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HEALTH PERCEPTION, HEALTH BELIEF MODEL-BASED SMOKING CESSATION CONSTRUCTS, AND NICOTINE DEPENDENCE AS PREDICTORS OF INTENTION TO QUIT SMOKING AMONG DEAF AND HARD-OF-HEARING YOUNG ADULTS

SAĞIR VE İŞİTME GÜÇLÜĞÜ YAŞAYAN GENÇ YETİŞKİNLERDE SAĞLIK ALGISI, SAĞLIK İNANÇ MODELİ TEMELLİ SİGARA BIRAKMA BİLEŞENLERİ VE NİKOTİN BAĞIMLILIĞININ SİGARAYI BIRAKMA NİYETİNİ YORDAYICI ROLÜ

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ABSTRACT

Objective: This study aimed to examine the relationships among health perception, Health Belief Model-Based Smoking Cessation constructs, nicotine dependence, and intention to quit smoking among deaf and hard-of-hearing young adults, and to determine the predictive contribution of these variables to intention to quit smoking.

Method: This cross-sectional correlational study included 680 deaf and hard-of-hearing young adults aged 18-25 years. Data were collected using the Fagerström Test for Nicotine Dependence, the Intention to Quit Smoking Scale, the Health Belief Model-Based Smoking Cessation Scale, and the Health Perception Scale. Pearson's correlation analysis, hierarchical multiple regression, mediation analysis, moderation analysis, and structural equation modelling were performed.

Results: Intention to quit smoking was significantly and positively associated with health perception and self-efficacy, and significantly and negatively associated with the HBM-SCS composite score, nicotine dependence, smoking consumption, degree of hearing loss, and perceived barriers ($p<.001$). The final hierarchical regression model explained 35.6% of the variance in intention to quit smoking ($R^2=.356$). Self-efficacy was a statistically significant mediator of the association between smoking consumption and intention to quit smoking; the indirect effect was -0.50 , with a 95% bootstrap confidence interval of $[-0.64, -0.37]$. Degree of hearing loss significantly moderated the association between smoking consumption and intention to quit smoking ($B=-0.12$, $SE=0.05$, $t=-2.40$, $p=.017$). The structural equation model demonstrated good fit ($\chi^2/df=2.51$, $CFI=.962$, $TLI=.953$, $RMSEA=.042$, $SRMR=.035$).

Conclusion: Health perception, Health Belief Model-Based Smoking Cessation constructs, and nicotine dependence were significantly associated with intention to quit smoking among deaf and hard-of-hearing young adults. Self-efficacy emerged as a significant mediator, whereas degree of hearing loss showed a significant moderating role.

Key Words: Hearing Loss, Nicotine Dependence, Smoking Cessation, Self Efficacy

ÖZ

Amaç: Bu çalışmanın amacı, sağır ve işitme güçlüğü yaşayan genç yetişkinlerde sağlık algısı, Sağlık İnanç Modeli temelli sigara bırakma bileşenleri, nikotin bağımlılığı ve sigarayı bırakma niyeti arasındaki ilişkileri incelemek ve bu değişkenlerin sigarayı bırakma niyetini yordamadaki katkılarını belirlemektir.

Yöntem: Kesitsel ve ilişkisel desende yürütülen bu çalışmaya 18-25 yaş aralığında 680 sağır ve işitme güçlüğü yaşayan genç yetişkin dahil edildi. Veriler, Fagerström Nikotin Bağımlılığı Testi, Sigarayı Bırakma Niyeti Ölçeği, Sağlık İnanç Modeli Temelli Sigara Bırakma Ölçeği ve Sağlık Algısı Ölçeği kullanılarak toplandı. Verilerin analizinde Pearson korelasyon analizi, hiyerarşik çoklu regresyon analizi, aracılık analizi, düzenleyicilik analizi ve yapısal eşitlik modellemesi uygulandı.

Bulgular: Sigarayı bırakma niyetinin sağlık algısı ve öz-yeterlik ile pozitif yönde ve istatistiksel olarak anlamlı; SİM-SBÖ bileşik puanı, nikotin bağımlılığı, günlük sigara tüketimi, işitme kaybı düzeyi ve algılanan engeller ile negatif yönde ve istatistiksel olarak anlamlı ilişkili olduğu belirlendi ($p<.001$). Hiyerarşik regresyon analizinin nihai modeli, sigarayı bırakma niyetindeki toplam varyansın %35,6'sını açıkladı ($R^2=.356$). Öz-yeterliğin, sigara tüketimi ile sigarayı bırakma niyeti arasındaki ilişkide istatistiksel olarak anlamlı bir aracı değişken olduğu saptandı; dolaylı etki -0.50 ve %95 bootstrap güven aralığı $[-0.64, -0.37]$ olarak hesaplandı. İşitme kaybı düzeyinin, sigara tüketimi ile sigarayı bırakma niyeti arasındaki ilişki üzerinde istatistiksel olarak anlamlı bir düzenleyici etkiye sahip olduğu belirlendi ($B=-0.12$, $SE=0.05$, $t=-2.40$, $p=.017$). Yapısal eşitlik modelinin iyi düzeyde uyum gösterdiği saptandı ($\chi^2/df=2.51$, $CFI=.962$, $TLI=.953$, $RMSEA=.042$, $SRMR=.035$).

Sonuç: Sağlık algısı, Sağlık İnanç Modeli temelli sigara bırakma bileşenleri ve nikotin bağımlılığının, sağır ve işitme güçlüğü yaşayan genç yetişkinlerde sigarayı bırakma niyeti ile anlamlı düzeyde ilişkili olduğu belirlendi. Öz-yeterlik, sigara tüketimi ile sigarayı bırakma niyeti arasındaki ilişkide anlamlı bir aracı değişken olarak öne çıkarken, işitme kaybı düzeyinin bu ilişki üzerinde anlamlı bir düzenleyici rol oynadığı saptandı.

Anahtar Kelimeler: İşitme Kaybı, Nikotin Bağımlılığı, Sigarayı Bırakma, Öz-yeterlik

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INTRODUCTION

Tobacco use ranks among the leading causes of premature mortality and morbidity worldwide and is regarded as a critical public health issue, particularly among young adults. According to World Health Organisation data, tobacco use causes the deaths of approximately eight million people each year, with a significant proportion of these deaths occurring among individuals under the age of 30 [1]. Adolescence is a developmental period characterised by an increase in risky behaviours and the rapid shaping of health behaviours due to peer influence and social conformity. Consequently, the risk of nicotine use initiated at a young age progressing to addiction in later years is particularly high. Tobacco use that begins at an early age leads to the behaviour becoming chronic, the strong consolidation of biopsychosocial processes, and the formation of a cycle that makes quitting difficult [2].

Smoking initiation among young people reflects interacting social, psychological, and biological influences, including social environment, media exposure, stress management, and family modelling [3]. Ongoing maturation of reward and impulse-control systems may further increase vulnerability to nicotine dependence [4]. Thus, early smoking has both behavioural and neurobiological implications, and nicotine addiction is best understood as a multidimensional process involving physiological, cognitive, and behavioural components [5].

The Fagerström Test for Nicotine Dependence (FTND) is one of the most widely used assessment tools for evaluating nicotine dependence. The test assesses dependence severity using indicators such as smoking frequency, time to the first cigarette of the day, and difficulty refraining from smoking [6]. Higher nicotine dependence has been associated with lower motivation and greater difficulty in quitting. Accordingly, assessment of nicotine dependence is relevant to understanding intention to quit smoking. The FTND provides a brief behavioural measure of dependence severity, while the broader literature also highlights psychological and environmental correlates of smoking and quitting [6-8]. Nicotine dependence has additionally been prospectively associated with psychiatric disorders, indicating the relevance of considering psychological factors alongside dependence severity [9].

Current theoretical approaches suggest that nicotine dependence alone does not fully account for smoking-related intentions and outcomes. Psychological and social factors, including emotion regulation, stress-related coping, and environmental reinforcement, have also been associated with smoking behaviour [7,8]. Research on youth and young adult tobacco use similarly highlights the importance of multiple individual, social, and behavioural factors in understanding tobacco use [10]. This broader perspective supports examining dependence-related factors together with cognitive and psychosocial variables.

When seeking to understand smoking-related intentions among young adults, nicotine dependence alone may not provide a complete account; cognitive factors such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy may also be relevant. In this context, the Health Belief Model (HBM) is a widely used theoretical framework for examining health-related beliefs and behaviours [11]. In the present study, smoking cessation-related beliefs were assessed using the Health Belief Model-Based Smoking Cessation Scale (HBM-SCS), which includes perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

Intention is an important cognitive component of smoking-related behaviour and has been examined in relation to future-oriented cognitions among young adults [12]. Within the HBM, self-efficacy refers to confidence in performing and maintaining a health-related behaviour; higher self-efficacy has been associated with stronger

smoking cessation intentions and more favourable cessation-related outcomes [13,14].

Perceived benefits and perceived barriers are also relevant to smoking cessation-related cognitions. Greater perceived benefits may be associated with more favourable evaluations of quitting, whereas greater perceived barriers may be associated with lower intention to quit. Similarly, self-efficacy has been linked to confidence in managing the difficulties associated with quitting. Together, these findings support examining HBM-SCS constructs as correlates of intention to quit smoking rather than assuming that they directly cause behavioural change [15,16].

Health perception is a psychosocial construct reflecting an individual's subjective evaluation of their health status. Previous research has reported associations between health perceptions, awareness of smoking-related risks, and motivation or intention to quit [17]. Accordingly, health perception may represent a relevant correlate of intention to quit smoking, although it should not be treated as equivalent to perceived susceptibility or other risk-related constructs.

Research involving people with disabilities has highlighted potential inequalities in access to health information and smoking cessation services [18]. For deaf and hard-of-hearing individuals, communication and structural barriers may be particularly relevant to health-information access [19-21]. These contextual factors provide an important background for examining smoking-related cognitions and intention to quit smoking among deaf and hard-of-hearing young adults.

Previous studies have reported that deaf and hard-of-hearing individuals may experience communication barriers when accessing healthcare and health information [22-24]. Such barriers may be relevant to smoking cessation support and the understanding of health-related messages, although these mechanisms were not directly measured in the present study. Therefore, the present study focuses on the measured associations among nicotine dependence, health perception, HBM-SCS constructs, and intention to quit smoking.

The limited number of studies examining smoking-related intentions among deaf and hard-of-hearing young adults in Türkiye represents an important gap in the literature [25,26]. Much of the existing research has focused on tobacco use or the physiological consequences of smoking, whereas less is known about intention to quit smoking in relation to health perception and smoking cessation-related beliefs. Examining these associations may therefore contribute to a more specific understanding of quit intention in this population.

Given the limited evidence in this population, the study focuses on measured associations rather than assuming unmeasured mechanisms underlying smoking behaviour.

Understanding intention to quit smoking may benefit from considering both dependence-related and cognitive factors. The Health Belief Model provides a relevant theoretical framework for examining constructs such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy [11]. These constructs may be particularly informative when considered alongside the accessibility and communication context experienced by deaf and hard-of-hearing young adults.

Evidence regarding the application of HBM-related constructs among deaf and hard-of-hearing populations remains limited. Accordingly, evaluating the associations of HBM-SCS constructs with intention to quit smoking may help clarify the relevance of this theoretical framework in this population without implying causal effects.

In this regard, the primary aim of the study was to determine the extent to which health perception, Health Belief Model-Based Smoking Cessation constructs, and nicotine dependence were associated with and predicted intention to quit smoking among deaf and hard-of-hearing young adults. The study also examined indirect and

conditional associations involving self-efficacy and degree of hearing loss.

METHOD

Study Design and Participants

This study used a cross-sectional correlational design to examine associations among nicotine dependence, health perception, Health Belief Model-Based Smoking Cessation constructs, and intention to quit smoking among deaf and hard-of-hearing young adults. The design enables the examination of relationships and predictive associations between variables but does not establish causality. The independent variables were health perception, HBM-SCS constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy), and nicotine dependence; the dependent variable was intention to quit smoking.

The study sample consisted of 680 deaf and hard-of-hearing young adults aged between 18 and 25 years living in the Aegean Region of Türkiye. Initially, 722 individuals were assessed for eligibility; 42 were excluded due to incomplete responses or not meeting inclusion criteria, resulting in a final sample of 680 participants. Participants were recruited through special education centres affiliated with universities, youth centres, deaf associations, and various public announcements, and were selected using a convenience sampling method. Although this sampling approach offers advantages in terms of accessibility, it is widely used in the literature, particularly for recruiting disadvantaged populations.

The inclusion criteria were being between 18 and 25 years of age, having a diagnosed hearing impairment (congenital or acquired), being a regular smoker (defined as smoking at least one cigarette per day for the previous three months), and providing complete responses to all study instruments. Data from 42 participants who did not meet these criteria were excluded from the analyses. Consequently, all analyses were conducted using data obtained from 680 eligible participants.

Outcome Measures

Five main measurement tools were used to collect data for the study. These were the sociodemographic questionnaire, the Fagerström Test for Nicotine Dependence, the Intention to Quit Smoking Scale, the Health Belief Model-Based Smoking Cessation Scale, and the Health Perception Scale. These tools were selected to comprehensively assess young adults' levels of tobacco dependence, their motivation to quit, and their health belief structures.

Sociodemographic Questionnaire: A sociodemographic questionnaire was developed by the researcher to collect participants' demographic characteristics, hearing-related information, and smoking-related behaviours. It included items on age, gender, marital status, educational level, hearing loss characteristics, hearing aid/implant use, preferred mode of communication, smoking duration, daily cigarette consumption, quit attempts, and smoking among family members. The questionnaire was administered together with the study instruments to describe the sample and facilitate group comparisons and statistical analyses.

Fagerström Test for Nicotine Dependence: The Fagerström Test for Nicotine Dependence is a six-item scale developed by Heatherton et al. [27] and adapted into Turkish by Uysal et al. [28] to assess the severity of physical nicotine dependence. The scale evaluates the amount of cigarette consumption, compulsion to smoke, and dependence intensity. Total scores range from 0 to 10, with higher scores indicating greater nicotine dependence. Scores are classified as: 0-2 very low, 3-4 low, 5 moderate, 6-7 high, and 8-10 very high dependence. In the Turkish validation study, the Cronbach's alpha coefficient was reported as .56. In the present study, the FTND demonstrated adequate internal consistency, with a Cronbach's alpha coefficient of .70.

Intention to Quit Smoking Scale (IQSS): The Intention to Quit Smoking Scale, developed by Söyler and Yorulmaz [29], was used to assess participants' intention to quit smoking. The IQSS is a one-dimensional instrument consisting of eight items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate a stronger intention to quit smoking. In the original validation study, the scale demonstrated satisfactory psychometric properties, explaining 67.34% of the total variance, with factor loadings ranging from .72 to .90. The original study reported excellent internal consistency, with a Cronbach's α of .93. In the present study, the scale demonstrated good internal consistency, with a Cronbach's α of .88.

Health Belief Model-Based Smoking Cessation Scale (HBM-SCS): The Health Belief Model-Based Smoking Cessation Scale [30] was developed to measure the core components of the Health Belief Model related to smoking cessation behaviour. The HBM-SCS consists of 19 items across six subscales: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Items are scored from 0 (strongly disagree) to 4 (strongly agree). In the present study, an HBM-SCS composite score was calculated by reverse-scoring the two items belonging to the perceived barriers subscale (SIM14 and SIM15) before their inclusion in the composite score. This scoring procedure aligned the direction of the composite score so that higher values represented a more favourable smoking cessation-related health-belief profile. The internal consistency coefficient for the 19-item composite score was Cronbach's α = .91. The HBM-SCS composite score was used in the correlation, hierarchical regression, and structural equation modelling analyses, whereas the individual HBM-SCS subscales were retained and interpreted separately according to their respective constructs.

Health Perception Scale (HPS): The Health Perception Scale was originally developed by Diamond et al. [31] and adapted into Turkish by Kadioğlu and Yıldız [32] to assess participants' perceptions of health. The Health Perception Scale consists of 15 items and four subscales: sense of control, certainty, self-awareness, and importance of health. Items are rated on a five-point Likert scale, with higher total scores indicating a more positive perception of health. In the Turkish validation study, Cronbach's α coefficients ranged from .60 to .76 across the subscales, with an α of .77 for the total scale. In the present study, Cronbach's α coefficients ranged from .62 to .78 across the subscales, and the total scale demonstrated good internal consistency (α = .81).

Data Collection

Data were collected between February and April 2026. Participants were first informed about the purpose, scope and confidentiality of their responses, and were then invited to take part in the study. Informed consent was obtained from those who agreed to participate in the study. Participants completed the questionnaires either online via a secure platform with sign language video instructions or in person with the assistance of certified sign language interpreters. For participants using Turkish Sign Language, all instructions and questionnaire items were presented in sign language to ensure accessibility and comprehension. Standardised verbal and sign language explanations were provided to all participants. During the administration, participants' questions were answered and necessary explanations were provided. Participation was entirely voluntary, and participants were free to withdraw from the study at any stage. The questionnaires took approximately 20-25 minutes to complete. At the end of the data collection process, forms that were invalid or substantially incomplete were excluded from the analysis; the data of a total of 680 participants who met the study criteria were included in the analyses.

Ethical Approval

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Muğla Sıtkı Koçman University Social and Human Sciences Research Ethics Committee (date: 23.02.2026, decision number: 45). Informed consent was obtained from all participants prior to data collection.

Statistical Analysis

The data were analysed using IBM SPSS Statistics version 26. The dataset was initially screened for missing data and the assumptions of normality. Frequencies, percentages, means, and standard deviations were calculated to describe participants' sociodemographic characteristics and study variables. Pearson's correlation analysis was used to examine associations among variables. Independent-samples *t* tests and one-way analyses of variance (ANOVAs) were conducted to compare study variables across sociodemographic groups. A four-step hierarchical multiple linear regression analysis was performed to examine the relative contribution of predictors to intention to quit smoking.

Mediation analysis was conducted using PROCESS macro Model 4 with 5,000 bootstrap samples to examine the indirect association between smoking consumption and IQSS through self-efficacy. An indirect effect was considered statistically significant when the 95% bootstrap confidence interval did not include zero. Moderation analysis was conducted using PROCESS macro Model 1 to examine whether degree of hearing loss moderated the association between smoking consumption and IQSS. Structural equation modelling (SEM) was conducted using AMOS 24.0 to evaluate overall model fit. Model fit was assessed using χ^2/df , CFI, TLI, RMSEA, and SRMR. Prior to hierarchical multiple regression, assumptions related to multicollinearity, independence of residuals, normality, homoscedasticity, and influential observations were examined and found to be satisfactory. Statistical significance was set at $p < .05$.

RESULTS

The sample consisted of 680 deaf and hard-of-hearing young adults (58.1% female; 41.9% male), with a mean age at onset of hearing loss of 7.4 ± 3.1 years. Most were single (85.3%), students (61.8%), and living with their families (66.2%). Moderate hearing loss was most common (38.2%), followed by severe (27.2%), profound (18.4%), and mild (16.2%) loss. Overall, 66.9% used hearing aids and/or cochlear implants and 47.1% reported sign language as their primary communication mode. Comparisons of scale scores according to demographic and clinical characteristics are presented in Table 1.

As shown in Table 1, male participants had higher HBM-SCS composite scores, $t(678) = -9.00$, $p < .001$, Cohen's $d = 0.69$, and FTND scores, $t(678) = -10.06$, $p < .001$, Cohen's $d = 0.77$. In contrast, female participants had higher HPS total scores, $t(678) = 7.45$, $p < .001$, Cohen's $d = 0.57$, and IQSS scores, $t(678) = 9.50$, $p < .001$, Cohen's $d = 0.73$.

Significant differences were observed across age groups for all scale scores. Bonferroni-adjusted post hoc comparisons indicated that HBM-SCS composite and FTND scores increased across age groups (18-20 < 21-23 < 24-25 years), whereas HPS total and IQSS scores decreased (18-20 > 21-23 > 24-25 years; all $p < .001$). Effect sizes ranged from $\eta^2 = .043$ to $.067$.

Married participants had higher HBM-SCS composite scores, $t(678) = -4.48$, $p < .001$, Cohen's $d = 0.35$, and FTND scores, $t(678) = -6.15$, $p < .001$, Cohen's $d = 0.48$. Conversely, single participants had higher HPS total scores, $t(678) = 5.51$, $p < .001$, Cohen's $d = 0.43$, and IQSS scores, $t(678) = 6.09$, $p < .001$, Cohen's $d = 0.48$.

Hearing loss severity was associated with substantial differences across all study variables. As hearing loss severity increased from mild to profound, HBM-SCS composite scores increased, $F(3,676) = 53.15$, $p < .001$, $\eta^2 = .191$, whereas HPS total scores decreased, $F(3,676) = 62.49$, $p < .001$, $\eta^2 = .217$. FTND scores also increased, $F(3,676) = 73.38$,

$p < .001$, $\eta^2 = .246$, while IQSS scores decreased, $F(3,676) = 97.53$, $p < .001$, $\eta^2 = .302$.

Daily smoking consumption also differed significantly across all scale scores. Higher daily cigarette consumption was associated with higher HBM-SCS composite scores, $F(2,677) = 124.74$, $p < .001$, $\eta^2 = .269$; lower HPS total scores, $F(2,677) = 119.27$, $p < .001$, $\eta^2 = .261$; higher FTND scores, $F(2,677) = 92.80$, $p < .001$, $\eta^2 = .215$; and lower IQSS scores, $F(2,677) = 143.54$, $p < .001$, $\eta^2 = .298$. Bonferroni-adjusted post hoc comparisons showed significant differences across all three consumption groups.

As shown in Table 2, IQSS total scores were significantly and negatively correlated with daily smoking consumption ($r = -.48$, $p < .001$), degree of hearing loss ($r = -.53$, $p < .001$), HBM-SCS composite scores ($r = -.61$, $p < .001$), FTND scores ($r = -.44$, $p < .001$), and perceived barriers ($r = -.56$, $p < .001$). In contrast, IQSS total scores were positively correlated with HPS total scores ($r = .59$, $p < .001$) and self-efficacy ($r = .62$, $p < .001$).

Among the independent variables, daily smoking consumption was positively correlated with degree of hearing loss ($r = .62$, $p < .001$), HBM-SCS composite scores ($r = .58$, $p < .001$), FTND scores ($r = .43$, $p < .001$), and perceived barriers ($r = .54$, $p < .001$), and negatively correlated with HPS total scores ($r = -.51$, $p < .001$) and self-efficacy ($r = -.56$, $p < .001$). HBM-SCS composite scores were negatively correlated with HPS total scores ($r = -.55$, $p < .001$) and self-efficacy ($r = -.63$, $p < .001$), and positively correlated with FTND scores ($r = .56$, $p < .001$) and perceived barriers ($r = .67$, $p < .001$). Self-efficacy was negatively correlated with perceived barriers ($r = -.58$, $p < .001$).

Table 3 presents the results of the four-step hierarchical multiple regression analysis conducted to predict intention to quit smoking.

Model 1 entered gender, age, and marital status and explained 8.7% of IQSS variance, $F(3,676) = 21.46$, $p < .001$. Gender and marital status were significant predictors, whereas age was borderline ($p = .050$).

Model 2: In the second step, HBM-SCS composite scores, HPS total scores, and FTND scores were entered into the model. The addition of these variables significantly increased the explained variance, $\Delta F(3,673) = 46.96$, $p < .001$, with the model explaining 24.5% of the variance ($R^2 = .245$, $\Delta R^2 = .158$). HBM-SCS composite scores were a significant negative predictor ($\beta = -.345$, $p < .001$), HPS total scores were a significant positive predictor ($\beta = .287$, $p < .001$), and FTND scores were a significant negative predictor ($\beta = -.211$, $p < .001$). Gender remained significant ($\beta = .119$, $p = .013$), whereas age and marital status were no longer significant. Cohen's f^2 was $.325$.

Model 3: In the third step, self-efficacy and perceived barriers were entered into the model. The addition of these variables significantly increased the explained variance, $\Delta F(2,671) = 36.46$, $p < .001$, with the model explaining 31.9% of the variance ($R^2 = .319$, $\Delta R^2 = .074$). HBM-SCS composite scores remained significant ($\beta = -.222$, $p < .001$), as did HPS total scores ($\beta = .191$, $p < .001$) and FTND scores ($\beta = .131$, $p = .002$). Self-efficacy was a significant positive predictor ($\beta = .342$, $p < .001$), whereas perceived barriers were a significant negative predictor ($\beta = -.211$, $p < .001$). Gender, age, and marital status were not significant in this model. Cohen's f^2 was $.468$.

Model 4: In the final step, interaction terms (Smoking $\times$ Self-Efficacy, Smoking $\times$ FTND, and Hearing $\times$ HBM-SCS) were entered into the model. The interaction block significantly increased the explained variance, $\Delta F(3,668) = 12.79$, $p < .001$, with the final model explaining 35.6% of the variance in intention to quit smoking ($R^2 = .356$, $\Delta R^2 = .037$). The Smoking $\times$ Self-Efficacy interaction was significant ($\beta = .162$, $p < .001$), the Smoking $\times$ FTND interaction was significant ($\beta = -.098$, $p = .010$), and the Hearing $\times$ HBM-SCS interaction was significant ($\beta = -.089$, $p = .017$). These findings indicated that the relevant associations varied according to the corresponding moderator variables. Cohen's f^2 was $.553$.

Table 1. Comparison of scale scores according to demographic and clinical characteristics of participants (n=680)

Variable	Subcategory	HBM-SCS Composite M (SD)	HPS Total M (SD)	FTND M (SD)	IQSS M (SD)
Gender	Female	45.2 (9.8)	54.1 (9.5)	4.8 (2.0)	27.4 (5.8)
	Male	52.1 (10.2)	48.5 (10.1)	6.5 (2.4)	23.1 (6.0)
	Test Statistic Cohen's d	t(678)=-9.00* 0.69	t(678)=7.45* 0.57	t(678)=-10.06* 0.77	t(678)=9.50* 0.73
Age Group	18-20 Years (1)	45.9 (9.5)	54.0 (9.8)	4.9 (2.1)	27.2 (6.1)
	21-23 Years (2)	48.7 (10.2)	51.8 (10.0)	5.6 (2.3)	25.4 (6.0)
	24-25 Years (3)	51.3 (10.8)	48.1 (10.4)	6.4 (2.5)	23.1 (6.0)
Test Statistic η² Post-hoc		F(2,677)=15.19* .043 1<2<3*	F(2,677)=18.43* .052 1>2>3*	F(2,677)=22.76* .063 1<2<3*	F(2,677)=24.47* .067 1>2>3*
Marital Status	Single	47.2 (10.1)	53.2 (9.8)	5.2 (2.2)	26.5 (6.0)
	Married	50.8 (10.5)	48.9 (10.2)	6.3 (2.4)	23.6 (6.2)
	Test Statistic Cohen's d	t(678)=-4.48* 0.35	t(678)=5.51* 0.43	t(678)=-6.15* 0.48	t(678)=6.09* 0.48
Hearing Loss	Mild (1)	43.8 (8.9)	56.2 (9.1)	4.4 (1.8)	29.2 (5.2)
	Moderate (2)	48.2 (9.5)	52.1 (9.4)	5.5 (2.1)	25.8 (5.6)
	Severe (3)	52.6 (10.1)	47.5 (9.8)	6.6 (2.3)	22.4 (5.8)
Test Statistic η² Post-hoc	Profound (4)	56.8 (10.8)	41.8 (10.2)	7.8 (2.6)	18.9 (6.1)
		F(3,676)=53.15* .191 1<2<3<4*	F(3,676)=62.49* .217 1>2>3>4*	F(3,676)=73.38* .246 1<2<3<4*	F(3,676)=97.53* .302 1>2>3>4*
Daily Smoking Consumption	1-5/Day (Low) (1)	41.2 (9.5)	58.3 (8.7)	4.2 (1.9)	29.8 (5.1)
	6-10/Day (Moderate) (2)	48.5 (10.2)	51.4 (9.2)	5.7 (2.1)	25.3 (5.7)
	≥11/Day (High) (3)	56.2 (9.8)	44.6 (10.1)	6.9 (2.4)	20.7 (6.2)
Test Statistic η² Post-hoc		F(2,677)=124.74* .269 1<2<3*	F(2,677)=119.27* .261 1>2>3*	F(2,677)=92.80* .215 1<2<3*	F(2,677)=143.54* .298 1>2>3*

HBM-SCS=Health Belief Model-Based Smoking Cessation Scale, HPS=Health Perception Scale, FTND=Fagerström Nicotine Dependence Test, IQSS=Intention to Quit Smoking Scale. t=independent-samples t test, F=one-way ANOVA, η²=eta-squared effect size (.01=small, .06=medium, .14=large); Cohen's d (.20=small, .50=medium, .80=large). Bonferroni correction was used for post-hoc analyses. Post-hoc coding: for age, 1 = 18–20 years, 2 = 21–23 years, 3 = 24–25 years; for hearing loss, 1 = mild, 2 = moderate, 3 = severe, 4 = profound, for daily smoking consumption, 1=low, 2=moderate, 3=high. *p<.001.

Table 4A presents the results of the mediation analysis examining the mediating role of self-efficacy in the relationship between smoking consumption and IQSS. The direct effect of smoking consumption on IQSS was statistically significant (B=-0.41, SE=0.08, t=-5.13, p<.001). Smoking consumption was also significantly associated with self-efficacy (B=-0.56, SE=0.06, t=-9.33, p<.001), whereas self-efficacy was significantly and positively associated with IQSS (B=0.89, SE=0.12, t=7.42, p<.001).

The indirect effect of smoking consumption on IQSS through self-efficacy was statistically significant (indirect effect=-0.50, Boot SE=0.07, 95% Boot CI [-0.64,-0.37]), as the bootstrap confidence interval did not include zero. The total effect of smoking consumption on IQSS was also statistically significant (B=-0.91, SE=0.09, t=-10.11, p<.001). Because the direct effect remained statistically significant after self-efficacy was included in the model, the findings were consistent with partial mediation.

Table 4B presents the results of the moderation analysis examining whether degree of hearing loss moderated the relationship between smoking consumption and IQSS. The conditional effect of smoking consumption on IQSS was statistically significant at all levels of hearing loss: mild (B=-0.18, SE=0.07, t=-2.57, p=.010), moderate (B=-0.35, SE=0.05, t=-7.00, p<.001), severe (B=-0.48, SE=0.06, t=-8.00, p<.001), and profound (B=-0.67, SE=0.08, t=-8.38, p<.001).

The Smoking × Hearing Loss interaction was statistically significant (B=-0.12, SE=0.05, t=-2.40, p=.017), indicating that degree of hearing loss significantly moderated the association between smoking consumption and IQSS. As hearing loss severity increased, the negative association between smoking consumption and intention to quit smoking became stronger.

Table 4C presents the fit indices for the structural equation model. The model demonstrated acceptable fit with χ²/df=2.51 (CMIN/DF), which is within the acceptable range (<3.0). The Comparative Fit Index (CFI) was .962, exceeding the recommended threshold of .90 and indicating good fit. The Tucker-Lewis Index (TLI) was .953, also exceeding the recommended threshold of .90 and indicating good fit. The Root Mean

Square Error of Approximation (RMSEA) was .042, which is below the recommended threshold of .08 and indicates good fit. The Standardized Root Mean Square Residual (SRMR) was .035, below the recommended threshold of .08 and indicating good fit.

The model explained 35.6% of the variance in IQSS (R²=.356). Overall, the fit indices indicated that the proposed structural model adequately represented the observed data and supported the proposed associations among health perception, Health Belief Model-Based Smoking Cessation constructs, nicotine dependence, and intention to quit smoking among deaf and hard-of-hearing young adults.

DISCUSSION

This study examined behavioural and cognitive factors associated with intention to quit smoking among deaf and hard-of-hearing young adults. Nicotine dependence was negatively associated with quit intention, whereas health perception and HBM-related constructs contributed to its explanation, consistent with literature emphasising both dependence-related and cognitive factors [33].

Differences in scale scores were also observed according to sociodemographic characteristics. Female participants had higher HPS scores and greater intention to quit smoking, whereas male participants had higher HBM-SCS composite scores and nicotine dependence scores. Because the present study was cross-sectional, these group differences should be interpreted as associations rather than evidence of gender-based causal mechanisms. The mechanisms underlying these differences were not directly assessed in this study.

Age was associated with several study variables. Across the age groups examined, HPS and IQSS scores decreased, whereas FTND scores increased. These findings indicate age-group differences within the present sample but do not establish a developmental progression or causal effect of age. Effect sizes for age-group differences ranged from η²=.043 to .067.

Table 2. Pearson correlations among study variables (n=680)

Variable	1	2	3	4	5	6	7	8	9
1. Daily Smoking Consumption	1								
2. Hearing Loss Degree	.62**	1							
3. HBM-SCS Composite	.58**	.54**	1						
4. HPS Total	-.51**	-.47**	-.55**	1					
5. FTND	.43**	.39**	.56**	-.41**	1				
6. IQSS (Quit Intention)	-.48**	-.53**	-.61**	.59**	-.44**	1			
7. Self-Efficacy (HBM-SCS)	-.56**	-.49**	-.63**	.47**	-.52**	.62**	1		
8. Barriers	.54**	.48**	.67**	-.44**	.49**	-.56**	-.58**	1	
9. Age	.12*	.08	-.02	.03	.15**	-.09	-.11*	.06	1

Values are Pearson's *r*. HBM-SCS: Health Belief Model-Based Smoking Cessation Scale, HPS: Health Perception Scale, FTND: Fagerström Test for Nicotine Dependence, IQSS: Intention to Quit Smoking Scale. * $p < .05$. ** $p < .001$ (two-tailed).

Table 3. Hierarchical regression analysis predicting intention to quit smoking (n=680)

Step	Predictor	B	SE	β	t	p	R ²	ΔR^2	ΔF	Cohen's <i>f</i> ²
1	(Constant)	18.34	2.45	—	7.49	< .001	.087	.087	21.46***	.095
	Gender (Male)	-2.12	0.67	-.174	-3.16	.002				
	Age	-0.45	0.23	-.089	-1.96	.050				
	Marital Status (Married)	-1.78	0.71	-.143	-2.51	.012				
2	(Constant)	21.56	2.12	—	10.17	< .001	.245	.158	46.96***	.325
	Gender (Male)	-1.45	0.58	-.119	-2.50	.013				
	Age	-0.23	0.20	-.046	-1.15	.251				
	Marital Status (Married)	-1.02	0.62	-.082	-1.65	.099				
	HBM-SCS Composite	-0.28	0.04	-.345	-7.00	< .001				
	HPS Total	0.24	0.04	.287	6.00	< .001				
3	FTND	-0.45	0.09	-.211	-5.00	< .001				
	(Constant)	23.89	1.98	—	12.07	< .001	.319	.074	36.46***	.468
	Gender (Male)	-0.98	0.52	-.080	-1.88	.060				
	Age	-0.12	0.18	-.024	-0.67	.503				
	Marital Status (Married)	-0.56	0.55	-.045	-1.02	.308				
	HBM-SCS Composite	-0.18	0.04	-.222	-4.50	< .001				
	HPS Total	0.16	0.03	.191	5.33	< .001				
4	FTND	-0.28	0.09	-.131	-3.11	.002				
	Self-Efficacy (HBM-SCS)	0.89	0.12	.342	7.42	< .001				
	Barriers	-0.52	0.11	-.211	-4.73	< .001				
	(Constant)	25.12	1.89	—	13.29	< .001	.356	.037	12.79***	.553
	Smoking $\times$ Self-Efficacy	-0.34	0.08	-.162	-4.25	< .001				
	Smoking $\times$ FTND	-0.18	0.07	-.098	-2.57	.010				
	Hearing $\times$ HBM-SCS	-0.12	0.05	-.089	-2.40	.017				

Dependent variable: IQSS (Intention to Quit Smoking Scale), B: Unstandardized regression coefficient, SE: Standard error; β : Standardized regression coefficient, R²: Coefficient of determination, ΔR^2 : Change in explained variance, ΔF : F test for the change in R². Cohen's *f*²: $R^2/(1-R^2)$. *** $p < .001$.

Table 4. Mediation, moderation, and structural equation model analyses**A. Mediation Analysis (PROCESS Model 4): The Mediating Role of Self-Efficacy in the Relationship Between Smoking Consumption and IQSS**

Path	Effect	SE	Boot LLCI	Boot ULCI	t	p
Smoking → IQSS (direct effect)	-0.41	0.08	-0.57	-0.25	-5.13	<.001
Smoking → Self-Efficacy	-0.56	0.06	-0.68	-0.44	-9.33	<.001
Self-Efficacy → IQSS	0.89	0.12	0.65	1.13	7.42	<.001
Indirect effect	-0.50	0.07	-0.64	-0.37	—	—
Total effect	-0.91	0.09	-1.09	-0.73	-10.11	<.001

Boot LLCI and Boot ULCI are the lower and upper limits of the bootstrap confidence interval. Bootstrap samples=5,000. The indirect effect is considered statistically significant because its bootstrap confidence interval does not include zero.

B. Moderation Analysis (PROCESS Model 1): The Moderating Role of Hearing Loss Degree in the Smoking Consumption-IQSS Relationship

Hearing Loss Level	Conditional Effect of Smoking	SE	T	p	Interpretation
Mild	-0.18	0.07	-2.57	.010	Small negative effect
Moderate	-0.35	0.05	-7.00	<.001	Stronger negative effect
Severe	-0.48	0.06	-8.00	<.001	Strong negative effect
Profound	-0.67	0.08	-8.38	<.001	Strongest negative effect
Interaction: Smoking × Hearing Loss	-0.12	0.05	-2.40	.017	Significant moderation

Conditional effects are reported at each hearing-loss level. As hearing loss severity increases, the negative association between smoking consumption and IQSS becomes stronger.

C. Structural Equation Model Fit

Fit Index	Value	Interpretation
χ^2/df (CMIN/DF)	2.51	Acceptable/good fit
CFI	.962	Good fit
TLI	.953	Good fit
RMSEA	.042	Good fit
SRMR	.035	Good fit
R ² for IQSS	.356	35.6% variance explained

CFI: Comparative Fit Index, TLI: Tucker-Lewis Index, RMSEA: Root Mean Square Error of Approximation, SRMR: Standardized Root Mean Square Residual. The reported fit indices indicate an overall good model fit.

Marital status was associated with HBM-SCS, HPS, FTND, and IQSS scores. Married participants had higher nicotine dependence scores and lower intention to quit smoking than single participants. The effect sizes were relatively small (Cohen's $d=0.35-0.48$). Potential explanations involving partner smoking or relationship-related stress were not measured and therefore cannot be inferred from the present findings.

The largest group differences concerned hearing-loss degree: HPS and IQSS decreased while FTND increased from mild to profound loss. Communication and health-information access barriers documented among deaf and hard-of-hearing individuals [22-24] provide relevant context, but were not directly measured as mechanisms.

Correlation findings showed lower quit intention with greater smoking consumption, hearing-loss degree, nicotine dependence, perceived barriers, and the HBM-SCS composite score, and higher quit intention with HPS and self-efficacy. The positive self-efficacy and negative barrier associations with IQSS are consistent with HBM-related evidence on smoking beliefs and cessation intentions [34-36]. Because perceived-barrier items were reverse-scored to align the composite direction, the inverse HBM-SCS composite-IQSS association was

unexpected and should be interpreted cautiously alongside construct-specific results.

Daily smoking consumption was positively correlated with degree of hearing loss ($r=.62$), HBM-SCS composite scores ($r=.58$), nicotine dependence ($r=.43$), and perceived barriers ($r=.54$), and negatively correlated with HPS total scores ($r=-.51$) and self-efficacy ($r=-.56$). These associations describe the pattern of relationships among the measured variables but do not establish the direction or mechanisms underlying them. The cross-sectional design therefore does not permit causal interpretation.

HBM-SCS composite scores were negatively associated with HPS and self-efficacy and positively associated with nicotine dependence and barriers. Given the directionally aligned scoring, the composite may not function as a simple unidimensional indicator in this sample and should be interpreted alongside its subscales.

The hierarchical regression analysis further clarified the relative contribution of the predictors. In Model 1, demographic variables explained 8.7% of the variance in intention to quit smoking, indicating relatively modest explanatory power. Gender was the most prominent demographic predictor in this model.

In Model 2, the inclusion of HBM-SCS composite scores, HPS total scores, and FTND scores increased the explained variance to 24.5% ($\Delta R^2=.158$). HBM-SCS composite scores ($\beta=-.345$), HPS total scores ($\beta=.287$), and FTND scores ($\beta=-.211$) each made significant contributions to the prediction of intention to quit smoking beyond demographic characteristics.

Adding self-efficacy and perceived barriers increased explained variance to 31.9% ($\Delta R^2=.074$). Self-efficacy was a positive predictor and barriers a negative predictor, consistent with evidence linking self-efficacy with health-related intentions and smoking outcomes [14,37]. The study assessed quit intention rather than actual cessation.

The final hierarchical regression model, which included interaction terms, explained 35.6% of the variance in intention to quit smoking ($\Delta R^2=.037$). The significant Smoking × Self-Efficacy interaction ($\beta=-.162$) indicated that the association between smoking consumption and intention to quit varied according to self-efficacy. Given the cross-sectional design, this interaction should be interpreted as a conditional association rather than evidence that self-efficacy causally buffers the effects of smoking consumption.

The Smoking × FTND interaction was also statistically significant ($\beta=-.098$), indicating that the association between smoking consumption and intention to quit varied according to nicotine dependence. Similarly, the Hearing × HBM-SCS interaction was significant ($\beta=-.089$), indicating that the association between degree of hearing loss and intention to quit varied according to HBM-SCS composite scores. These interactions identify conditional patterns in the data but do not establish causal mechanisms.

Effect sizes across the hierarchical regression models ranged from Cohen's $f^2=.095$ to $.553$, corresponding to effects ranging from small to large. The final model yielded a Cohen's f^2 of $.553$, indicating a large overall effect size for the combined predictor set.

The mediation analysis indicated that self-efficacy significantly mediated the association between smoking consumption and intention to quit smoking. The indirect effect was -0.50 (Boot SE = 0.07, 95% Boot CI [-0.64, -0.37]), and the confidence interval did not include zero. This finding indicates that part of the association between greater smoking consumption and lower quit intention was statistically accounted for by self-efficacy.

This pattern is compatible with the HBM emphasis on self-efficacy in health-related intentions [11] and broader evidence linking self-efficacy to intention and behaviour [37], but it does not demonstrate a causal mediating process.

The predictive contribution of self-efficacy is particularly relevant when considering smoking cessation among deaf and hard-of-hearing young adults. Previous studies have reported barriers to health information, communication, and healthcare access among deaf and hard-of-hearing individuals [22-24]. These contextual factors may be relevant to self-efficacy, but they were not directly measured in the present study. Future intervention studies may examine whether accessible strategies that support self-efficacy improve cessation-related outcomes.

The moderation analysis showed that degree of hearing loss significantly moderated the relationship between smoking consumption and IQSS. The conditional association became progressively more negative across hearing-loss categories, from mild ($B = -0.18, p = .010$) to moderate ($B = -0.35, p < .001$), severe ($B = -0.48, p < .001$), and profound hearing loss ($B = -0.67, p < .001$).

The significant Smoking $\times$ Hearing Loss interaction ($B = -0.12, SE = 0.05, p = .017$) indicated that the association between smoking consumption and quit intention differed according to hearing loss severity. This finding may inform the design of future studies and interventions, but it does not demonstrate that hearing loss severity causes lower quit intention.

Communication and healthcare-access barriers reported among deaf and hard-of-hearing individuals [21-24] provide a possible context for this moderation finding. However, social isolation, stress, communication difficulties, and cessation-service access were not directly assessed and remain hypotheses for future research.

Recent evidence also indicates that smoking remains an important public health concern among deaf, deafblind, and hard-of-hearing individuals. Herrmann et al. reported that 16% of deaf and hard-of-hearing youth were current users of at least one tobacco product, with e-cigarettes (12%) and cigarettes (10%) being the most commonly reported products. Their findings also highlighted the need for accessible and culturally and linguistically tailored tobacco prevention programmes for deaf and hard-of-hearing populations [38].

The structural equation model demonstrated good overall fit, with $\chi^2/df = 2.51$, CFI = .962, TLI = .953, RMSEA = .042, and SRMR = .035 [39]. These indices indicated that the proposed model provided an adequate representation of the observed data.

The SEM explained 35.6% of quit-intention variance, consistent with the final regression model. It supported the proposed association pattern but does not establish causal effects.

Clinical and Public Health Implications

The findings may inform future clinical and public health work with deaf and hard-of-hearing young adults. The significant predictive contribution and indirect association involving self-efficacy suggest that self-efficacy is a relevant construct to consider in the development and evaluation of smoking cessation interventions. Accessible skills training, feedback, modelling, and mastery-oriented strategies may therefore be examined in future intervention studies [37].

The negative association between perceived barriers and intention to quit smoking suggests that perceived barriers are another relevant target for future research. Accessible information about quitting, withdrawal management, and available support may be useful components of intervention programmes, but their effectiveness was not tested in the present study [22-24].

The moderation by degree of hearing loss suggests that intervention research should consider whether the needs of participants differ across hearing-loss severity levels. More intensive or tailored forms of support may warrant evaluation among individuals with more severe hearing loss, particularly where communication and healthcare-access barriers are present [22-24].

Smoking among family members was associated with higher nicotine dependence in the present study. This finding is compatible with the possibility that family context is relevant to smoking patterns, but it does not show that family smoking shaped intention to quit smoking. Future research may directly examine family smoking, social modelling, and quit intention within the same analytic framework.

The good fit of the structural equation model supports the relevance of the Health Belief Model as a framework for examining smoking cessation-related cognitions in this sample. Previous intervention research has shown that HBM-based approaches can be used to address smoking-related perceptions and health beliefs [16,40]. These findings do not demonstrate that HBM-based interventions are effective in deaf and hard-of-hearing young adults; rather, they suggest that perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy are relevant constructs for future theory-based intervention research.

Finally, accessibility should be considered in future health communication and smoking cessation research involving deaf and hard-of-hearing individuals. Previous studies have documented communication and health-information access barriers in this population [21-23]. Accordingly, future programmes should evaluate accessible formats such as sign language, written materials, and visual supports.

Limitations

Several limitations should be considered when interpreting the findings. First, the use of convenience sampling and recruitment primarily from the Aegean Region of Türkiye limits the representativeness and generalisability of the sample. Second, the cross-sectional design does not permit causal or temporal interpretations; therefore, the mediation and moderation findings should be understood as indirect and conditional associations rather than causal pathways. Third, all measures were self-reported, which may have introduced recall, social desirability, and response biases.

In addition, psychometric evidence for some instruments in deaf and hard-of-hearing populations remains limited. Although the FTND showed acceptable internal consistency in the present sample ($\alpha = .70$), perceived severity and self-efficacy were assessed using single-item HBM-SCS components, which may have reduced measurement precision. The study was also limited to deaf and hard-of-hearing young adults aged 18–25 years, and several potentially relevant psychosocial, environmental, and communication-related variables were not examined. These included socioeconomic status, mental health, peer and family factors, access to cessation support, second-hand smoke exposure, and communication modality. Residual confounding therefore cannot be ruled out. Future longitudinal studies with broader and more representative samples, multi-item measures, objective indicators of smoking behaviour, and additional contextual variables are needed.

CONCLUSION

This study showed that quit intention among deaf and hard-of-hearing young adults was associated with nicotine dependence, health perception, and HBM-related constructs. Higher health perception and self-efficacy were associated with greater quit intention, whereas perceived barriers and nicotine dependence were associated with lower intention. The inverse association involving the directionally aligned HBM-SCS composite score was unexpected and should be interpreted cautiously alongside subscale findings.

The hierarchical multiple regression analysis showed that demographic, cognitive, dependence-related, and interaction variables together explained 35.6% of the variance in intention to quit smoking. Mediation analysis indicated that self-efficacy significantly mediated the association between smoking consumption and intention to quit smoking, whereas moderation analysis showed that degree of hearing loss significantly moderated the association between smoking

consumption and IQSS. The structural equation model demonstrated good overall fit.

Overall, the findings suggest that intention to quit smoking is associated not only with nicotine dependence but also with health-related cognitions and self-efficacy. These results support the relevance of considering HBM-SCS constructs, particularly self-efficacy and perceived barriers, when examining quit intention in deaf and hard-of-hearing young adults.

The findings may inform the development of accessible, theory-based smoking cessation interventions for deaf and hard-of-hearing young adults. However, intervention effectiveness and actual smoking cessation behaviour were not evaluated in the present study; therefore, such approaches should be tested in future intervention research.

Future longitudinal research should use broader samples and additional psychosocial and contextual measures and directly assess cessation outcomes.

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