Original research

DIGITAL HEALTH

DIGITAL HEALTH
Volume 9: 1–9

DOI: 10.1177/20552076231194913
journals.sagepub.com/home/dhj

Sage

Digital screening method using social media advertising for the remote assessment of trigeminal neuralgia

Fu-Yu B Chen[1] and Daniel AN Barbosa[2]

Abstract

Objective: Global trends, such as improving accessibility to healthcare services through the Internet, and the COVID-19 pandemic are among the driving factors in the adoption of digital health. This study hypothesized that digital solutions can reach and gather data from a large number of patients with trigeminal neuralgia (TN), a commonly misdiagnosed neuropathic facial pain syndrome, and quickly and fast-track their diagnosis by suggesting them to consult a neurologist. We developed an accessible digital screening tool based on patient symptoms and history to test this hypothesis and used social media advertisement to screen a general population for TN.

Methods: The standard diagnostic criteria, International Classification of Orofacial Pain, for facial pain is digitized as a web-based questionnaire that allows easy access to the evaluation for patients with suspected TN symptoms. Targeted search with relevant keywords and display campaigns on Google search engine and Facebook social media platform were used to reach large numbers of subjects. A report was autogenerated, which included a summary of a subject's symptoms, likely or likely not TN diagnosis, and information to seek appropriate medical assistance.

Results: The website was live for seven weeks and generated 240 screening questionnaire submissions, with a total spending of $2482. Forty-four subjects (18.3%) that reported typical symptoms of TN experienced unilateral and episodic pain in one of the trigeminal nerve regions.

Conclusions: We have demonstrated the feasibility of social media advertisement and digitally screening a general population for TN, gathering valuable clinical data, such as pain characteristics, through a web-based questionnaire. Based on these data, patients with similar symptoms of TN are suggested to consult a neurologist for diagnosis. This study provides a framework for using digital screening tools to improve the healthcare experience of patients who would spend several months before finding appropriate diagnosis for their specific conditions.

Keywords

Digital health, facial pain, web-based diagnosis, social media, remote assessment

Submission date: 12 January 2023; Acceptance date: 28 July 2023

Introduction

Trigeminal neuralgia (TN) is a debilitating pain disorder that is characterized by intermittent, typically unilateral, sharp, and electric shock-like episodes of pain in one or more of the distributions of the trigeminal nerve.[1] These episodes are precipitated by seemingly innocuous stimuli ("triggers") that are encountered in everyday life—eating,

[1]Biomedical Engineering Department, Chung-Yuan Christian University, Taoyuan City, Taiwan
[2]Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Corresponding author:
Fu-Yu B Chen, Biomedical Engineering Department, Chung-Yuan Christian University, No. 200, Zhongbei Road, Zhongli District, Taoyuan City, Taiwan.
Email: beverlychen@cycu.edu.tw

chewing, talking, tooth brushing, or even a gentle breeze.[2] Accordingly, this disorder has a dramatic influence on the quality of life of affected individuals.[3] Episodes may be sporadic, occurring multiple times per day and as frequently as few to few hundred times per day.[4] Microvascular decompression (MVD) provides immediate pain relief in over 90% of patients and permanent and complete pain relief in approximately 80% of patients.[1] Treatment for TN is well established and effective because of the success rates of pharmacological and surgical interventions, such as MVD.[5] Nevertheless, a significant gap in care evident. Trigeminal neuralgia has a small prevalence of approximately 6–29 cases per 100,000 person-years.[6–8]

Primary care clinicians and dentists may not encounter many TN patients in their practice due to its rarity. The diagnosis of TN is typically based on patient's pain characteristics and clinical history. Accordingly, appropriate diagnosis is a challenge for nonexpert clinicians in primary care, especially in the early phases. Antonaci et al.[9] showed that patients frequently suffer from TN symptoms for 10.8 months prior to receiving a definitive diagnosis, and they spent on average 7.2 months and multiple visits to various providers prior to receiving a diagnosis. Approximately 82% of TN patients initially consulted a dentist because the pain is frequently triggered by eating, and 53% of these patients routinely underwent unnecessary invasive dental procedures—including tooth extractions and root canals, sometimes multiple times—due to misdiagnosis.[10,11] Neurologists are well aware of the tumultuous journey that TN patients face and even implement workflows to prioritize the triage of new TN patients as quickly as possible to ease the pain and frustration that they have experienced.

Despite the relatively low disease prevalence, help can be extended to TN patients, and the financial burden of this patient population on the healthcare system can be minimized in the prediagnosis period. Trigeminal neuralgia conditions can be screened in a variety of ways, such as existing orofacial pain questionnaires[12,13] and MRI imaging,[14] and patients can be given proper care. However, these methods are not widely accessible to patients and suitable for primary care due to certain barriers: (1) administered in person; (2) administered by a specific specialist; (3) potentially high cost; (4) scheduled during availability of patients and providers; and (5) demand definite diagnosis.[15] Consequently, the demand for accessible methods for screening and reaching TN patients that direct them to appropriate medical assistance is increasing. Digital health solution is an attractive area for innovation in expediting TN diagnosis.

The current state of digital health creates opportunities for solutions to reach specific populations at a convenient time and location. Global trends, such as an increased challenge for rural patients to access healthcare and the COVID-19 pandemic, have resulted in increased clinical adoption and patient acceptance of digital health solutions.[16] Moreover, the healthcare industry is now transitioning toward value-based healthcare, which reimburses based on outcomes and patient experience. Efforts must be exerted to provide personalized healthcare experiences and improve patient outcomes and experience. Personalized digital health carries immense potential to improve our ability to deliver improved healthcare experiences to a wider range of patients, including those with less common conditions. Digital screening tools targeted directly and specifically to patients with relevant health care concerns (e.g., identified through keywords used in web searches) have significant potential to improve access to proper diagnosis and become the best treatment. These tools can contribute to a higher level of satisfaction with healthcare experiences.

We hypothesized that digital screening solutions can quickly reach and gather data from large numbers of patients with specific medical conditions. To test this hypothesis, we developed an accessible digital screening tool that targets patients with TN, a commonly misdiagnosed neuropathic facial pain syndrome.[9] The aim of this study is to develop a tool that can efficiently and cost-effectively reach a considerable number of patients with a clinical presentation similar to TN and gather meaningful clinical information in a short period of time.

Methods

Online screening instrument development

To develop an accessible digital screening tool for TN, we interviewed healthcare professionals with expertise in diagnosing and treating patients with TN (e.g., neurologists and neurosurgeons) from a tertiary academic hospital (Stanford Health Care) and reviewed the TN definition[17] and the diagnostic criteria of the International Classification of Orofacial Pain (1st edition).[18] Based on the abovementioned information, we prepared a screening questionnaire that included pain history, pain location, and additional history questions and TN criteria, as shown in Table 1. The episodic and unilateral pain in the trigeminal nerve facial regions (jaw, cheek, and forehead) was used as objective screening criteria to categorize subjects into likely and likely not TN diagnosis, and a report was autogenerated. The content of the report contains pretabulated information on a general description of TN symptoms and treatment options, a summary of a subject's symptoms, likely or likely not TN diagnosis, and suggestion to consult neurologist for likely TN diagnosis for further investigation or primary physician for likely not TN diagnosis for alternative diagnosis. The report is printable for the subject to discuss with clinicians. An example of the report is supplied in Supplementary A.

Table 1. Screening questionnaire questions, options, and TN definition and criteria.

Questions	Questionnaire options	TN definition and criteria
Episodic or continuous pain	Episodic (occurs in bursts) and continuous (nearly constant)	Episodic
Pain location and face region	One side or both sides of face. Jaw, cheek bone, forehead, temple, nose, whole side, jaw joint, and tooth	One side of face in the region of one or more of jaw, cheek bone, and forehead (TN location)
Pain severity	On a scale of 1 to 10	Severe pain
Pain characteristics	Shooting, dull, sharp or stabbing, achy, sore, shock-like, and tender	Electric shock-like, shooting, and stabbing or sharp
Frequency and duration of episodic pain	Always, sometimes, and never	Recurrent paroxysms lasting from a fraction of a second to 2 min
Additional history	Prior consultation/ diagnosis, medication history (steroids, aspirin, NSAIDs, and opioids), and dental care	Patients with TN also frequently endure multiple unnecessary dental procedures prior to reaching a diagnosis

TN: trigeminal neuralgia.

In the questionnaire, the question sequence and content were adaptive based on the selected answer to previous questions. The purpose of the adaptive questionnaire was to streamline the data collection by only asking relevant questions. For example, if a subject reported bilateral pain, then all options presented for the subject to indicate pain location were bilateral (Figure 1). Answering every question was not mandatory to increase submission rate, giving the subjects the freedom to skip questions when they feel irrelevant or uncomfortable to disclose.

Subject engagement and advertisement targets

To digitally reach and engage subjects, we used targeted search and display campaigns on search engines, such as Google, and social media platforms, such as Facebook, to drive traffic to our web-based questionnaire. We identified relevant keyword themes and phrases, including "jaw pain," "facial pain," and "dental pain," that TN subjects are likely to enter when searching the internet to perform targeted search and display ads.

A budge of $4000 was allocated for paid advertisements for seven weeks to understand the funding required to acquire a potential TN subject. The target age range for the subject was set between 35 years old and 65 years old for Google and Facebook ads, and the target location is United States. The age range was limited to adults and elderly because they correspond to the majority of TN patients. An advertisement about our website was written to engage with potential TN subjects, as shown in Figure 2(a). In the target search campaign, the ad was shown to users who entered keywords and phrases that Google deemed to be related. The display campaign used a keyword and phrase mechanism to find target subjects when they were visiting properties outside of Facebook and Google, such as browsing online, watching YouTube videos, or checking email. A similar approach using keywords and phrases was completed for social media advertising.

Data analysis

Website visits are defined as unique sessions in which a participant viewed at least one page within the website. Submissions encompass all entries in the screening questionnaire, including the partial responses. Costs account for paid advertisements on Google and Facebook. A chi-square test of independence was performed to examine the relation between likely TN diagnostic subjects and whether they report seeing a provider or not.

Results

Website design for subject engagement

A website was created to digitally reach potential TN subjects (Figures 2(b)–2(d)). The website contains an engaging title, relatable quotes from TN patients, an explanation of the solution (how it works), and information regarding our mission and background to build credibility and trust for subjects to complete the questionnaire.

Website engagement and cost

The website was live for seven weeks (from 15 July 20 to 31 August 20), and the total cost for advertisement was $2482. The website generated 1883 unique visits and 240 screening questionnaire submissions over seven-week study period (Figure 3(a)). The conversion rate from website visit to complete questionnaire was on average approximately 12.5%. Paid display advertisement was live for the first two weeks, but the conversion rate was

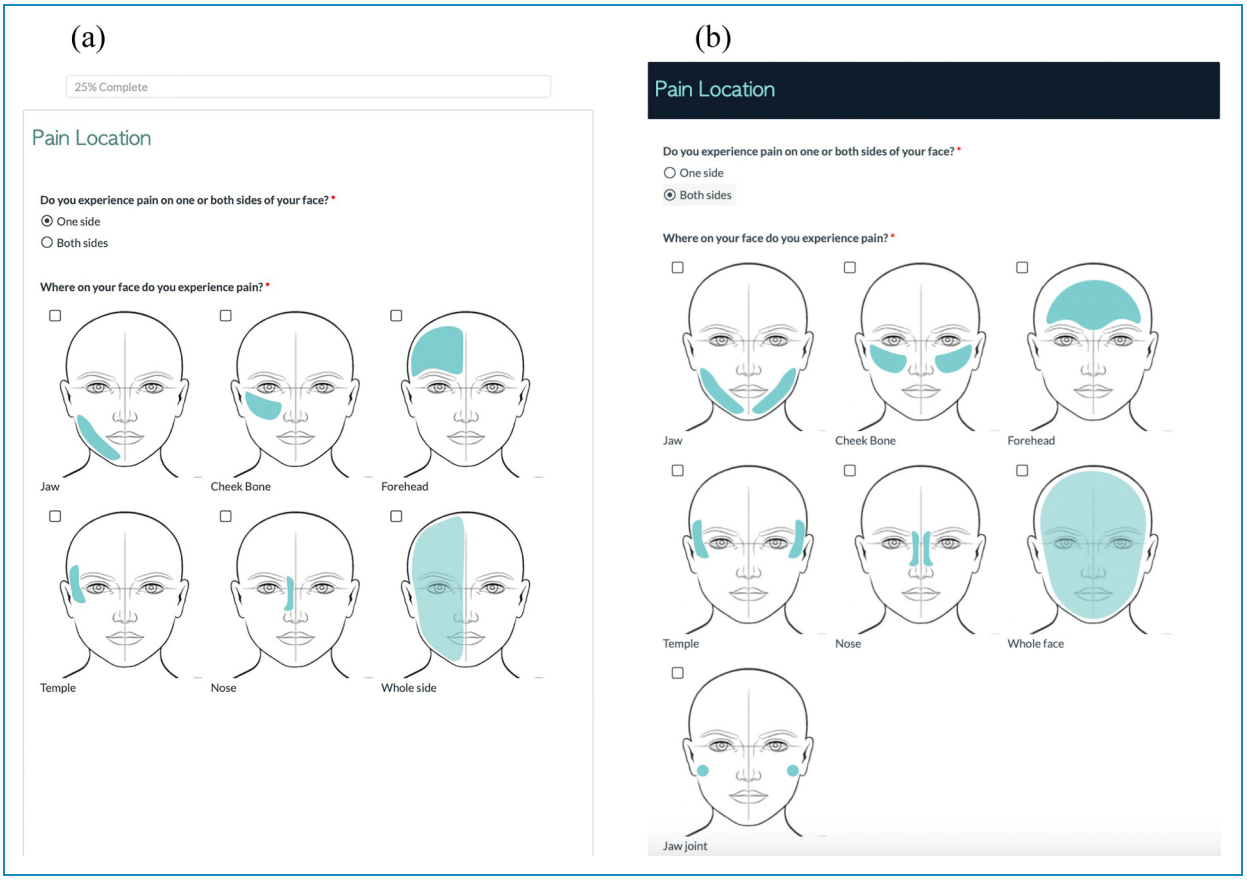

Figure 1. Example of the adaptive questionnaire. (a) Question display when "one side" is selected. (b) Question display when "both sides" is selected.

unstable. After switching to paid search advertisement, the conversion increased from 5% in week 2 to a steady state of approximately 12%–15% by week 3, as shown in Figure 3(b).

A breakdown of the cost used for the different digital advertising channels and the characteristics of questionnaire submissions are shown in Table 2. The digital advertising costs for every website visit and questionnaire submission were $1.32 and $10.34, respectively. Spending $2062 on Google ads generated 48% of the traffic (902 unique visitors). Meanwhile, spending $420 on Facebook advertisement contributed 16% of the traffic (302 unique visitors). Majority of the questionnaire submissions were received from mobile operating systems (61%) and completed in less than 5 min (76%).

Questionnaire results

The questionnaire results showed that 44 (18.3%) out of the 240 total subjects met the likely TN diagnostic criteria of having episodic pain on one side of the face at jaw, cheek, or forehead location. The website recommended these subjects print out their reported symptoms and consult a neurologist. The subject symptoms reported in the screening questionnaire are shown in Table 3. Moreover, the subjects provided pain scores on a Visual Analog Scale ranging from 0 (no pain) to 10 (worst pain possible). Pain ratings below 8 (45%) and greater than 8 (43%) were similar in submissions. Majority of the subjects reported continuous (66%) and unilateral pain (57%). However, a similar number of patients reported pain in each region of the face defined in Table 1. The most common characteristics of pain reported by subjects were achy (48%), sharp or stabbing (44%), and sore (35%). Majority of the respondents reported additional dull background pain always (33%) or sometimes (47%).

The patient diagnosis and treatment experiences reported in the screening questionnaire are outlined in Table 4. A similar number of subjects reported having been seen by a healthcare provider regarding their pain (34%) as those who had not (32%). Among the individuals that reported being seen by a provider, majority of them consulted a primary care physician (23%). No significant relationship was observed between likely TN subjects that reported having seen by a provider ($\chi^2 = 2.24$, $df = 1$, and $p > 0.05$). Out of the 44 subjects who reported having received

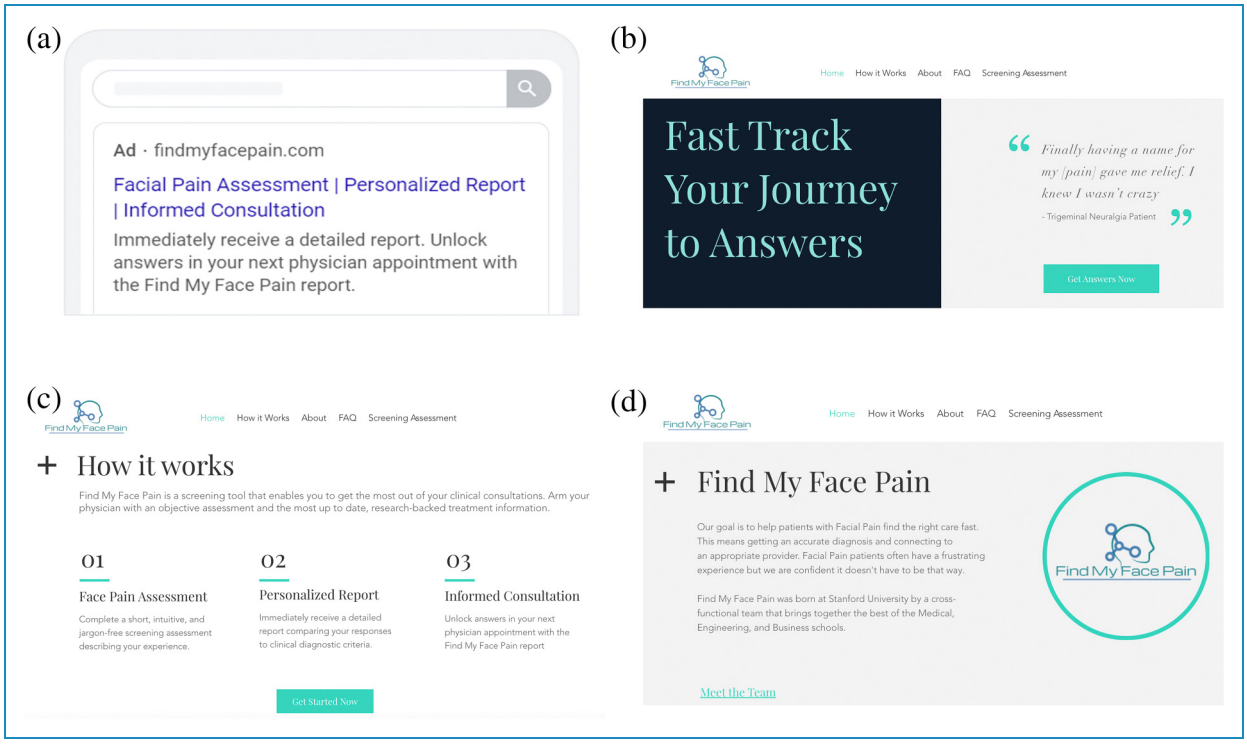

Figure 2. (a) Example of a Google ad for our website. This advertisement consists of three engaging headlines and detailed descriptions explaining the benefits of our diagnostic questionnaire. (b) Website to engage potential trigeminal neuralgia (TN) subjects. Engaging title and relatable quotes from TN patients. (c) Our solution for the TN subjects is explained in three simple steps. (d) Our mission and the description of the team members.

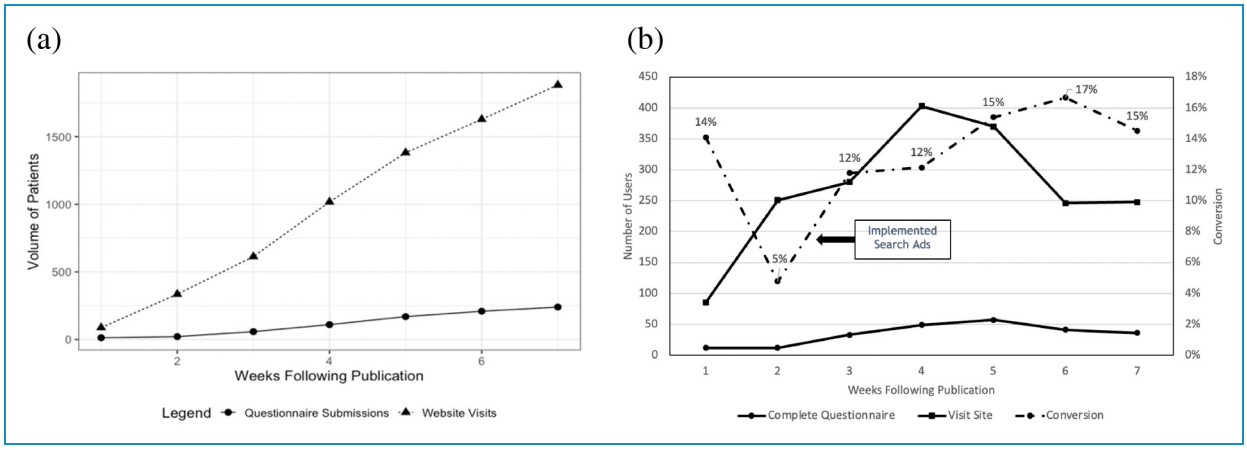

Figure 3. (a) Cumulative number of patients that visited the website and completed the screening questionnaire every week following website publication. (b) Patient funnel: converting from site visit to completed questionnaire.

a diagnosis, more than half of them (55%) did not believe that the diagnosis was accurate. The subjects reported taking medications for their pain in 45% of all submissions, with nonsteroidal anti-inflammatory drugs or NSAIDs (61%) and opioids (50%) as the most common medications. Thirty-seven subjects (15%) reported having received dental treatment for their pain.

Discussion

Trigeminal neuralgia is a rare neurological disease characterized by debilitating pain attacks, significantly affecting the patient's quality of life. Although TN has a straightforward diagnosis criterion and effective treatment, it is commonly misdiagnosed and treated in the primary care setting

Table 2. Cost breakdown of spending on digital advertisements and characteristics of the screening questionnaire submissions.

	N	(%)
Digital advertising channels	–	–
Google ads	$2062.26	(100)
Google search, YouTube, and map	$1555.70	(75)
Google partner websites	$505.39	(25)
Facebook	$419.98	(100)
Total questionnaire submissions	240	(100)
Duration (minutes)	–	–
<2 min	72	(30)
2–5 min	110	(46)
>5 min	58	(24)
Operating system		
Desktop	85	(35)
Mobile	147	(61)
Other	8	(3)

as dental or atypical facial pain. Currently, a suitable initial assessment tool for use in primary care by nonexpert clinicians is lacking. The demand for accessible screening methods for likely TN subjects that can direct them to the appropriate diagnostic and treatment pathways is increasing. The internet has expanded the accessibility of health and medical information for individuals who frequently search for medical information.[19,20] The objective of this study is to determine the feasibility of a targeted search and display advertisement campaign to digitally reach and screen potential TN subjects.

This research demonstrates the feasibility of a digital screening tool for a small prevalence disease and diagnostics that primarily rely on patient symptoms and history. This study reached approximately 1883 unique visits and 240 screening questionnaires by using targeted search and display campaigns on Google and Facebook platforms with a digital screening questionnaire in a span of seven weeks. Out of the 240 questionnaires submitted, 44 subjects (18.3%) exhibited symptoms similar to TN and were advised to consult a neurologist for further examination. A similar method has been used in the study of McCartney et al.[21] to diagnose patients with different facial pain syndromes, such as typical TN (TN1), by using an online questionnaire with artificial neural network (ANN) based on facial pain syndromes and patient history training data. The online digital screening solution proposed in this study offers a faster method to reach potential target subjects, increased convenience by removing time and location requirements, and minimized costs by eliminating labor and overhead costs with the traditional clinical screening method. McCartney et al.[21] took five years and seven months to gather 813 facial pain patients for their online facial questionnaire from one medical center.

The key aspect of this study is its suggestion that one of the main factors that define the utility of the various screening tools is their capability to acquire meaningful clinical data to point patients toward the most appropriate diagnostic and treatment pathways. This work is particularly useful for screening TN subjects that require prompt diagnosis and minimizing unnecessary treatments, such as tooth extraction. In contrast with the formal orofacial diagnostic questionnaires,[12,13] the online digital screening method proposed in this study does not need to provide a specific diagnosis. This method can filter responses to capture the overwhelming majority of subjects who are likely to have TN condition (i.e., high sensitivity). Furthermore, we were able to gather detailed information about the experiences of subjects with facial pain at a relatively low cost of $10.34 per subject and 62% of budgeted advertisement spent (cost: $2482, budget: $4000). This study included the assessment of pain intensity, frequency, quality, location, and characteristics, as indicated in Results section. These aspects are the same key features of TN pain syndromes that neurologists attempt to uncover in in-office diagnostic visits. Additionally, we collected information about current experience in relation to the diagnostic (e.g., healthcare providers visited) and treatment attempts (e.g., medications and dental treatments). These data are also the key information used by neurologists in determining the next steps for diagnosis and treatment. A printable report with the abovementioned information at the end of the digital questionnaire allows subjects to understand their conditions and immediately seek appropriate medical assistance. Meanwhile, the report with patient symptoms and history assists clinicians in making efficient diagnostic and treatment decisions. This work can aid in expediting the delivery and minimize the cost of healthcare for TN patients.

The internet hosts a diverse demographic, including individuals experiencing facial pain and likely TN subjects who have and have not consulted a healthcare provider, which opens the possibility of remotely and digitally reaching a large population of suspected subjects. However, the conversion rate remained low, and the cost associated with reaching and engaging with a target subject is high due to the absence of a target strategy. Accordingly, the advertisement channel and strategy that align with the target medical

Table 3. Summary of patients that reported symptoms.

	N	(%)
Total questionnaire submissions	240	(100)
Pain intensity	–	–
4–7	108	(45)
8–10	103	(43)
No response	15	(6)
Pain type	–	–
Episodic	78	(32)
Frequency	–	–
Hourly	19	(24)
Daily	46	(59)
Weekly	4	(5)
Monthly	9	(11)
Duration	–	–
1–60 s	30	(38)
1–60 min	46	(59)
>1 h	2	(3)
Continuous	159	(66)
No response	3	(1)
Pain location	–	–
Unilateral	136	(57)
Bilateral	47	(20)
No response	57	(24)
Face region	–	–
Cheek bone	77	(32)
Forehead	47	(20)
Jaw	85	(35)
Jaw joint	75	(31)
Nose	45	(19)
Teeth	48	(20)
Temple	64	(27)
Whole side	54	(23)
No response	57	(24)
Characteristics	–	–
Achy	116	(48)
Dull	77	(32)
Sharp or stabbing	106	(44)
Shock-like	67	(28)
Shooting	81	(34)
Sore	83	(35)
Tender	72	(30)
No response	2	(1)
Background dull pain	–	–
Always	77	(33)
Sometimes	112	(47)
Never	49	(21)
No response	2	(1)

condition must be carefully considered. In this study, paid search is a significantly better channel for reaching potential TN subjects than paid display advertisement because subjects may actively search for a solution on the internet due to unresolved pain.

Limitations

Although this study shows several benefits of the digital screening tool for TN, it has some limitations. A report with suggestions was presented to the subjects at the end of the online questionnaire. We neither referred the potential TN subjects to neurologists nor followed up on their diagnosis. Furthermore, the likely TN screening criteria were based on the subjects that manifested TN signs of episodic and unilateral pain, commonly referred to as typical TN (TN1). However, the other types of TN were not

Table 4. Summary of patient reported diagnosis and treatment.

	N	(%)
Total questionnaire submissions	240	(100)
Patient seen by a provider	–	–
Yes	81	(34)
Dentist	43	(18)
Ear, nose, and throat physician	40	(17)
Emergency care	11	(5)
Neurologist	47	(20)
Primary care physician	55	(23)
No	76	(32)
No response	83	(35)
Diagnosed	–	–
Yes	44	(18)
Believed that the diagnosis is accurate	20	(45)
Believed that the diagnosis is inaccurate	24	(55)
No	37	(15)
No response	159	(66)
Used medications		
Yes	107	(45)
Aspirin	28	(26)
NSAIDs	65	(61)
Opioids	54	(50)
Steroids	30	(28)
No response	134	(56)
No	50	(21)
No response	83	(35)
Received dental treatment	–	–
Yes	37	(15)
No	119	(50)
No response	84	(35)

included in the diagnostic criteria, such as TN2 with constant background pain17 and subject presenting rare bilateral TN pain.[22] This situation could potentially result in false positives and additional management and referral in the healthcare system. McCartney et al.[21] demonstrated high sensitivity (92.4%) in diagnosing TN1 using an online questionnaire and an ANN algorithm in one medical center. Future research should explore the sensitivity and specificity of integrating an online TN screening solution for general population into a healthcare referral network.

Another limitation is that the online digital screening tool has a dilemma between convenience and completion of questions. In this study, the majority of the questionnaire submissions (75%) were completed in less than 5 min because answering all the questions was not mandatory, giving the subjects the freedom to skip certain questions and quickly complete them. The drawback was incomplete data collection. For example, a considerable number of participants did not respond to the additional medical history questions compared with the symptom-related questions in this study. Future study should focus on codesigning a user-centered and informative online digital questionnaire with neurologists and primary care clinicians.

Conclusions

We have demonstrated the feasibility of screening a general population for likely TN subjects through social media advertisement and a web-based questionnaire. Such a mechanism allowed us to gather valuable clinical data, such as pain characteristics and prior history, from the participants. This study provides a framework for using targeted, digital screening tools to remotely and digitally reach a reasonable number of suspected TN subjects in a short period of time and at a reasonable cost. A printable report with the abovementioned information at the end of the digital questionnaire allows subjects to understand their conditions and immediately seek appropriate medical assistance. Digital screening solution can improve the healthcare experience of patients who would otherwise spend several months before finding an appropriate diagnosis.

Acknowledgements: The authors express our gratitude to the neurologists and neurosurgeons at Stanford Health Care for their valuable clinical insights. In addition, the authors extend their thanks to Stanford Biodesign for funding the study.

Contributorship: FC and DB conducted a thorough review of the literature and conceptualized the study. FC was involved in protocol development and website setting. DB conducted the data analysis. FC and DB wrote the draft of the manuscript. FC finished the final draft of the manuscript. All authors reviewed

and edited the manuscript and approved the final version for submission.

Declaration of conflicting interests: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval: The study was carried out in accordance with the Declaration of Helsinki. All subjects were informed about the study, and all of them gave their consent to participate.

Funding: The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by Stanford Biodesign Summer Extension Grant. Stanford Byers Center for Biodesign.

Guarantor: FC.

ORCID iD: Fu-Yu B Chen https://orcid.org/0000-0001-8168-0850

Supplemental material: Supplemental material for this article is available online.

References

1. Xu R, Xie ME and Jackson CM. Trigeminal neuralgia: current approaches and emerging interventions. *J Pain Res* 2021; 14: 3437–3463.
2. Di Stefano G, Maarbjerg S, Nurmikko T, et al. Triggering trigeminal neuralgia. *Cephalalgia* 2018; 38: 1049–1056.
3. Zakrzewska JM, Wu J, Mon-Williams M, et al. Evaluating the impact of trigeminal neuralgia. *Pasin* 2017; 158: 1166–1174.
4. Türk Börü Ü, Duman A, Bölük C, et al. Botulinum toxin in the treatment of trigeminal neuralgia: 6-month follow-up. *Medicine (Baltimore)* 2017; 96: e8133.
5. Holste K, Chan AY, Rolston JD, et al. Pain outcomes following microvascular decompression for drug-resistant trigeminal neuralgia: a systematic review and meta-analysis. *Neurosurgery* 2020; 86: 182–190.
6. Svedung Wettervik T, Snel D, Kristiansson P, et al. Incidence of trigeminal neuralgia: a population-based study in central Sweden. *Eur J Pain* 2023; 27: 580–587.
7. Koopman JSHA, Dieleman JP, Huygen FJ, et al. Incidence of facial pain in the general population. *Pain* 2009; 147: 122–127.
8. De Toledo IP, Conti Réus J, Fernandes M, et al. Prevalence of trigeminal neuralgia: a systematic review. *J Am Dental Assoc* 2016; 147: 570–576.e572.
9. Antonaci F, Arceri S, Rakusa M, et al. Pitfals in recognition and management of trigeminal neuralgia. *J Headache Pain* 2020; 21: 82.
10. von Eckardstein KL, Keil M and Rohde V. Unnecessary dental procedures as a consequence of trigeminal neuralgia. *Neurosurg Rev* 2015; 38: 355–360.
11. Tripathi M, Sadashiva N, Gupta A, et al. Please spare my teeth! Dental procedures and trigeminal neuralgia. *Surg Neurol Int* 2020; 11: 55.
12. Jafree DJ, Zakrzewska JM, Bhatia S, et al. Accuracy of the painDETECT screening questionnaire for detection of neuropathic components in hospital-based patients with orofacial pain: a prospective cohort study. *J Headache Pain* 2018; 19: 03.
13. Herrero Babiloni A, Nixdorf DR, Law AS, et al. Initial accuracy assessment of the modified S-LANSS for the detection of neuropathic orofacial pain conditions. *Quintessence Int* 2017; 48: 419–429.
14. Reid MC, Eccleston C and Pillemer K. Management of chronic pain in older adults. *BMJ* 2015; 350: h532.
15. Teshima T, Zakrzewska J and Potter R. A systematic review of screening diagnostic tools for trigeminal neuralgia. *Br J Pain* 2023; 17: 255–266.
16. Ruth J, Willwacher S and Korn O. Acceptance of digital sports: a study showing the rising acceptance of digital health activities due to the SARS-CoV-19 pandemic. *Int J Environ Res Public Health* 2022; 19: 596.
17. Eller JL, Raslan AM and Burchiel KJ. Trigeminal neuralgia: definition and classification. *Neurosurg Focus* 2005; 18: E3.
18. International classification of orofacial pain. *Cephalalgia* 2020; 40: 129–221.
19. Ciofani JL, Han D, Allahwala UK, et al. Internet search volume for chest pain during the COVID-19 pandemic. *Am Heart J* 2021; 231: 157–159.
20. Bratucu R, Gheorghe IR, Purcarea RM, et al. Cause and effect: the linkage between the health information seeking behavior and the online environment—a review. *J Med Life* 2014; 7: 310–316.
21. McCartney S, Weltin M and Burchiel KJ. Use of an artificial neural network for diagnosis of facial pain syndromes: an update. *Stereotact Funct Neurosurg* 2013; 92: 44–52.
22. Xu R, So RJ, Lee KK, et al. Sequential onset of bilateral trigeminal neuralgia: clinical presentation and outcomes. *Clin Neurol Neurosurg* 2023; 229: 107745.