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ORIGINAL RESEARCH

Examining knowledge, interests, and preferences of Cherokee adults for improved program design and implementation

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Abstract

Introduction: Cultural engagement and connection are integral to Indigenous health and well-being yet there is limited protocol for eliciting community-based needs to develop and implement culture focused health interventions. This paper details findings from a tribally based participatory research study that documented the level of knowledge and interest Cherokee citizens have in key components of their culture. The study also collected participants' program design preferences. This information will inform the creation of a Cherokee cultural intervention to prevent cardiovascular diseases.

Methods: Indigenous and decolonizing research methodologies were central to the conceptualization, design, and implementation of this research. Data collection was conducted using a cross-sectional, self-report, online survey developed and tested by a Cherokee community advisory board. The study population included enrolled Cherokee citizens over the age of 18 (n=355). Chi-square (X2) analysis, t-tests for continuous variables, and analysis of variance (ANOVA) were utilized to assess sample demographic differences of primary variables of interest.

Results: Most respondents self-reported limited knowledge of important periods in Cherokee history, a low level of knowledge of traditional beliefs, values, lifeways and feelings of tribal connection, and a limited ability to understand, use, and/or speak more than a few Cherokee words (0-9 words). Most participants across all ages, genders, and locations wanted to know more about their history, traditions, and language and reported that they were willing to commit time, over a prolonged period, to further their learning and cultural engagement.

Conclusions: The improved understanding of cultural knowledge, interests, and preferences resulting from this study will play a central role in the development of acceptable, appropriate, and feasible interventions that are grounded in Cherokee community needs and desires for the future. The results also expand upon existing knowledge about optimizing the design and implementation of cultural interventions focused on improving the health and well-being of Indigenous communities.

Keywords: Indigenous, health promotion, well-being, language, culture, connection, community, participatory

Abstract in Español at the end of the article

INTRODUCTION

A growing body of research highlights the importance of understanding the context and centrality of culture for intervention design and implementation within Indigenous communities [1-4]. Interventions that are implemented without cultural tailoring and/or meaningful collaboration with Indigenous communities may not have the intended effect. This can be due to a lack of inclusion of culturally relevant practices, providers, and community leaders, and a reliance on western biomedical approaches that compartmentalize problems and solutions [5-8]. Acceptable and often more effective interventions are community-driven, culturally grounded, and based on tribal/cultural beliefs and values [5]. Other important considerations include incorporation of Indigenous needs and practices around meeting, decision making, and participant engagement [3, 4]. Moreover, interventions that utilize tribally based participatory research (i.e., TBPR) methods, inclusively integrate cultural practices of the community, and seek the Indigenous community's preferences, result in improved feasibility and compatibility to their specific setting [4]. However, there is limited United States-based published research that describes the current knowledge, interests, and preferences of Indigenous communities in the process of engaging culture within the context of intervention development.

This manuscript is part of a larger project aimed to reduce cardiovascular (CVD) risk amongst Indigenous populations. The project began with monthly community advisory board (CAB) meetings to create a Cherokee-informed project to reduce cardiovascular diseases (CVD) risk. After one year, the CAB decided that there was not enough information available about the Cherokee population regarding 1) citizens' cultural and historical knowledge 2) interest in learning Cherokee culture and history, 3) program participation preferences, as well as 4) current physical and mental health statistics. Therefore, the Principal Investigator (first author) with the CAB co-created the survey so that they could complete the creation of the CVD risk reduction program using up-to-date information about Cherokee knowledge, interests, and preferences. This manuscript will detail the results of the survey regarding program participation preferences as well as cultural knowledge and needs, while health information will be presented in a forthcoming manuscript. Data collected for this project was essential in creating a culturally grounded intervention to reduce CVD risk within a Cherokee population. Likewise, we believe that the information gathered in this survey may be helpful in the consideration of program development for a wide range of health, cultural, and educational interventions for Cherokees and could serve as a model for other tribally based participatory research projects.

This paper examines the level of knowledge and interest Cherokee citizens have in key components of Cherokee culture including language, history, and traditional values and practices in preparation for the development of a culture and health centered intervention. As shown in Figure 1, language and culture are at the heart of how Cherokees conceptualize well-being and influence all other determinants of thriving individuals, family, and community [9]. An improved understanding of the state of knowledge and interest in Cherokee culture and practical aspects of program implementation (scheduling, likelihood of participation) are critical to the development of acceptable, appropriate, and feasible interventions that are grounded in Cherokee's current needs and desires for the future.

Figure 1. Key components of Cherokee well-being [9].

Eliciting community need and preferences within Indigenous communities

Eliciting community needs, opinions, and epidemiological data are important preliminary steps for developing and implementing interventions with Indigenous communities [10-12]. Collaboration with Indigenous communities is key to determine what preliminary data is needed, as well as ensuring the development of culturally driven interventions [1]. To accomplish this, research teams have used a variety of methods, including focus groups [13], community advisory boards [14], concept mapping [15], and surveys [16]. All these forms of data collection can guide intervention planning. Survey methods are specifically useful in understanding the broad community needs and preferences about types of interventions or components needed for intervention development. One example, the Tribal Health and Re-

silience in Vulnerable Environments (THRIVE) study, used tailored surveys to assess the needs, preferences, and health behaviors among two Indigenous communities [17]. The survey results were used to define participants' current behaviors and specific needs before designing a social support and physical activity program. This approach helped ensure that the program would be developed to best fit the priorities and preferences of the community, increasing the likelihood of participation [16]. Other Indigenous projects have used surveys to identify health prevalence indicators and participants most urgent needs [16, 18, 19].

Importance of culture for the health of Indigenous populations

A growing body of evidence illustrates that when culture, including Indigenous history, knowledge, values, and lifeways, is woven into prevention and intervention strategies, there is a significant benefit to Indigenous physical, mental/emotional, and social/cultural health [20-22]. Among Indigenous communities in California, those with better reported overall health had stronger cultural connectedness based on fluency in their Indigenous language, higher participation in cultural practices, and sustained connection to the Indigenous community [23]. A study of Anishinaabe adults found protective effects of traditional cultural activity participation against diabetes risks and outcomes. Cultural engagement was related to lowered blood sugar through the path of reduced apathy [24]. A literature review found cultural interventions and cultural and language knowledge among Indigenous communities protective against cardiometabolic disease risk factors [25].

The buffering effects of a supportive social network developed through cultural connection (tribal, familial, and peer) have been linked to reduced health problems. Youth reporting a strong bond to family, community members, and Elders have shown greater resilience and increased protective factors compared to youth with less cultural identity [20, 26-29]. Emotional support decreases mortality risk by half [30] and social support (including social network type, size, and frequency of contact) is linked to increased survival of a cardiovascular event and reduced recurrence [31]. Social networks reduce stress [32, 33] by creating a system of interconnectedness and feedback loops around positive health behaviors [34] and may be as salient, or more, to improved health outcomes as diet, exercise, and tobacco prevention.

Greater cultural spirituality has also been found to improve the mental health of Indigenous people [35-37]. Across a wide age range (15-64 years old) those who reported greater cultural spirituality were less likely to experience a suicide attempt compared to those reporting less cultural spirituality [36]. Regaining cultural identity and greater connection with cultural practices has also been found to protect against substance misuse [38, 39] and may buffer the negative effects of discrimination, historical loss, and trauma [40, 41]. The accumulation of findings, consistent across time and contexts, establishes the critical role cultural engagement and spirituality play in Indigenous health and wellbeing and as protective factors for Indigenous communities.

Role of language and cultural/historical knowledge in health and well-being

Indigenous language loss that has occurred through historical oppression has resulted in worsened physical and mental health of Indigenous communities [42, 43]. Indigenous communities recognize "that language is the medicine" [44; p. 862] and is needed to bring back health and balance to their communities. Using and revitalizing Indigenous language and knowledge increases cultural connectedness and is associated with positive health and well-being making it a particularly salient protective factor for health risks [45-47]. Around the world, maintaining or revitalizing Indigenous languages is associated with positive mental and physical health [43], and improved social and educational outcomes. In Indigenous communities in Canada where at least over half of the community fluently spoke their native language, a near zero suicide rate was found in the youth population (only 1 youth from 1987 –1992), compared to the communities that had fewer native speakers or less knowledge of their native language (84 youth from 1987 – 1992) [48]. Additionally, compared to six other cultural indicators (e.g. self-governance, access to traditional land, facilities for preserving culture, etc.), language knowledge and use had a greatest effect on the reduction of suicide rates among youth [48]. Another study found that strong language use and cultural practices were linked to a reduction in obesity, diabetes prevalence, and cardiovascular disease [49]. Common quantitative measures of socioeconomic status and education could not account for these differences [49]. Consistently, the literature demonstrates that language plays an essential role in Indigenous health and well-being. This is echoed in two reviews regarding the health of effects of Indigenous language use demonstrating that language use is associated with positive mental and physical health outcomes [42, 43]. Therefore, it is vital to gauge the level of use, proficiency, and community needs in preserving and expanding native language. The right to, access to, and use of Indigenous language is an issue of sovereignty, inherent cultural rights and lifeways, as well as a public health.

Culture based interventions in Indigenous communities

The centering of culture preserves Indigenous ways of knowing and living and strengthens cultural connectedness and continuity [50]. Examples of interventions developed by Indigenous people for Indigenous people include a tailored curriculum to teach youth about their heritage, traditions, and culture [51]; the *Qungasvik* ("tools for life") intervention [52]; the Traditional Spirituality Program centered on the sweat lodge ceremony

[53]; the Remember the Removal (RTR) program [54]; a Lakota ceremonial healing program [55]; and The Healing of the Canoe project [5].

Young adult participants in the Cherokee Nation's RTR program shared that the experience facilitated their own reflection about historical events and trauma that their ancestors experienced and how their ancestors reacted and endured in the face of oppression, thereby increasing their Cherokee cultural identity, knowledge about Cherokee values, and feelings of resilience [54]. The participants described emotional connections to learning history, gained an understanding of the effects of discrimination, and increased their sense of resilience and belonging, a protective factor for health [54]. After finishing the RTR program, participants had improved physical, mental, and social/cultural health outcomes immediately after completion and at a six-month follow-up assessment [54]. The results indicate that the RTR program had lasting positive health effects for Cherokee young adults across several health domains, reinforcing evidence for culturally driven interventions within a Cherokee population to improve health and well-being.

Similar positive impacts from culturally centered interventions have been found with other Indigenous groups. Among the Lakota, a group therapy program that facilitated a grieving process through traditional Lakota ceremonies helped participants gain more awareness of historical trauma and grief, resulted in feelings of relief [55], and a newfound commitment to facing historical trauma, while helping their community heal through traditional practices [55]. A traditional hula dance program for Native Hawaiians significantly improved blood pressure and reduced cardiovascular disease risk [56]. Finally, for Suquamish and Port Gamble S'Klallam youth, participating in a four month culturally driven curriculum centered on the canoe journey increased their sense of hope, optimism, and self-efficacy and reduced substance use [5]. Research using tribally-based cultural interventions results in positive health outcomes and promotes the health and well-being of Indigenous people and communities.

METHODS

Indigenous research/decolonizing methodologies

Interventions with Indigenous communities often utilize approaches developed for non-Indigenous populations and then seek to adapt them with limited or no consultation with the target population. In contrast, the methodology used for this research draws on the RTR program, a 30-year-old community-derived initiative created by citizens of the Cherokee Nation. Building off the deep-seated RTR program minimizes potential cultural and ethical violations (e.g., helicopter research, culturally incongruent interventions, etc.) that are common in most research projects with Indigenous communities. This approach also empowers the Cherokee Nation and its citizens to address their own needs using their own values and skillsets.

A critical component of this research is the use of community/tribal-based participatory research (C/TBPR) principles [57] and Indigenous methodologies [58] to partner with the Cherokee Nation. In CBPR, a multidisciplinary team utilizes a flattened hierarchy to approach issues that have been prioritized by community members [59]. Indigenous research methods use Indigenous beliefs and knowledge throughout the research process to guide researchers and restore equity and balance to Indigenous communities [58]. The research question, methods for change, and the interventions must also be community-derived [60] and tailored to the region, community, and culture [61]. Specific CBPR and Indigenous research orientations and methodologies utilized by the research team involved privileging Cherokee-specific ways of being, including meeting styles, cultural protocol, and decision-making processes. The partnerships developed and strengthened through this process can lead to changes in policy and procedures, community action, and improved health outcomes that are defined by both community members and the research team [62-64].

A community advisory board (CAB) (n=9), as well as a history and culture committee (n =4) were formed to create a program to improve cultural connectedness and Cherokee cultural and historical knowledge. Board and committee formation was built upon a previous research project collaboration (e.g., Remember the Removal) in which members envisioned a new project that would focus on Cherokee community revitalization [13]. The history and culture committee was made up of four expert Cherokee historians: three Cherokee Nation citizens, two affiliated with the RTR program, and two PhD level academics. The community advisory board was comprised of nine Cherokee Nation citizens; six were affiliated with the RTR program, two were Cherokee elders, and areas of expertise of the CAB included Cherokee history, mapping, language, mental health, physical health, traditional games, and community programming. To effectively create the program, the board and committee decided to solicit information from Cherokee citizens about their historical and cultural knowledge, their interest in learning more about these topics, and the preferences regarding program implementation. Survey questions were developed collaboratively by the PI, the history and culture committee, the community advisory board, and the PI's mentors. Cherokee linguists, Cherokee historians, sociologists, cardiovascular physicians and Cherokee community members were among those who contributed to the instrument creation.

Authors´ positionality

The study population in this project were Cherokee citizens. The lead author and principal investigator of the study, Dr. Melissa E. Lewis, is a citizen of the Cherokee Nation. Cherokee Nation citizens were engaged in the study from idea formation, throughout the project including dissemination. Specifically, the study was co-

designed by a history and culture committee and community advisory board in which 12 of 13 are Cherokee Nation citizens. The committee and board met monthly for one year to create the research design and study instruments. All study participants reported that they were citizens of a Cherokee federally recognized tribe. Post-survey, the committee and board met again several times to interpret and write the results of the study. All committee and advisory board members were invited to participate in this manuscript as authors. Study results in this manuscript were also presented to a group of Cherokee citizens involved in the larger intervention project for review and editing before dissemination. Of the manuscript authors, 8 of 11 are Indigenous, 3 of 4 of the history and culture committee are represented and 2 of the 9 community advisory board members are authors.

Study context

With over 400,000 registered tribal citizens, Cherokee Nation (CN) is one of the largest federally recognized tribes in the US [9]. The Cherokee Nation comprises 14 counties in Northeastern Oklahoma and is home to 63% of Cherokee citizens and 200,000 other Indigenous peoples. Indigenous people living in the CN have a lower median income ($44,554) [9] and high school completion rate (82.9%) compared to the state average (86.7%) [65]. Federal policies over many eras banned Cherokee cultural and traditional practices including family customs, traditional community living, and traditional Cherokee spirituality (until the Indian Religious Freedom Act in 1978). The Cherokee language was banned in public schools and places due to allotment era policies [66]. Cherokee youth today lack access to Cherokee history education at school and at home and have less access to traditional cultural activities than prior generations. The reduction of Cherokee language use and cultural knowledge and practices have become a critical and growing issue. As a result, there are less than 1500 fluent speakers of the Cherokee language with the average age of around 65 years or older [67, 68].

Study population and data collection

The study population included Cherokee citizens over the age of 18. Data was collected using a self-administered anonymous online Research Electronic Data Capture (REDCapTM) survey. Participants were asked to read and sign an informed consent before completing the survey. The survey link was shared on the Cherokee Nation's Facebook page, which receives extensive traffic. The survey was available for an 8-month period and took an estimated 15-20 minutes to complete. Upon completion, respondents were entered into the chance to win one of three $50 gift cards.

Measures

Survey questions included demographic information (i.e., age, gender, income, education, tribe affiliation, and whether the participant lived on or off the reservation) as well as questions related to knowledge and interest in Cherokee history, traditional cultural activities, language, and cultural connection, as well as self-reported physical and mental health information. For this manuscript's purposes, we will focus on knowledge, interest, and culture. This is the first time these instruments have been used. Questions were created, edited, and piloted by the committee and CAB until a consensus was reached regarding all assessments.

Cultural knowledge, connection and language use

Knowledge of history. Respondents were asked how knowledgeable they were about five key periods in Cherokee history identified by the CAB. Periods included pre and early contact (pre-1690), pre-revolutionary (1700´s-1791), long removal (1760s-1830s), US Civil War (1830s-1860s), and the allotment era (late 1800s-1930s). Each question included a description of events that marked each period (historical period definitions can be found in Supplementary material 1). Response options ranged from No knowledge (0) to Very knowledgeable (4). Respondents were also asked yes/no questions regarding if they knew when family was removed from traditional homelands, family membership in Union or Confederate regiments, location of family allotment land, and continued family ownership of allotment land. A total score was created by taking a sum of all 5 items (range from 0-20), internal reliability for the knowledge items was excellent (Cronbach's alpha = .91).

Tribal community connection. Respondents were asked "How connected do you feel to your tribal community?" Response options ranged from Not at all connected (0) to Very connected (4).

Traditional beliefs. Knowledge of traditional beliefs was assessed by asking respondents,"How knowledgeable do you feel about traditional Cherokee beliefs, values, and lifeways?" Response options ranged from Not at all knowledgeable (1) to Extremely knowledgeable (5).

Language. Respondents shared their level of proficiency in understanding, using, and speaking the Cherokee language (see Table 2 for proficiency levels). These items had high internal reliability (Cronbach alpha = .94). There were also yes/no questions asking respondents if their grandparent was fluent in Cherokee, if their parent was fluent in Cherokee, and if they heard Cherokee spoken in the home while growing up.

Interest in cultural learning

Learning history. Interest in learning history was assessed by asking respondents their interest in learning more about each of the five key periods referenced in the Knowledge of history measure (pre and early contact, pre-revolutionary, long removal, US Civil War, and the allotment era). Response options ranged from Not at all interested (0) to Very interested (4). A total score was created by taking a sum of all 5 items (range from 0-20).

Internal reliability for the historical items was excellent (Cronbach's alpha = .91).

Table 1. Sample demographics.

	N=355	%
Age		
20-29	43	12.11
30-49	189	53.24
≥ 50	123	34.65
Gender		
Female	263	74.08
Male	86	24.23
Gender neutral	6	1.69
Income		
(missing)	69	19.44
< 40k	92	25.92
40-60k	62	17.46
60-80k	28	7.89
80-100k	38	10.70
> 100k	66	18.59
Education		
(missing)	60	16.90
No formal education	3	0.85
H.S. Diploma	78	21.97
College/Vocational degree	127	35.77
Advanced Degree	70	19.72
Other	17	4.79
Which federally recognized Cherokee tribe are you enrolled in?		
Cherokee	349	98.31
UKB	5	1.41
EBCI	1	0.28
Are you affiliated with any other tribes?		
No	332	93.52
Yes	23	6.48
Live on Reservation		
(missing)	3	0.85
No	195	54.93
Yes	157	44.23

Learning traditional activities and values. Respondents were asked their level of interest in learning (Not at all interested - Very interested) traditional activities like stickball (i.e., a precursor to modern day Lacrosse), basket making, pottery, and cooking, traditional cultural values (e.g., Gadugi-this word means people coming together as one and working to help one another), and spirituality like prayers, daily practices, and stomp dance. Internal reliability for the interest in activity items was acceptable (Cronbach's alpha = .65).

Learning language. Respondents shared their level of interest in learning (0 = Not at all interested – 4 = Very interested) key words, basic conversation, and reading and writing in Cherokee. Internal reliability for the language items was excellent (Cronbach's alpha = .86).

Scheduling preferences and time allotment

Scheduling. Scheduling preferences were assessed by asking respondents the likelihood (Not at all likely (0) - Very likely (4)) that they would take 1-2 and 3-5 days off from work/school a month to learn about Cherokee history, culture, and language within the Cherokee Nation 14 county jurisdictional area. Respondents were also asked the days/time (e.g. Friday night) that would be most feasible for them to participate and the learning timeline (Meeting once a month for up to one year (0), Meeting twice a month for 6 months (1), or Meeting 2-3 times a month for 3 months (2)) that would be most preferable.

Dedicating time. Respondents were asked the likelihood that they would dedicate 1-2 hours and 3-5 hours to reading/homework a week. Response options ranged from Not at all likely (0) to Very likely (4).

Analysis

Descriptive statistics were examined for all survey responses. To assess sample demographic differences among respondent knowledge/interest of Cherokee culture, history and language, chi-square (X2) analysis, t-tests for continuous variables, and Analysis of Variance (ANOVA) was utilized. Differences among sample demographics included gender, age, and whether the respondent lived on or off the reservation at the time of the survey. All analyses were performed using SAS, version 9.4.

Ethical considerations

All study materials and protocols were approved through the University of Missouri IRB and the Cherokee Nation IRB. This manuscript was approved by the Cherokee Nation IRB before dissemination.

RESULTS

Characteristics of participants

A total of 355 participants completed the survey. All participants reported that they were citizens of a Cherokee federally recognized tribe. Most participants identified as being Cherokee Nation citizens (98%) and female (74%), with a mean age of 45 years (SD = 12.65, range = 25-86 years; see Table 1). Thirty-seven percent of participants reported their annual household income as being greater than $60,000, with 56% having received a college degree or higher. Nearly half (44%) of participants reportedly live on the Cherokee Nation reservation.

Knowledge of history, culture, and language

When participants were asked about their knowledge of Cherokee history, 60% (or greater) reported little

(1 = 'little knowledge') to no knowledge (0 = 'no knowledge') about the pre- and early contact period, the pre-revolutionary period, the civil war period, and the allotment era. Forty-eight percent of participants, however, reported having 'some knowledge to being very knowledgeable' about the long removal period. Half (50%) of participants remembered when their own family was removed from their traditional homelands. Similarly, 39% of participants (n = 140) reported knowing where their family allotment land is and 43% of these (n = 60) reported that it was still owned by a family member.

Table 2. Knowledge of culture, family history and language; n=355).

	%	Mean	SD	Median	Range
Knowledge of history					
Pre and early contact period		1.13	0.89	1.00	0-4
Pre-Revolutionary		1.07	0.88	1.00	0-4
Long Removal period		1.45	0.91	2.00	0-4
US Civil War period		1.17	0.93	1.00	0-4
Allotment era		1.28	0.94	1.00	0-4
Total Knowledge Score (sum of 5 above)		6.10	3.94	6.00	0-20
Knowledge of family history					
Know when family was removed from traditional homelands	49.58				
Know if family members belonged to Indian Home Guard (Union)	7.61				
Know if family members belonged to Confederate regiments	18.31				
Knowledge of family allotment land	39.44				
Ownership of family allotment land	42.85				
Cultural connection/knowledge of traditions					
Feeling of connection to tribal community		1.95	1.21	2.00	0-4
Knowledge of traditional Cherokee beliefs, values, and lifeways		2.39	1.06	2.00	1-5
Proficiency in understanding the Cherokee language					
I understand 0-9 Cherokee words	58.87				
I understand 10-20 Cherokee words	13.52				
I understand a lot of common words and simple phrases	21.13				
I can understand simple conversations in Cherokee	4.23				
I can understand a lot of conversations in Cherokee	2.25				
Proficiency in using and speaking the Cherokee language					
I can say 0-9 Cherokee words	63.38				
I can say 10-20 Cherokee words	14.65				
I can say a lot of common words and simple phrases	17.46				
I can hold simple conversations in Cherokee	2.82				
I can talk about everyday events in Cherokee	0.85				
I can speak about anything in Cherokee with any Cherokee speaker	0.85				
Cherokee spoken at home while growing up	22.54				
Parent is/was a fluent Cherokee speaker	11.27				
Grandparent is/was a fluent Cherokee speaker	38.59				

SD=Standard Deviation

Mean scores for tribal connection and traditional knowledge were 2 (neutral) and 2.4 (slightly knowledgeable). When asked about their proficiency in understanding and speaking the Cherokee language, more than 70% can understand and/or speak 20 words or less of the Cherokee language, with the majority (58%) only able to speak 0-9 words. Only 22% reported to have heard Cherokee spoken in their home growing up while 11% reported that their parents were fluent in the Cherokee language (see Table 2).

Table 3. Demographic differences - Knowledge of culture, family history and language.

	Female	Male	t	p-value	20-29	30-49	≥50	F	p-value	Off	On	t	p-value
Knowledge of history													
Total score (0-20)	5.57	7.49	3.54	.0006	5.68	6.01	6.19	0.26	.76	5.94	6.15	48	.62
Knowledge of culture													
Connection to comm.	1.86	2.18	2.10	.03	1.85	1.81a	2.17a	3.59	.02	1.67	2.27	4.75	<.0001
Traditional CN beliefs	2.29	2.61	2.38	.01	2.28	2.30	2.50	1.52	.22	2.19	2.60	3.65	.0003
Language proficiency													
Understanding (0-5)	0.71	0.88	1.34	.18	0.90	0.69	0.79	0.87	.42	0.47	1.09	5.73	<.0001
Using and speaking (0-5)	0.58	0.79	1.63	.10	0.88	0.57	0.64	1.56	.21	0.41	0.92	4.93	<.0001

Note: Nine participants were excluded from this analysis due to missing data, total N = 346. T-tests were conducted when comparisons were made between gender and on/off reservation. Analysis of Variance (ANOVA) was conducted when looking at age (i.e., subscript denotes significant differences between age groups, a differs from a). Off and On reservations

When taking gender into account, male respondents reported higher levels of knowledge about Cherokee history than female respondents (7.49 vs. 5.57 respectively, t = 3.54, p =.0006), (Table 3). Additionally, males reported higher knowledge about Cherokee culture (connection to community and traditional beliefs), than female respondents (p <.05). Also, a higher percentage of male respondents reported that the Cherokee language was spoken in their home when growing up as compared to female respondents (33 vs 19% respectively, X2 = 6.41, p = .01). There were, however, no gender differences noted regarding the respondent's understanding and/or speaking of the Cherokee language.

Older respondents (> 50 years) in general reported higher knowledge of Cherokee culture, specifically their connection to the tribal community (F = 3.59, p = .02). Respondents living on the reservation also reported higher levels of Cherokee cultural knowledge including tribal community connection (t = 4.75, p <.0001) and traditional beliefs (t = 3.65, p = .0003) as compared to those living off the reservation. Furthermore, respondents living on the reservation reported higher language proficiency for both understanding and use/speaking (p < .0001).

Interest in learning history, culture/traditions, and language

Participants were very interested (70% or greater) in learning more about Cherokee history, including events like pre- and early contact period, pre-revolutionary period, civil war period, and the allotment era (Table 4). Additionally, participants reported high interest in learning more about traditional Cherokee activities (e.g., stickball, basket making), cultural values, and the Cherokee language.

The strong interest in learning more about Cherokee history, cultural practices, and traditions did not vary significantly by demographic group (Table 5). There were some differences in interest in learning Cherokee language. Middle-aged adults (30-49) had significantly more interest in learning the Cherokee language than older respondents (> 50 years), particularly basic conversational terms (F = 4.62, p = .01), as well as reading and writing skills (F = 6.47, p = .001). Additionally, off reservation respondents reported more interest in learning the Cherokee language, particularly key words (t = 1.98, p = .04).

Likelihood of program participation

In terms of scheduling time for cultural learning, participants reported that they were more likely to take 1-2 days off from work a month (Supplementary material 2). Most participants preferred to attend sessions held over a weekend (80%) and 47% preferred monthly sessions as opposed to more frequent meeting options. Participants were more likely to dedicate 1-2 hours to homework vs 3-5 hours each week.

DISCUSSION

To our knowledge, this survey is the first comprehensive assessment of Cherokee Nation citizens' knowledge and interest in learning about their history, language, and culture. It is also the first to document program preferences. Findings indicate that most respondents had limited knowledge about key periods in Cherokee history and a high interest in learning more, demonstrating an important need for additional educational

opportunities. Those living off reservation and 30–49-year-old respondents reported the most interest in learning more about Cherokee culture. Those that lived off reservation compared to on reservation reported less cultural and language knowledge, most likely representing reduced access to these resources and the community. This finding is similar to research done in other Indigenous communities that found that a desire to learn more about culture is reported even from individuals who experience disconnection from their Indigenous land and community [69].

Table 4. Interest in learning; n=355).

	Mean	SD	Median	Range
Learning history				
Pre and early contact period	3.74	0.55	4.00	0-4
Pre-Revolutionary	3.71	0.61	4.00	0-4
Long Removal period	3.81	0.50	4.00	0-4
US Civil War period	3.73	0.59	4.00	0-4
Allotment era	3.80	0.50	4.00	0-4
Learning activities and values				
Traditional activities like stickball, basket making, pottery, cooking	3.65	0.62	4.00	0-4
Traditional cultural values	3.75	0.51	4.00	0-4
Spirituality like prayers, daily practices, and stomp dance	3.61	0.77	4.00	0-4
Learning language				
Key words in Cherokee	3.84	0.45	4.00	0-4
Basic Cherokee conversation	3.77	0.56	4.00	0-4
Read and write in Cherokee	3.61	0.69	4.00	0-4

SD=Standard Deviation

Less than 40% of participants reported knowing where their family allotment land is, and a similar percentage indicated that the land was still owned by a family member. These findings are indicative of the systematic disenfranchisement that occurred during the allotment era and challenges Cherokee families continue to face in reclaiming their family's allotment land [70]. As noted by Clint Carroll, "present-day natural resource management in the Cherokee Nation is inexorably tied to the history and ongoing practice of settler colonial resource control and exploitation" (p.143) [70]. Cherokees had limited control over their lands which has implications for the ability of Cherokees to thrive, engage in traditional ecological practices, and pass on knowledge, traditions, and values to the next generation [66, 71].

Most respondents indicated that they had a relatively low level of knowledge of traditional beliefs, values, lifeways and feelings of tribal connection but wanted to be more connected, though there were significant differences between genders. Male respondent rated themselves significantly higher than females in knowledge of Cherokee culture. Males also reported at higher rates than females that they grew up in a home in which someone spoke the Cherokee language. It is important to note that there were more females than males in this study which could have affected results as well. Because these questions are self-reported we cannot decern between actual knowledge and belief in one's knowledge. Research has shown that females often underrate their own abilities compared to men, which may explain some of the noted gender differences, although these studies were not conducted within Cherokee populations [72, 73]. There were also significant differences between age groups and respondents living on/off reservation with older respondents and those living on reservations reporting greater knowledge, cultural connection, and traditional Cherokee beliefs, values, and lifeways. All demographic groups expressed a strong interest in learning more about Cherokee history and cultural practices and traditions, suggesting that tribal and community programs should be inclusive of all generations and locations of Cherokees.

There are no known assessments or documents that describe Cherokee citizens' current level of knowledge around their ancestral history or their cultural knowledge. However, there is emerging research that illustrates the positive results related to immersing young adults in cultural learning within Cherokee Nation programming. For example, after participating in the RTR program, Cherokee young adults described how they developed cultural knowledge and values through their involvement. Cultural knowledge and values acquired were "treat everyone with kindness, help each other, work together, take care of one another, treat each other as family, and be confident" (p. 239, Table 1) [74]. These values are consistent with traditional Cherokee values and are translated from the Cherokee language. Therefore, immersive programs such as the RTR exemplify an avenue for revitalizing Cherokee cultural knowledge and transmitting traditional values [74].

Table 5. Demographic differences – Interest in learning.

	Female	Male	t	p-value	20-29	30-49	≥50	F	p-value	Off	On	t	p-value
Interest in Cherokee history													
Total Score	18.7	18.8	0.09	.93	18.2	18.9	18.7	1.59	.20	18.8	18.73	0.22	.82
Interest in learning Cherokee culture													
Activities like stickball	3.67	3.62	0.69	.49	3.60	3.66	3.67	0.21	.80	3.67	3.64	0.44	.66
Trad. cultural values	3.74	3.77	0.45	.65	3.65	3.77	3.76	0.87	.41	3.78	3.72	0.99	.32
Spirituality	3.65	3.51	1.38	.16	3.58	3.67	3.54	1.15	.31	3.64	3.58	0.75	.45
Interest in learning Cherokee language													
Keywords	3.84	3.88	0.82	.41	3.85	3.88	3.80	1.04	.35	3.89	3.79	1.98	.04
Basic conversation	3.77	3.77	0.09	.92	3.75	3.85a	3.65a	4.62	.01	3.77	3.77	0.12	.90
Read/write	3.61	3.65	0.56	.57	3.63	3.73a	3.45a	6.47	.001	3.58	3.67	1.23	.22

Note: Nine participants were excluded from this analysis due to missing data, total N = 346. T-tests were conducted when comparisons were made between gender and on/off reservation. Analysis of Variance (ANOVA) was conducted when looking at age (i.e., subscript denotes significant differences between age groups, a differs from a). Off and On reservations

Cherokee language

Most survey respondents (around 60%) can speak only a few Cherokee words (0-9 words) while 17% can say common words and phrases. Less than 1% were fluent Cherokee speakers. This is not surprising given that only around 11% said that their parents were fluent speakers and 39% reported that their grandparents were fluent speakers. This data builds on a 2002 assessment that reported that, at that time, all fluent Cherokee speakers were over the age of 40 and most of their children in their sample were not fluent speakers [75]. Therefore, most fluent speakers today are likely over the age of 60.

Until recent history, the Cherokee language was the primary language of choice and use. While the history of Cherokee language use is not well documented, in 1817, all Cherokees spoke the Cherokee language and about ¾ were bilingual (English) [76]. To ensure the perpetuation of the Cherokee language, those that spoke English during treaty negotiations were fined by the tribe. An 1835 census of Cherokees found that twice the number of Cherokees could read Cherokee compared to English (2,714; 1,071) demonstrating a Cherokee preference for reading and writing [77]. A photo of Cherokee Nation Principal Chief John Ross in 1866 has comments written in Cherokee demonstrating his language fluency [78]. In 1872, a report from the Annual Report of the Board in Indian Commissioners shared that, "While at most the whole of Cherokees who do not speak English can read and write the Cherokee by using the characters invented by Sequoyah [79] (p. 159)," suggesting that Cherokee literacy was near 100% at that time.

An anthropological report of four Cherokee communities in Oklahoma in 1964, found that, "At present, Cherokee is the language of Cherokee settlements. At community gatherings virtually all formal discourse and most informal conversation is in Cherokee [80]." The author noted that for most Cherokees, the Cherokee language was their first language and was learned in the home. The report found no community in which English language was the primary language and shared that English is only learned in school [80]. Even for Cherokee communities that used English, the Cherokee language was still found to be the primary language for more than half of those households. The report concludes that the "older (Cherokee) generation wants to hang on to its language [80]," and that is why the use of the language is so pervasive. Further, the author writes a moving statement about the role of Cherokee language within Cherokee culture; "It is becoming apparent that Cherokee is spoken at such times not only because Cherokee speakers exist, but also because use of Cherokee defines the event as a Cherokee event," [80] highlighting the centrality of the Cherokee language to Cherokee culture.

The 1964 anthropological report occurred during the final stages of the boarding school era (1869-1960s) [81] and the effects of this era have proved devastating for the Cherokee language. During the 1920's, over 80% of Indigenous children in the United States were enrolled in boarding schools. During the boarding school era, most fluent Cherokee speakers entered primarily English-speaking environments by the age of 5 years old, thus prohibiting boarding school attendees from passing their language down to their children. At the same time, United States government suppressed not only the Cherokee language, but other cultural lifeways, in large effort to assimilate Cherokees to Western culture [61].

By 2002, only 17% were speaking Cherokee regularly in their home [75]. Fluent speakers reported that this decline started before or during the start of elementary

schools and most of their children did not speak Cherokee fluently [75]. In the current study, 22% reported that some amount of Cherokee was spoken at home and less than 1% in our sample were currently fluent speakers (e.g., "I can speak about anything in Cherokee with any Cherokee speaker"). It is important to note that this study did not purposively sample fluent speakers as was the case in the 2002 assessment. Further, technology accessibility and survey interest could also have affected the ability for fluent speakers to participate in this online study, possibly limiting their participation.

Despite US federal government efforts to diminish the Cherokee language, especially in educational settings, Cherokees continued then, and still today, to print their language in public press, radio, and media and to communicate informally in Cherokee through conversation and private writings, which promotes preservation and continuation of the written language [82, 83]. Other Indigenous communities have experienced similar challenges with language loss and share that settler-colonial environments continue to negatively affect language loss and language learning. For example, in a study in Hawaii, participants shared that they struggled to integrate their Indigenous language into their life, which has been dominated by Western culture and driven by expectations of English dialogue [84].

The Cherokee Nation Language Department reports that there are about 2,000 first language speakers of Cherokee across the three federally recognized tribes of Cherokee people (Cherokee Nation, Eastern Band of Cherokee Indians, and the United Keetoowah Band of Cherokee Indians) and several thousand tribal members currently participating in Cherokee language programs [85]. An estimate of 2,000 fluent speakers out of approximately 400,000 federally recognized Cherokees represents a rate of less than 1% of the Cherokee population are fluent speakers, which is consistent with this study's findings [86]. Also, the 2,000 speakers estimate has not been adjusted to account for the nearly 500 speakers known to have died since 2019 [68, 67]. As mentioned earlier, a 2002 report found that no one younger than 40 had proficient conversational skills and only 17% of speakers use Cherokee in their home [67]. As a result, most children of Cherokee language speakers cannot speak Cherokee [67].

The results of our survey indicate a decline in interactions with and exposure to fluent Cherokee speakers especially for those living off the Cherokee Nation reservation and participants in the youngest age group (20-29), so more outreach to younger generations and/or those living off reservation could have significant positive impacts. Furthermore, most respondents expressed a strong interest in learning more of the Cherokee language. This has been echoed by Cherokees for many years: Through history (1964 [80], 2002 [75]) and even today, as demonstrated in this survey, Cherokees report a desire to be more proficient in speaking the Cherokee language and rate it as very important to impart the language to future generations. A growing body of research has demonstrated that Indigenous language use and revitalization have positive health, social, and educational impacts for Indigenous people [45-47, 43]. Therefore, programs with a strong Cherokee language component may be instrumental in improving Cherokee health and well-being and fulfilling the needs and desires of Cherokee citizens to preserve, revitalize, and actively use the Cherokee language.

Our survey also highlights that most Cherokees feel the need to speak their language and believe its upmost preservation is important for future generations. As the number of parents that speak the Cherokee language is declining, it is drawing their children and families to look for other resources outside of the home to learn Cherokee culture and language. Cultural language loss does not occur in a vacuum and is a critical indicator of the health of a culture.

Limitations

This study is limited by the convenience sample that was used for data analysis. There was an oversampling of women in this study, most participants were between the ages of 30-50 and there was a higher proportion (56%) of those college-educated in our sample compared to the general Oklahoma population (53%) and the average rate for Native Americans (46%) [87]. This could have been due to recruitment and survey methods being solely online and using social media for recruitment. Purposeful and in person sampling and survey taking may be important to facilitate in the future to improve representation and generalizability. Many measures that were employed have not been previously validated, because they were created for this specific population, resulting in high internal reliability.

Conclusion

This cross-sectional survey provides data and trends regarding Cherokee citizens' knowledge, interests, and preferences related to cultural connection and learning. Cherokees of all ages, genders, and locations want to know more about their history, traditions, and language and are willing to commit time, over a prolonged period, to further their learning and cultural engagement. Specifically, there is a need and desire for more programs to teach Cherokee history, language, and culture and for citizens to connect to their tribal community. Given the low rates of cultural and linguistic Cherokee knowledge, along with the rapidly decreasing rates of fluent speakers, Cherokees face an impending linguistic crisis, cultural crisis, and, consequently, a public health crisis. However, with the appropriate support and allocation of resources, these crises may be averted. Specifically, research shows that programs focused on traditional cultural beliefs and practices improve physical, mental, and social/cultural health [20-24, 36-40, 42-47, 54]. In addition to health benefits and community desires, language and culture are central to the Cherokee worldview and are critical for the continuity of Cherokee people.

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AI utilization
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Author contributions
MEL, JDB, RS, JR, SH, and TSW designed the study. MEL, IB, BNA, and JBS wrote the first draft. JBS helped facilitate data collection, conducted data analysis, and created tables. MEL, IB, BNA, JDB, RS, JR, SH, TSW, and HP edited and finalized the manuscript. MEL procured funding for the study. All authors significantly contributed to this manuscript and gave final approval of this manuscript.

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ABSTRACT IN SPANISH

Examinando los conocimientos, intereses y preferencias de personas adultas Cherokee para mejorar el diseño y la implementación de programas

Introducción: La participación cultural y la conexión con la cultura son elementos fundamentales para la salud y el bienestar de los pueblos Indígenas; sin embargo, existe una limitada sistematización de protocolos para identificar necesidades comunitarias que permitan desarrollar e implementar intervenciones de salud centradas en la cultura. Este artículo presenta los hallazgos de un estudio de investigación participativa de base tribal que documentó el nivel de conocimiento e interés que las personas ciudadanas Cherokee tienen respecto a componentes clave de su cultura. El estudio también recogió las preferencias de las y los participantes en relación con el diseño de programas. Esta información servirá para orientar la creación de una intervención cultural Cherokee destinada a la prevención de enfermedades cardiovasculares.

Métodos: Las metodologías de investigación Indígena y descolonizadora fueron centrales en la conceptualización, el diseño y la implementación del estudio. La recolección de datos se realizó mediante una encuesta transversal, autoadministrada y anónima en línea, desarrollada y pilotada por un consejo asesor comunitario Cherokee. La población de estudio incluyó a ciudadanos Cherokee inscritos, mayores de 18 años (n=355). Se utilizaron análisis de chi-cuadrado (χ^2), pruebas t para variables continuas y análisis de varianza (ANOVA) para evaluar diferencias demográficas en las principales variables de interés.

Resultados: La mayoría de las personas participantes reportó un conocimiento limitado sobre períodos importantes de la historia Cherokee, bajos niveles de conocimiento sobre creencias tradicionales, valores y formas de vida, así como débiles sentimientos de conexión tribal. Asimismo, señalaron una capacidad limitada para comprender, usar y/o hablar más que unas pocas palabras en lengua Cherokee (0–9 palabras). La mayoría de las y los participantes, independientemente de la edad, el género o el lugar de residencia, expresó interés en aprender más sobre su historia, tradiciones y lengua, y manifestó disposición a comprometer tiempo de manera sostenida para profundizar su aprendizaje y participación cultural.

Conclusiones: La mejora en la comprensión del conocimiento cultural, los intereses y las preferencias derivada de este estudio desempeñará un papel central en el desarrollo de intervenciones aceptables, apropiadas y viables, fundamentadas en las necesidades y aspiraciones de la comunidad Cherokee para el futuro. Los resultados también amplían el conocimiento existente sobre cómo optimizar el diseño y la implementación de intervenciones culturales orientadas a mejorar la salud y el bienestar de las comunidades Indígenas.

Palabras clave: Indígena, promoción de la salud, bienestar, idioma, cultura, conexión, comunidad, participativa

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