survivors which have remained persistent in the United States [11,12]. In addition to other adverse social determinants of health, food insecurity may play a role in the increased risk for poor risk factor control and higher cardiovascular risk in Black stroke survivors. Black Americans have an overall double risk for recurring stroke compared to White Americans [9,12].

The combination of stroke survivorship, food insecurity, and racial disparities presents a complex set of challenges for individuals and communities. To address these issues some healthcare providers have implemented screening strategies in outpatient clinics to identify patients affected most by socio-economic disparities. These efforts are being performed to provide access to programs that address food insecurity and promote access to healthy food options [13–15].

In addition to implementing food insecurity screening tools among stroke survivors, it is crucial to understand differences in implementing multiple modes of collecting this information: electronic versus paper-based screeners. This is especially important with the current shift to electronic patient questionnaires as a result of the COVID-19 pandemic [16]. Studies have shown that web-based questionnaires are preferred by younger patients, and electronic methods have advantages over traditional paper-based methods, such as real-time data availability and increased convenience and accessibility [17,18]. Electronic questionnaires may provide a convenient method for stroke survivors to complete electronic forms from the comfort of their own home and at their own pace. On the other hand, paper-based questionnaires may be preferable for some stroke survivors who tend to be older, may have impaired cognition, may suffer from physical disability, or may require a caregiver for assistance [19]. Further, paper-based questionnaires can be completed in-person, which can be particularly useful for those who lack internet access or who have lower digital literacy.

The distinctive features of the feasibility framework developed by Orsmond and Cohn [20] can be used to determine the feasibility of incorporating self-reported food insecurity screeners through paper-based and electronic methodology among patients who are seen in a stroke clinic. In this study, we used the framework to assess the practicality of administrating an electronic and paper-based food insecurity screener. Specifically, feasibility was assessed by comparing the food insecurity and sample characteristics of patients by screener delivery modality (electronic vs. paper). Last, feasibility was evaluated by comparing the amount of missing data by screener delivery modality (electronic vs. paper).

2. Methods

2.1. Patient population

The pre-visit questionnaires were sent electronically to all patients who were scheduled for a new visit in the Stroke Transitions Education and Prevention (STEP) outpatient clinic within the 14 days before their visit from February 1, 2021, through July 31, 2021 (n = 654). The clinic is located in an urban setting with many patients coming from economically disadvantaged areas, contributing to a broad neighborhood diversity. Patients were excluded from this study if they did not report history of prior stroke or transient ischemic attack (n = 84). Those who presented to the clinic but did not complete a survey (n = 164), did not complete the food insecurity screener (n = 20), or reported "I do not know" on the food insecurity screener (n = 21) were also excluded. The final sample consists of 365 patients with symptomatic ischemic stroke who completed the food insecurity screener. Patients who completed the

food insecurity screener but did not complete the socio-demographic questionnaire were included in the analytic sample (Fig. 1).

3. Data collection

3.1. Questionnaire administration

New patients scheduled for visits in the STEP clinic were administered a demographic, clinical, and risk factor screening questionnaire prior to their initial clinical visit since October 2014. When the program transitioned to telehealth visits in March 2020 because of the COVID-19 pandemic, an electronic version of the questionnaire was developed to ensure continued comprehensive patient assessments. This system led to increased efficiency of clinical assessments, and when in-person visits returned, the approach was adjusted such that all patients received an electronic questionnaire prior to the clinic visit.

During the study period, each patient scheduled for an initial clinic appointment in the stroke clinic was sent an electronic questionnaire prior to their telemedicine or in-person visit using an electronic self-report questionnaire administered through the Research Electronic Data Capture (REDCap) database [21,22]. If a patient was presenting for an in-person patient visit and had not completed their electronic questionnaire prior to the appointment, they were given a paper-based form to complete. The paper screening was administered by clinic medical assistants, who provided the questionnaire to patients prior to their visit. These were collected prior to evaluation by the clinical provider. The clinic staff entered responses in the medical chart after their visit. Routine screening for food insecurity was initiated in February 2021. Electronic questionnaires were available in English throughout the study period and a Spanish translated electronic version was added in the last two months of the period (June and July 2021). English and Spanish paper-based questionnaires were available throughout the entire period.

The Food Insecurity Project was approved by the institutional review board Committee for the Protection of Human Subjects at the University of Texas Health Science Center at Houston (IRB #HSC-MS-21-0647). Implied consent upon completion of questionnaire was used in this study. The STROBE cross-sectional checklist was utilized for reporting and presenting findings.

3.2. Feasibility outcomes

The first indicator was recruitment capability which included retrospectively measuring the count and percentage of patients presenting to the clinic who completed the paper-based or electronic questionnaires and specifically the percentage of patients who

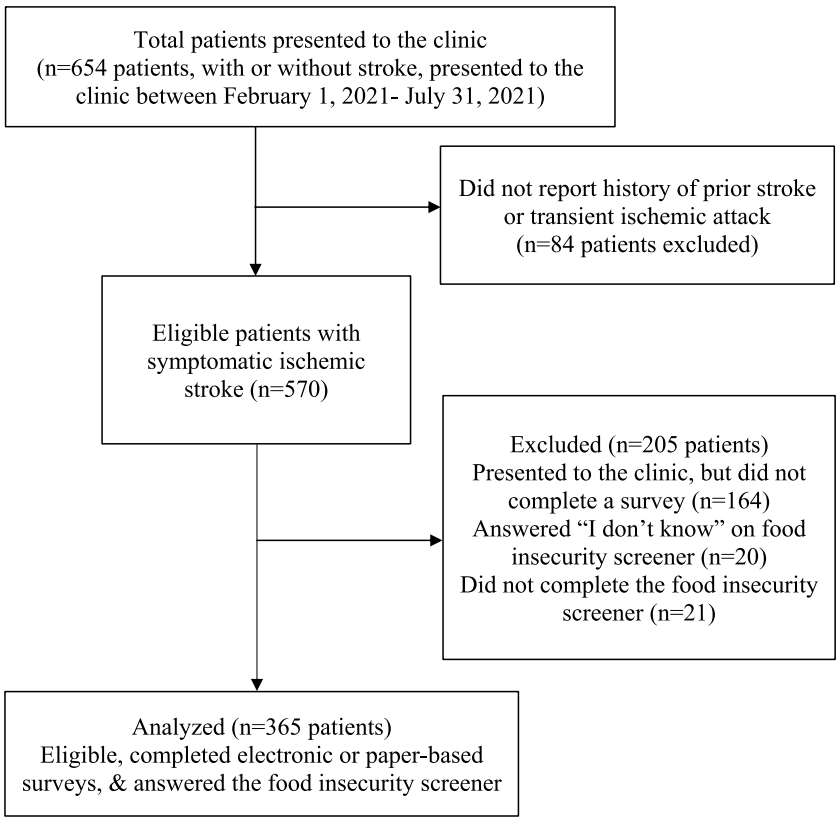

Fig. 1. Study flow chart.

completed the electronic questionnaire administered within the study timeframe. We also retrospectively evaluated the resulting sample characteristics to understand differences between those who complete paper-based compared to electronic questionnaires, which would provide valuable insight to determine barriers in different subgroups of patients. Lastly, we assessed the feasibility of data collection procedures by determining the amount of data collected and whether the data was relatively complete. We estimated the count and percentage of data missingness for socio-economic characteristics for patients who completed both the paper-based and electronic questionnaires, which would provide an insight into data usability.

3.3. Food insecurity

Food insecurity was assessed by the 2-item Hunger Vital Sign Screener™ [23]. The screener includes two statements: "you worried whether your food would run out before you got money to buy more" and "the food you bought just didn't last and you didn't have money to get more" [23]. Response options for both items included "often true," "sometimes true," or "never true." Food insecurity is defined by answering "often true" or "sometimes true" to either question yielding a high sensitivity for food insecurity detected (96.7 %). To be categorized as food secure, an individual must answer "never true" to both questions [23].

3.4. Socio-demographic characteristics

Socio-demographic characteristics of stoke patients who completed the electronic and paper-based questionnaires were collected and included: self-reported age, sex (female, male), race and ethnicity (Hispanic, non-Hispanic White, non-Hispanic Black, non-Hispanic, other), marital status (single, married, separated, divorce, widowed, other), employment status (employed, retired, disability prior to stroke, unemployed, other), education, (high school or less, some college and more) and current living status (home alone, home with spouse/friends/or family, assisted living facility, other). These characteristics were chosen based on their relevance to understanding health disparities and social determinants of health impacting food insecurity among stroke patients. They align with

Table 1
Food security status and socio-economic characteristics of patients in an outpatient stroke clinic.

	Overall population (n = 365)		Completed Electronic Questionnaires (n = 234)		Completed Paper-Based Questionnaires (n = 131)		P-value
	N	%	N	%	N	%	
	365	100	234	64.1	131	35.9	
Food Security Status							
Food Insecure	52	14.3	24	10.24	28	21.4	**0.004**
Food Secure	313	85.8	210	89.74	103	78.6	
Socio-demographic Characteristics							
Age (M, SD)	60.5	15.6	60.83	16.26	59.70	14.3	0.520
Gender							
Male	182	50.0	109	46.78	85	54.1	0.10
Female	182	50.0	124	53.22	58	44.3	
Race/Ethnicity							
Hispanic	84	23.0	42	18.0	42	32.1	**0.011**
Non-Hispanic White	144	39.5	104	44.4	40	30.5	
Non-Hispanic Black	109	29.9	69	29.5	40	30.5	
Non-Hispanic Other	22	6.0	16	6.8	6	4.6	
Unknown	6	1.6	3	1.3	3	2.3	
Marital Status							
Single	68	20.1	43	18.5	25	23.6	0.520
Married	198	58.6	134	57.8	64	60.4	
Separated	5	1.5	4	1.7	1	0.9	
Divorced	31	9.2	25	10.8	6	5.7	
Widowed	33	9.8	23	9.9	10	9.4	
Other	3	0.9	3	1.3	0	0.0	
Employment Status							
Employed	112	33.8	82	35.5	30	30.0	0.30
Retired	118	35.7	86	37.2	32	32.0	
Disability (prior to stroke)	39	11.8	22	9.5	17	17.0	
Unemployed	44	13.3	29	12.6	15	15.0	
Other	18	5.4	12	5.2	6	6.0	
Education							
High School Diploma or less	130	40.4	82	36.4	48	49.5	**0.029**
Some College and more	192	59.6	143	63.6	49	50.5	
Current Living Status							
Home -Alone	38	11.3	30	12.9	8	7.8	0.55
Home – With Spouse/Friends/Family	280	83.3	191	82.0	89	86.4	
Assisted Living Facility	5	1.5	3	1.3	2	1.9	
Other	13	3.9	9	3.9	4	3.9	

those collected in national surveys, such as the National Health and Nutrition Examination Survey (NHANES) and the Behavioral Risk Factor Surveillance System (BRFSS), and are routinely collected within our health system to ensure comprehensive patient assessments and facilitate comparisons across different populations and studies.

3.5. Statistical analysis

We examined the counts (and percentages) of patients presenting to the clinic, either discharged from the hospital or referred for new patient evaluation, who completed the food insecurity screener along with any other component of the questionnaire. A completed questionnaire was defined as one with a completed food insecurity screener but may have missing demographic information.

To assess food insecurity and socio-demographic characteristics by screener delivery modality (electronic vs. paper), we used Pearson's Chi-squared test and Fisher's exact test for categorical variables, with a two-tailed p-value below 0.05 as a threshold for significance. We also reported the count and percentage for data missingness across the socio-demographic characteristics by screener delivery modality (electronic vs. paper). Available data analysis was used for missing data. All data analysis were conducted using STATA 16.0 statistical software (StataCorp LLC).

4. Results

4.1. Patient characteristics

There was a total of 654 patients presenting to the STEP clinic for an initial clinic visit in the study period, and 406 patients (62.1 %) met eligibility criteria and completed the questionnaires, and 365 (89.9 %) provided responses to the food insecurity screener (131 individuals completed paper-based questionnaires and 234 completed electronic questionnaires).

The prevalence of food insecurity and the socio-demographic characteristics of patients who completed the food insecurity screener are presented in Table 1. This patient population was predominantly Non-Hispanic White (39.5 %), followed by 29.9 % Non-Hispanic Black, 23 % Hispanic, and 6 % Non-Hispanic other. Among these patients, 33.8 % were employed, 35.75 % were retired, 11.8 % disable (prior to stroke), and 13.3 % were unemployed. Further, 83.3 % of patients reported living at home with spouse/friends/family; meanwhile, 11.3 % reported living at home alone. Overall, 14.3 % of patients reported experiencing food insecurity. A higher prevalence of food insecurity was observed among those who completed the paper-based questionnaires compared to those who complete the questionnaires electronically (21.4 % vs 10.2 %, $p = 0.004$). There were significant socio-demographic differences (i.e., race/ethnicity and education) between the stroke patients who completed the paper-based vs electronic questionnaires by ethnicity and education status. Hispanic patients were more likely to complete the paper-based compared to electronic questionnaires (32.1 % vs 18.0 %, $p = 0.011$). Patients with a 12^{th} grade (high school) education or less were more likely to complete paper-based questionnaires vs. electronic questionnaires (49.5 % vs. 36.4 %, $p = 0.029$).

Table 2 compares the missingness of data captured using electronic versus paper-based questionnaires among the stroke survivor population in the outpatient clinic. The paper-based questionnaires had a higher percentage of missing data for age (10.69 % vs. 2.14 %), marital status (19.08 % vs. 0.85 %), employment status (28.24 % vs. 6.41 %), education (25.95 % vs. 3.85 %), and current living status (21.37 % vs. 0.43 %) when compared to electronic questionnaires.

5. Discussion

In this study, we adapted components of the feasibility framework developed by Orsmond and Cohn [20] to evaluate the

Table 2
Number and percent of missing cases among the overall analytic sample and by completed questionnaire modality from patients in the STEP outpatient clinic.

	Overall population (n = 365)		Completed Electronic Questionnaires (n = 234)		Completed Paper-Based Questionnaires (n = 131)	
	N	%	N	%	N	%
Food Security Status	0	0	0	0	0	0
Age	19	5.21	5	2.14	14	10.69
Gender	1	0.27	1	0.43	0	0
Race/Ethnicity	0	0	0	0	0	0
Marital Status	27	7.4	2	0.85	25	19.08
Employment Status	52	14.25	15	6.41	37	28.24
Education	43	11.78	9	3.85	34	25.95
Current Living Status	29	7.95	1	0.43	28	21.37
Total	171	46.86	33	14.11	138	105.33

Note: The overall analytic sample size is 365. A completed questionnaire was defined as one that had completed the food security screener, but may have had missing data on the socio-demographic characteristics. Because there is missing data in some of the socio-demographics, the sample size is not consistent across all variables.

practicality of screening for food insecurity and assess the data retrospectively among stroke survivors. Among 406 stroke patients evaluated, 89.9 % successfully completed the food insecurity screening questions. The response rate achieved was higher than the Current Population Survey (CPS) Census Bureau study respondents, which reported a response rate of 73 % in December 2021 [2]. Our clinic's high response rate may be attributed to the multiple questionnaire modalities offered to patients, which increases patient's willingness to respond to that portion of the questionnaire. Lower response rate was observed in 2020 and 2021 for the CPS, attributed to the COVID-19 pandemic influencing data collection. The sample in the current study can be considered a sample of convenience and more of a "captive audience" compared to a national sample, and thus could be attributed to a higher response rate. While respondents in the CPS are surveyed using telephone and in-person interviews, the current study used electronic and paper-based surveys, which could have also contributed to the different response rates.

We found statistically significant sociodemographic characteristic differences between patients completing electronic questionnaires compared to patients completing paper-based questionnaires. These reported differences may reflect barriers related to completing electronic questionnaires, including access to internet, access to devices that support questionnaire completion, and digital literacy. Low digital literacy is more common in individuals with lower educational attainment, older age, and lower income [24,25]. These same factors are associated with higher risk for poor outcomes after stroke [26,27]. Furthermore, the physical and cognitive impairments that follow stroke may compound the impact of age, education, and other social determinants of health on the ability to complete electronic questionnaires. The use of strictly electronic questionnaires may not capture those who are at highest risk and need further support.

Among Hispanic patients, the use of paper-based questionnaires was higher compared to electronic questionnaires. There are multiple possible reasons for this that require additional study. Electronic questionnaires for Spanish-speaking patients were not available until the last two months of the study period. Consequently, the absence of an electronic option in Spanish for the first four months may have disproportionately affected their ability to complete the electronic questionnaire. Furthermore, this delay in providing an electronic Spanish questionnaire could have led to an increased preference for and reliance on the paper-based version among Hispanic patients. The delayed availability of the Spanish electronic survey and the associated barriers to its completion likely contributed to the observed differences in the likelihood of form completion by ethnicity, highlighting the need for further research to better understand and address these challenges.

To our knowledge, this is the first retrospective review assessing the successful approach to screening for food insecurity in a stroke survivor population. The prevalence of food insecurity among stroke survivors in this study was 14.3 % which was higher than the national average [2]. Food insecurity is often overlooked among stroke survivors in outpatient clinics [3]. However, systematic screening for food insecurity through the use of a validated food insecurity measure [23], as was done in this study, is the first step. Despite the availability of several federal aid programs that address food insecurity, there is underutilization of these programs among stroke patients who need these programs [27,28]. Further, there is a lack of integration between aid programs and healthcare systems [28]. Integrating a food assistance referral system as a result of food insecurity screening may also be useful for improving delivery of post-stroke care to meet the needs of stroke survivors by facilitating social risk-informed and social risk-targeted care [29].

To standardize food insecurity screening, it is essential to integrate behavioral science and workflow improvements into routine clinical practice. Offering financial incentives and better reimbursement policies can motivate healthcare providers to conduct these screenings more consistently. Additionally, tracking food insecurity screening as a quality improvement (QI) measure can help drive systematic improvements. Strengthening the connections between healthcare systems and community resources can further support the effective implementation of food insecurity screenings.

There are some limitations of this study. Data are from a single center and may not reflect the barriers faced in other institutions or by other stroke survivor populations. There was a dearth of information for those who did not complete the questionnaires, which prevents further assessment of barriers to questionnaire completion. The Spanish version of the questionnaire was not rolled out until the end of the roll out period, which introduced a system-level barrier for those with limited English proficiency. Since the Spanish translated electronic version was added in the last two months of the period, this could have introduced potential bias in the completion rates for electronic versus paper-based questionnaires among Hispanic patients. Further, we cannot precisely quantify the impact of the language availability on the preference for paper questionnaires among Hispanic patients. The absence of this data introduces a potential bias, as the preference for paper-based questionnaires may partly reflect the unavailability of an electronic Spanish option for the majority of the study period. This could lead to an overestimation of the preference for paper-based questionnaires among Spanish-speaking Hispanic patients. In the context of clinical care at our institution, we do not routinely collect certain patient-level information, including income data, insurance details, language preferences, and detailed information on digital literacy or internet access. The absence of these variables reflects the limitations inherent in a retrospective study design. Moreover, considering our outpatient clinic demographics, predominantly Spanish-speaking population with lower technology literacy (or access to internet) may have been under-represented.

Future studies should ensure that all language versions of questionnaires are available from the start of the study period. Additionally, collecting detailed information on language preferences and the specific language used to complete questionnaires would provide more nuanced insights into the factors influencing questionnaire modality preferences among diverse patient populations. Further study and program improvement are needed to address socio-economic data collection through paper surveys. Understanding and mitigating the barriers faced by patients in completing socio-economic data fields, especially in paper surveys, will enhance the accuracy and completeness of data collection. Future research should explore strategies to improve the collection of socio-economic data, possibly through hybrid approaches that combine electronic and paper-based methods or through enhanced support for patients completing paper surveys. We acknowledge the importance of further modeling to explore the nuanced aspects of screener administration and patient characteristics. As such, we recommend future studies that incorporate multivariable regression models and

additional data collection to compare characteristics between patients who chose telemedicine versus in-person appointments.

6. Conclusion

Assessing food insecurity within a stroke clinic is feasible. The use of both electronic and paper-based questionnaires provides the opportunity to comprehensively identify individuals experiencing food insecurity. Clinical care teams can then provide the appropriate referrals and take food insecurity into consideration when developing an outpatient self-management plan for stroke survivors. It is important to note that this study primarily focused on the feasibility of administering the screeners and identifying patients who are food insecure. The next steps in our research will involve systematically providing resource information to those identified as food insecure and assessing the impact of these interventions. We recommend using behavioral science and QI efforts, enhancing financial incentives, and tracking screening as a QI measure. Developing community partnerships can facilitate effective referrals for food insecure patients. These strategies can improve patient outcomes and promote health equity.

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Data availability statement

Data associated with this study has not been deposited into a publicly available repository. Data will be made available on request.

CRediT authorship contribution statement

Maha Almohamad: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Dania Mofleh:** Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Investigation, Formal analysis, Conceptualization. **Daphene Altema-Johnson:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Conceptualization. **Mariam Ahmed:** Writing – review & editing, Writing – original draft, Data curation. **Joseph Fries:** Writing – review & editing, Writing – original draft, Resources, Data curation. **Munachi Okpala:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Conceptualization. **A. Sarah Cohen:** Writing – review & editing, Writing – original draft, Methodology, Data curation. **Daphne C. Hernandez:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Anjail Sharrief:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e36142.

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