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Profiles of importance, readiness and confidence in quitting tobacco use

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Abstract

Objective—This study examined whether rulers of importance, readiness and confidence (IRC) in quitting smoking could be used to identify subgroups of smokers, with the future goal of potentially tailoring interventions to specific readiness profiles.

Methods—Consecutive emergency department patients 18 years old were considered for enrolment. Participants provided information on their tobacco use and motivation to quit smoking using 10-point IRC rulers. We used latent profile analysis on the IRC rulers to identify subgroups of smokers and examined associations between profile membership and participant's nicotine dependence and demographics.

Results—A total of 1549 patients were screened, yielding a sample of 609 tobacco users. According to statistical fit indices, a four-profile solution fits best: 32% displayed maximum importance and readiness with strong confidence, 43% of the sample displayed relatively average levels of all three variables, 17% displayed below average importance with least favourable readiness and confidence and 7% displayed least favourable importance and readiness but relatively high confidence. Profiles were then shown to differ on nicotine dependence and educational level.

Conclusions—Four distinct profiles of IRC responses were observed. Identifying and describing these patterns has the potential to enhance future targeted intervention efforts and has implications for theory development.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Keywords

Tobacco; readiness-to-change; latent profile analysis; IRC

Introduction

Indices of motivational readiness to change tobacco use, such as importance, readiness and confidence (IRC) in quitting, can be useful for predicting cessation (e.g. Williams et al., 2002). Simple 10-point rulers of these three domains have been promoted by therapies such as Motivational Interviewing (Resnicow et al., 2002) and are in widespread clinical use. These rulers have been shown to be clinically desirable screening indices, as they are much shorter than other readiness-to-change measures while performing as well as or better than these longer measures (LaBrie et al., 2005). Researchers have discussed the utility of the IRC rulers in documenting motivations to quit smoking, as well as their utility in fostering patient-generated reasons to quit smoking (Kahler et al., 2009). No research, however, has examined the extent to which subgroups of smokers can be identified based on these three rulers. It is likely the relation between ratings is as important, if not more so, than the absolute value of individual rulers for tobacco cessation. High importance, for example, probably has a different implication for motivation to quit in the context of low readiness versus high readiness.

The examination of unobserved subgroups in smoking cessation research is becoming increasingly popular, with recent work focusing on identifying latent classes of individuals based on nicotine withdrawal symptoms (Xian et al., 2005). However, these methods have never been applied to IRC rulers. The identification of unique profiles based on these rulers and establishing how these profiles are related to smoking represent important developments, because they could help advance health behaviour theory and improve our ability to target interventions to specific individuals. This could, in turn, lead to improved treatment efficacy, cost effectiveness and client satisfaction.

Methods

Procedure and participants

We recruited participants from a large, urban hospital emergency department in [Blinded]. Research associates screened patients from 9 am to 10 pm, 7 days a week. Patients 18 years-of-age who used tobacco in the past 30 days received verbal description of this study before providing written, informed consent. We excluded patients who were cognitively impaired, critically ill, in acute distress or with an insurmountable language barrier. This study was approved by the hospital's institutional review board.

Measures

Importance, readiness and confidence for quitting tobacco use rulers—

Participants rated three rulers associated with motivation to quit smoking. We indexed *Importance* by, “How important is stopping smoking to you?” (1 = Not important at all; 10 = Most important goal of my life). We indexed *Readiness* by, “How ready are you to quit

smoking within the next month?” (1 = Not at all; 10 = 100% ready). We indexed *Confidence* by, “How confident are you that you could quit smoking within the next month and stay quit for good?” (1 = Not at all; 10 = 100% confident). These IRC rulers represent a useful and effective metric for the examination of these three constructs (Rollnick, 1998; Kahler et al., 2009), and previous research using similar, single-item “readiness rulers” has shown strong test-retest reliability (Donovan et al., 1998).

Demographics—Participants provided information on their *age* (in years), *sex* (coded 0 = male; 1 = female) and *educational level* (coded 1 = less than a high school degree; 2 = a high school degree; 3 = post-secondary education).

Nicotine dependence—The *Heavy Smoking Index (HSI)* total is a measure of nicotine dependence represented by the sum of cigarettes smoked per day (0 = 1–10; 1 = 11–20; 2 = 21–30; 3 = 31+) and the time after waking until first cigarette (0 = 61+ minutes; 1 = 31–60; 2 = 6–30; 3 = 0–5). Scores between 1 and 3 indicate low dependence, and scores greater than three indicate high dependence (Heatherton et al., 1989).

Plan of analysis

A series of latent profile analyses were performed using IRC as indicators. Latent profile modelling represents a parametric method for illustrating unobserved subgroups of a population (see Collins & Lanza, 2009). We used statistical (i.e. Akaike information criteria (AIC), Bayesian information criteria (BIC), adjusted likelihood ratio test (aLRT) and entropy; see Nylund et al., 2006) and substantive decision criteria when choosing the most appropriate solution. Lower values on the AIC and BIC indicate better fit, and a significant aLRT indicates that a *K*-profile solution fits better than a *K*–1-profile solution. Higher entropy values (range = 0–1.0) indicate more distinct profile separation. Unequal indicator variances were assumed across profiles. During estimation, when all participants within a profile responded to an indicator in the same way (e.g. importance = 10), we fixed this conditional mean, setting an arbitrarily small value (0.2) for the conditional variance. This allowed for an interpretable solution to be estimated. Once we established the final profile solution, we used a set of demographic (age, sex and educational level) and smoking (HSI total score) covariates to predict profile membership through a logistic function. Given the exploratory nature of latent profile analysis, these covariates were selected to provide more thorough description of profile differences and to provide clinical insight into potentially differential cessation efforts across profiles.

A *p*-level of 0.05 was used as a cut-off for statistical significance for the covariate analyses. Missing data were handled by the Full Information Maximum Likelihood facility in Mplus statistical software (Muthén & Muthén, 1998–2010).

Results

We screened 1549 patients, yielding a sample of 609 smokers. The sample was relatively evenly distributed in terms of sex and educational level (see Table I for sample characteristics).

Preliminary analysis

On average, participants reported greater importance than readiness ($t_{595} = 9.15, p < 0.001$), greater readiness than confidence ($t_{593} = 3.93, p < 0.001$) and greater importance than confidence ($t_{593} = 10.19, p < 0.001$). In regard to smoking, 334 participants (55%) reported smoking 1–10 cigarettes per day, 200 (33%) smoked 11–20, 46 (8%) smoked 21–30 and 25 (4%) smoked more than 31 (4 missing; 1%). The average HSI score corresponded to low nicotine dependence.

Correlations among the IRC rulers were moderate ($r_{\text{importance and readiness}} = 0.65, p < 0.001$; $r_{\text{readiness and confidence}} = 0.51, p < 0.001$; and $r_{\text{importance and confidence}} = 0.33, p < 0.001$).

Latent profile analysis

We examined the AIC, BIC, aLRT and entropy for two-, three-, four- and five-profile solutions. A four-profile solution fit the data best because it represented the point at which changes in the AIC and BIC remained substantial, the aLRT remained largely significant and all random start values converged to the same solution. While the inclusion of a fifth class resulted in a mild decline in the AIC ($\Delta \text{AIC} = -20$), the BIC was nearly identical ($\Delta \text{BIC} = -2$), the significance of the aLRT was greatly reduced (from $p < 0.0001$ to $p = 0.01$), entropy decreased (0.92–0.90) and convergence problems were observed (only 3 of 20 random starts converged).

Results of the latent profile analysis were graphically summarized in Fig. 1. The first profile (approximately 32% of the sample) reported that quitting smoking was the “Most important goal of my life” and that they were “100% ready” while reporting far above sample-average confidence. The second and largest profile (43%) displayed a pattern similar to the sample-level findings, with a higher conditional mean for importance than for readiness and confidence, but with mean levels hovering around the middle of the rulers. The third profile (17%) exhibited below sample-average importance while being “Not at all” ready or confident in quitting. The fourth and smallest profile (7%) reported that quitting smoking was “Not important at all” and were “Not at all” ready to quit, but they exhibited relatively higher confidence.

Covariates were added to examine associations with profile membership. The first profile served as the reference group because they appeared most prepared to quit. Results are summarized in Table II. In terms of demographics, only education was predictive of profile membership, such that members of the second profile were more educated than members of the first ($p < 0.01$). In terms of smoking, results indicated that higher HSI total scores were associated with membership in the third profile over the first profile ($p < 0.05$).

Discussion

This study expands upon the existing literature on readiness-to-quit smoking through the identification and description of subgroups of smokers. Previous research in other areas of behavioural and psychiatric medicine (van Rossum et al., 2008; Sysko et al., 2010) has shown differential treatment outcomes across unobserved, latent classes of adult patients. This study represents a first step towards identifying subtypes of cigarette smokers based on

their self-reported IRC in quitting, with the future goal of examining differential cessation and treatment response over time.

Using IRC rulers, four distinct profiles of smokers were identified. The first and most favourable profile (Profile 1) felt very strongly that their smoking was a problem and felt imminently ready and relatively confident that they could change. This first profile appears composed of those most prepared to change, and future research should focus on establishing whether this wellspring of motivation and confidence translates into action and, ultimately, to long-term abstinence. In contrast, the modal profile (Profile 2) appeared to represent those individuals who recognize that their smoking is a cause for concern, but they tend to be only moderately motivated to change their behaviours. They are ambivalent, so-called “fence sitters”, understanding that they should change but not really ready or confident in their ability to do so in the near future. These two profiles correspond well, conceptually, with the preparation and contemplation stages of change (Prochaska et al., 1994). While even those individuals in the less ready profiles may benefit from brief intervention, these two profiles would likely benefit the most from these types of efforts. Those in Profile 1, who no longer need any more convincing about how important cessation is for them and who are imminently ready to take action, might benefit most from interventions geared towards shoring up self-efficacy and moving to actual behaviour change. Additionally, the cessation efforts of these individuals might greatly benefit from the use of supplemental pharmacotherapies to capitalize on their strong desire to quit smoking. Those in Profile 2, who generally recognize the importance of change but remain ambivalent and uncertain about their ability to succeed, might benefit most from counselling geared towards increasing internal motivation.

The third subgroup (Profile 3) represented individuals who display mild concern about smoking while showing absolutely no readiness or confidence in changing their behaviour. Individuals in this profile also showed greater nicotine dependence than the most ready-to-quit profile, making them less likely to successfully quit (Breslau & Johnson, 2000). They may require more intensive counselling targeting the importance of quitting before tackling readiness or efficacy. For example, personalized feedback that makes the risks of smoking more tangible and personally relevant may increase perceived importance of quitting (Resnicow et al., 2002).

The pattern exhibited by the smallest subgroup (Profile 4) indicated a complete lack of concern with smoking, but, interestingly, they maintained relatively high confidence in quitting. These individuals may be best embodied by the statement, “I could probably quit it if I wanted to – but I don’t want to”. This profile highlights the potential advantage of using profiles over simple use of a scale in isolation. Based on theories like the Theory of Planned Behavior (Ajzen, 1991) and Social Learning Theory (Bandura, 1978), individuals with higher confidence in their ability to quit would be more likely to quit than those with lesser confidence. Although the individuals in Profile 4 have confidence ratings that are on par with those in Profile 2 (interested but ambivalent), because of Profile 4’s least favourable importance and readiness ratings, we would not expect them to be likely try to quit. So, despite their relatively high confidence, they are actually more similar to Profile 3, the

unmotivated group. Strong confidence in the face of low importance and readiness is highly unlikely to lead to behaviour change.

This study had several limitations. First, we used a cross-sectional study design that did not allow for the examination of quitting over time. Additional work examining cessation rates over time by profile would provide a degree of predictive validity for the solution of this study, as well as a more complete understanding of the clinical relevance of the observed profiles. Second, we sampled emergency department patients of a single, urban hospital. Future work should examine a more geographically diverse sample, as well as individuals outside of the emergency medical setting. Third, the use of only three rulers might have limited the ability to identify rarer but potentially relevant profiles of smokers. Future research should seek to include additional rulers, such as quit intentions or social support for quitting (Carey et al., 1999), which might allow for estimating additional profiles while also providing validation for the solution of this study.

Despite these limitations, this study is the first to apply latent profile analysis techniques to readiness rulers. It revealed distinct profiles of smokers and therefore represents an important step in refining our understanding of IRC as it relates to quitting smoking. It sets the foundation for other studies that can affect clinical practice; with replication and further validation of IRC profiles, future researchers might look to tailor treatment or prevention programmes to account for subgroup membership. This tailoring to the level of the profile has the potential to enhance programme efficacy, efficiency and client satisfaction.

References

- Ajzen I. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*. 1991; 50:179–211.
- Bandura A. Social learning theory of aggression. *Journal of Communication*. 1978; 28:12–29. [PubMed: 690254]
- Breslau N, Johnson EO. Predicting smoking cessation and major depression in nicotine-dependent smokers. *American Journal of Public Health*. 2000; 90:1122–1127. [PubMed: 10897192]
- Carey KB, Purnine DM, Maisto SA, Carey MP. Assessing readiness to change substance abuse: A critical review of instruments. *Clinical Psychology: Science and Practice*. 1999; 6:245–266.
- Collins, LM.; Lanza, ST. Latent class and latent transition analysis with applications in the social, behavioral, and health sciences. Hoboken, NJ: Wiley; 2009.
- Donovan RJ, Jones S, Holman CDJ, Corti B. Assessing the reliability of a stage of change scale. *Health Education Research*. 1998; 13:285–291. [PubMed: 10181026]
- Heatherton TF, Kozlowski LT, Frecker RC, Rickert W, Robinson J. Measuring the heaviness of smoking: Using self-reported time to the first cigarette of the day and number of cigarettes per day. *British Journal of Addiction*. 1989; 84:791–800. [PubMed: 2758152]
- Kahler, CW.; Leventhal, AM.; Brown, RA. Behavioral interventions in smoking cessation. In: Ries, RK.; Fiellin, DA.; Miller, SC.; Saitz, R., editors. *Principles of Addiction Medicine*. 4th ed.. Philadelphia, PA: Wolters Kluwer; 2009. p. 803-817.
- LaBrie J, Quinlan T, Schiffman J, Earleywine M. Performance of alcohol and safer-sex readiness to change rulers compared to readiness to change questionnaires. *Psychology of Addictive Behaviors*. 2005; 19:112–115. [PubMed: 15783287]
- Muthén, LK.; Muthén, BO. *Mplus user's guide*. 6th ed.. Los Angeles, CA: Muthén & Muthén; 1998–2010.

- Nylund KL, Asparouhov T, Muthen B. Deciding on the number of classes in latent class analysis and growth mixture modeling. A Monte Carlo simulation study. *Structural Equation Modeling*. 2006; 14:535–569.
- Prochaska, JO.; Norcross, JC.; DiClemente, CC. *Changing for good*. New York, NY: Morrow; 1994.
- Resnicow K, Dilorio C, Soet JE, Borrelli B, Hecht J, Ernst D. Motivational interviewing in health promotion: It sounds like something is changing. *Health Psychology*. 2002; 21:444–451. [PubMed: 12211511]
- Rollnick, S. Readiness, importance, and confidence: Critical conditions of change in treatment. In: Miller, WR.; Heather, N., editors. *Treating addictive behaviors*. 2nd ed.. New York, NY: Plenum Press; 1998.
- Sysko R, Hildebrandt T, Wilson GT, Wilfley DE, Agras WS. Heterogeneity moderates treatment response among patients with binge eating disorder. *Journal of Consulting and Clinical Psychology*. 2010; 78:681–690. [PubMed: 20873903]
- van Rossum I, Haro JM, Tenback D, Boomsma M, Goetz I, Vieta E, van Os J. EMBLEM Advisory Board. Stability and treatment outcome of distinct classes of mania. *European Psychiatry*. 2008; 23:360–367. [PubMed: 18434101]
- Williams GG, Gagné M, Ryan RM, Deci EL. Facilitating autonomous motivation for smoking cessation. *Health Psychology*. 2002; 21:40–50. [PubMed: 11846344]
- Xian H, Scherrer J, Madden P, Lyons M, Tsuang M, True W, Eisen S. Latent class typology of nicotine withdrawal: Genetic contributions and association with failed smoking cessation and psychiatric disorders. *Psychological Medicine*. 2005; 35:409–419. [PubMed: 15841876]

Figure 1.

Latent profiles using IRC rulers ($n = 609$).

Note: Substantive profile labels: Profile 1 – Highly motivated and confident, “imminent changers”; Profile 2 – Ambivalent about change, “fence sitters”; Profile 3 – Recognize some importance but not at all ready to change, “contented smokers”; Profile 4 – Not at all ready to change, “I could probably quit – but I don’t want to”.

Table I

Sample characteristics

	Mean (SD)	N (%)
Age (in years)	40 (14)	
Sex		
Male		327 (54)
Female		282 (46)
Educational level*		
<High school degree		176 (29)
High school degree		263 (43)
Post-secondary		167 (27)
Education		
Importance	7.1 (3.4)	
Readiness	6.0 (3.8)	
Confidence	5.4 (3.7)	
HSI total	2.4 (1.6)	

Note:

* Three participants with missing data (<1%).

Table II

Odds ratios (95% confidence intervals) of covariates to the latent profile solution

	Odds ratios relative to Profile 1 (32%)		
	Profile 2 (43%)	Profile 3 (17%)	Profile 4 (7%)
Age	0.99 (0.98–1.00)	0.99 (0.97–1.02)	1.02 (0.98–1.05)
Sex _(0 = Male, 1 = Female)	0.79 (0.54–1.15)	1.28 (0.74–2.23)	0.52 (0.22–1.24)
Educational level	1.26** (1.08–1.48)	1.06 (0.85–1.32)	1.201 (0.86–1.71)
HSI total	0.99 (0.88–1.12)	1.26* (1.06–1.50)	1.10 (0.82–1.49)

Notes: HIS, Heavy Smoking Index.

* and ** Significant at $p < 0.05$ and $p < 0.01$, respectively.