Future orientation and smoking cessation: secondary analysis of data from a smoking cessation trial

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ABSTRACT

Aims To examine the association between future orientation (how individuals consider and value outcomes in the future) and smoking cessation at 4 weeks and 6 months post quit-date in individuals enrolled in a smoking cessation study. Design Cohort analysis of randomized controlled trial data. Setting UK primary care. Participants Adults aged ≥18 years smoking ≥15 cigarettes daily, prepared to quit in the next 2 weeks. Measurements Future orientation was measured prior to quitting and at 4 weeks post-quitting using the Consideration of Future Consequences Scale. Smoking cessation at 4 weeks and 6 months was confirmed biochemically. Those lost to follow-up were assumed to not be abstinent. Potential confounders adjusted for were: age, gender, educational attainment, nicotine dependence and longest previous period quit. Findings A total of 697 participants provided data at baseline; 422 provided information on future orientation at 4 weeks. There was no evidence of an association between future orientation at baseline and abstinence at 4 weeks (adjusted odds ratio (aOR) = 1.05, 95% confidence intervals (CI) 0.80–1.38) or 6 months (aOR = 0.85, 95% CI = 0.60–1.20). There was no change in future orientation from baseline to 4 weeks and no evidence that the change differed between those who were and were not quit at 4 weeks (adjusted regression coefficient = −0.04, 95% CI = −0.16 to 0.08). Conclusions In smokers who are prepared to quit in the next 2 weeks, the extent of future orientation is unlikely to be a strong predictor of quitting over 4 weeks or 6 months and any increase in future orientation following quitting is likely to be small.

Keywords Cohort study, future orientation, motivation, smoking, time perspective, time preference.

INTRODUCTION

Future orientation describes how individuals consider and value outcomes occurring in the future versus those in the present day [1]. It is proposed that those who are more future orientated, and so think more about future outcomes and place more value on these outcomes, are likely to behave in a way to maximize their future utility [2–4].

Future orientation is a key component of Becker & Murphy’s Theory of Rational Addiction, which states that individuals will continue to consume addictive substances only if the present-day benefits outweigh the future costs [5]. Similarly, Hall & Fong’s Temporal Self Regulation Theory argues that individual valuations of temporal consequences of behaviour are a key determinant of whether or not individuals pursue healthy behaviours [6]. These theories suggest some role for future orientation in addictive and unhealthy behaviours, but are not clear exactly what this role might be in terms of motivation to take up addictive and unhealthy behaviours in the first place, motivation to change these behaviours or success in attempts to change.

There is now substantial cross-sectional evidence of relationships between future orientation and a range of health behaviours [7–12]. This relationship is strongest for smoking; smokers tend to be less future orientated than ex- and non-smokers [7,13–18]. There are three possible, not necessarily mutually exclusive, explanations for this association: low future orientation may reduce smokers’ motivation and ability to quit; smoking may cause people to become less future orientated; and smoking and future orientation may not be causally related, but instead share common causes.
If low future orientation influences people to remain smokers, there are two possible ways this could operate. Low future orientation may reduce any concern about the adverse health consequences of smoking, which tend to be many years in the future [19], and so reduce motivation to quit. Alternatively, as people who attempt to stop smoking experience a few weeks of discomfort [20], low future orientation may undermine the ability to persevere through this in order to obtain the desired long-term goal of abstinence.

These alternatives have different implications for how we might tackle smoking. Public health messages often emphasize serious, but temporally distant, consequences of smoking in order to motivate quit attempts. If low future orientation impedes motivation to quit, these messages are likely to be relatively ineffective in those with low future orientation. Alternatively, if low future orientation makes quitting more difficult to bear, interventions that reduce the discomfort of quitting are likely to help people with low future orientation succeed.

Cross-sectional studies are unable to distinguish between the various causal explanations of the relationship between future orientation and smoking. In particular, cross-sectional studies cannot exclude the possibility of reverse causation—that is, that smoking cessation causes people to become more future orientated instead of, or alongside, future orientation influencing the smoking cessation. Cognitive dissonance could explain why smoking, with its widely known adverse health consequences, is incompatible with greater future orientation, which may change on successful cessation. While future orientation is generally considered a stable trait, there is scant evidence for this; longitudinal studies are required to gain this evidence. The alternative, non-causal explanation, that a common cause explains the association between future orientation and smoking, can be excluded by controlling statistically for potential confounding variables.

A small number of longitudinal studies have explored the relationship between future orientation and smoking cessation [10,21–24]. Studies in large population cohorts have found that greater future orientation is associated with spontaneous quitting over follow-up periods of 4–7 years [10,23]. As only successful quitting is measured (and not unsuccessful quit attempts), these studies cannot differentiate between future orientation increasing quit attempts made, or increasing the success of attempts. Limited control for confounding also means that the possibility of common cause cannot be excluded.

Other work has studied future orientation in those who have begun quit attempts in the last 4–10 weeks [21,22]. This finds that future orientation early in a quit attempt is associated with continued abstinence at 6 months. As all participants in these studies had already begun quitting at baseline, these results suggest that greater future orientation is associated with increased success of quit attempts. However, as approximately 40% of quit attempts fail within 7 days [25], these findings suggest that future orientation increases the success of established quit attempts, but not necessarily all quit attempts. No conclusions can be drawn on the influence of future orientation on the success of new quit attempts.

The aim of this study was to examine the longitudinal association between future orientation and quitting. Participants were enrolled into a smoking cessation study and hence were all motivated to quit. Therefore, any association between future orientation and quitting found must arise from the influence of future orientation on quit success, rather than motivation to quit. However, future orientation was measured before quit attempts began, meaning that the influence of future orientation on quit success overall could be explored. By including good control for potential confounders, the study also offers a greater possibility to exclude common cause than previously.

**METHODS**

**Data source and permissions**

The data came from a randomized trial of abrupt cessation versus smoking reduction prior to cessation conducted in England from 2009 to 2012 (trial registration number: ISRCTN22526020) [26]. In both arms of this trial, participants were offered behavioural counselling and nicotine replacement therapy. The only difference between groups was that while those in the abrupt cessation arm were requested to smoke normally until the quit date and then stop smoking altogether, those in the reduction arm followed a schedule of gradual reduction in smoking in the 2 weeks prior to quit date. The results of the trial have not yet been published, but showed formally inconclusive evidence of non-inferiority of reduction. The trial was authorized by the National Research Ethics Committee, the Medicines and Healthcare products Regulatory Agency and local National Health Service (NHS) Research and Development offices. Separate permissions were not required for this analysis.

**Inclusion criteria**

General practitioners invited adult heavy smokers (smoking the equivalent of at least 15 cigarettes daily), who were willing to stop smoking completely in 2 weeks, to take part. Individuals were excluded if they were currently undergoing other treatment to stop smoking, had cautions for the use of nicotine replacement therapy or had a severe acute or chronic medical or psychiatric condition making them inappropriate for trial.
participation. Almost all people with stable medical and psychiatric conditions were enrolled.

Variables of interest

Future orientation

Future orientation was measured using the Consideration of Future Consequences Scale (CFCS) [27]. This asks respondents to rate agreement with 12 items on a five-point scale from ‘very untrue of me’ (scored 1) to ‘very true of me’ (scored 5). Examples of statements include: ‘I consider how things might be in the future and try to influence those things with my day to day behaviour’ and ‘I am willing to sacrifice immediate happiness or well-being in order to achieve future outcomes’. After reverse scoring of appropriate items, mean item score was calculated with higher scores indicating greater consideration of future consequences.

Originally, CFCS was reported as a single-factor scale [27]. However, a two-factor solution has since been reported as more appropriate [28–30]. We therefore also used the two subscale means for the CFC-immediate (CFCS-I) and CFC-future (CFCS-F). Higher scores on CFCS-F and CFCS-I subscales indicate higher consideration of future and immediate consequences, respectively.

Change in time perspective was calculated as mean item score on the relevant scale at follow-up, minus mean item score at baseline.

Smoking cessation

Smoking cessation at 4 weeks and 6 months post-quit date was classified using the Russell Standard [31]. This uses an intention-to-treat approach, assuming that people lost to follow-up are smokers, and allows a grace period of 2 weeks after quit day, thereafter allowing for no more than five cigarettes smoked. Self-reported quitting was confirmed biochemically using exhaled carbon monoxide readings of less than 10 parts per million.

Potential confounding variables

A number of potential confounding variables known to be associated with smoking cessation, future orientation or both were included. Future orientation has been reported to vary across the life course [32], and tends to be higher in women than men [28], therefore age in years and gender were included. Nicotine dependence at baseline and previous quit attempts are important determinants of future smoking cessation [33], and these were measured using the Fagerström Test for Nicotine Dependence (FTND) [34] and self-reported longest previous period quit in years, respectively. Socio-economic position is associated with both future orientation and smoking cessation [2], and was measured using educational qualifications and dichotomized into having or not having post-school qualifications.

Data collection

Data on participant demographics, smoking history, nicotine dependence and future orientation were collected at baseline, 2 weeks prior to quit date. Contactable participants were followed-up in person 4 weeks post-quit date and smoking status and CFCS re-assessed. At 6 months post-quit date, participants were telephoned and reported smoking status. Those who said they no longer smoked were invited to attend a clinic to confirm this biochemically.

Analysis

Logistic regression was used to determine if scores on the full CFCS, or either subscale, at baseline predicted abstinence at either 4 weeks or 6 months post-quit date, before and after controlling for age, gender, educational attainment, FTND, longest period previously quit and trial arm. In adjusted models, interactions between CFCS variables and other covariates were explored and tested using likelihood ratio tests. In these analyses, continuous variables (e.g. age) were grouped into categorical variables (e.g. 10-year age groups) to ease interpretation.

Linear regression was used to determine if quitting at 4 weeks was associated with a change in CFCS score (full and subscales) between baseline and 4 weeks post-quit date. Similar analyses for quitting at 6 months could not be performed, as CFCS was not measured at 6 months.

All analyses were conducted on an available case basis using Stata version 11.0 [35].

RESULTS

A total of 697 participants were enrolled and provided data at baseline. Of these, 422 (60.7%) attended clinic 4 weeks post-quit day and provided information on CFCS.

Half the participants were women, and half had post-school qualifications. At 4 weeks post-quit date, 308 (44.2%) participants were confirmed biochemically as abstinent, while at 6 months 131 (18.8%) were abstinent. Overall CFCS scores averaged 3.1 [interquartile range (IQR) 2.8–3.6] at baseline. This is slightly lower than has been reported in mixed populations of smokers and non-smokers (Table 1) [7,30].

There was no association between baseline CFCS total or subscale scores and abstinence at 4 weeks (Table 2) or 6 months (Table 3) post-quit date in univariate or multivariate analyses. The only statistically significant interaction was between CFCS total score and education when considering abstinence at 4 weeks. Greater future
Table 1 Descriptive statistics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Abstinent at 4 weeks</th>
<th>Abstinent at 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Yes</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women, n (%)</td>
<td>347</td>
<td>140 (40.4)</td>
</tr>
<tr>
<td>Men, n (%)</td>
<td>350</td>
<td>168 (48.0)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-school qualifications, n (%)</td>
<td>345</td>
<td>171 (49.6)</td>
</tr>
<tr>
<td>No post-school qualifications, n (%)</td>
<td>333</td>
<td>128 (38.4)</td>
</tr>
<tr>
<td>Continuous variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in full years, median (IQR)</td>
<td>697</td>
<td>49 (40 to 58)</td>
</tr>
<tr>
<td>FTND score, median (IQR)</td>
<td>683</td>
<td>5 (4 to 7)</td>
</tr>
<tr>
<td>Longest previously quit in years, median (IQR)</td>
<td>660</td>
<td>0.25 (0.04 to 1)</td>
</tr>
<tr>
<td>CFCS at baseline, median (IQR)</td>
<td>695</td>
<td>3.2 (2.8 to 3.7)</td>
</tr>
<tr>
<td>CFCS change baseline to four weeks, median (IQR)</td>
<td>422</td>
<td>0.1 (−0.3 to 0.3)</td>
</tr>
<tr>
<td>CFCS-F at baseline, median (IQR)</td>
<td>695</td>
<td>3.4 (2.8 to 3.8)</td>
</tr>
<tr>
<td>CFCS-F change baseline to four weeks, median (IQR)</td>
<td>421</td>
<td>0 (−0.4 to 0.4)</td>
</tr>
<tr>
<td>CFCS-I at baseline, median (IQR)</td>
<td>695</td>
<td>2.9 (2.3 to 3.4)</td>
</tr>
<tr>
<td>CFCS-I change baseline to four weeks, median (IQR)</td>
<td>421</td>
<td>0 (−0.4 to 0.4)</td>
</tr>
</tbody>
</table>

FTND = Fagerström Test for Nicotine Dependence; CFCS = mean item score on Consideration of Future Consequences Scale; mean item score on CFCS-F = Consideration of Future Consequences Scale, future subscale; mean item score on CFCS-I = Consideration of Future Consequences Scale, immediate subscale; IQR = interquartile range.
Table 2  Association between baseline Consideration of Future Consequences Scale and abstinence from smoking at 4 weeks post-quit date.

<table>
<thead>
<tr>
<th>Variable</th>
<th>CFCS mean item score, OR(^a) (95% CI)</th>
<th>CFCS-F mean item score, OR(^a) (95% CI)</th>
<th>CFCS-I mean item score, OR(^a) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted</td>
<td>Adjusted(^b)</td>
<td>Unadjusted</td>
</tr>
<tr>
<td>CFCS scale/subscale</td>
<td>1.17 (0.91–1.50)</td>
<td>1.05 (0.80–1.38)</td>
<td>1.12 (0.92–1.38)</td>
</tr>
<tr>
<td>Age</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Male (versus female)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Post-school quals (versus not)</td>
<td>–</td>
<td>1.51 (1.08–2.11)</td>
<td>–</td>
</tr>
<tr>
<td>FTND score</td>
<td>–</td>
<td>0.89 (0.82–0.96)</td>
<td>–</td>
</tr>
<tr>
<td>Longest quit (years)</td>
<td>–</td>
<td>1.07 (0.99–1.16)</td>
<td>–</td>
</tr>
<tr>
<td>Abrupt arm (versus reduction)</td>
<td>–</td>
<td>1.37 (0.99–1.89)</td>
<td>–</td>
</tr>
</tbody>
</table>

FTND = Fagerström Test for Nicotine Dependence; OR = odds ratio; CI = confidence intervals; CFCS = Consideration of Future Consequences Scale; CFCS-F = Consideration of Future Consequences Scale, future subscale; CFCS-I = Consideration of Future Consequences Scale, immediate subscale. \(^a\)OR of abstinence for a 1-point increase in CFCS score; \(^b\)adjusted for all variables listed.

Table 3  Association between baseline Consideration of Future Consequences Scale and abstinence from smoking at 6 months post-quit date.

<table>
<thead>
<tr>
<th>Variable</th>
<th>CFCS mean item score, OR(^a) (95% CI)</th>
<th>CFCS-F mean item score, OR(^a) (95% CI)</th>
<th>CFCS-I mean item score, OR(^a) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted</td>
<td>Adjusted(^b)</td>
<td>Unadjusted</td>
</tr>
<tr>
<td>CFCS scale/subscale</td>
<td>0.95 (0.69–1.31)</td>
<td>0.85 (0.60–1.20)</td>
<td>1.00 (0.78–1.29)</td>
</tr>
<tr>
<td>Age</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Male (versus female)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Post-school quals (versus not)</td>
<td>–</td>
<td>1.36 (0.89–2.10)</td>
<td>–</td>
</tr>
<tr>
<td>FTND score</td>
<td>–</td>
<td>0.88 (0.80–0.97)</td>
<td>–</td>
</tr>
<tr>
<td>Longest quit (years)</td>
<td>–</td>
<td>1.14 (1.05–1.24)</td>
<td>–</td>
</tr>
<tr>
<td>Abrupt arm (versus reduction)</td>
<td>–</td>
<td>1.41 (0.93–2.15)</td>
<td>–</td>
</tr>
</tbody>
</table>

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Future orientation and smoking cessation

In this cohort of smokers, who had shown clear and strong motivation to stop smoking by agreeing to take part in a smoking cessation trial, there was no association between future orientation and short-term abstinence. Future orientation changed little over time, and there was no association between short-term abstinence and change in future orientation.

**Strengths and limitations**

Unlike much previous work [7–12], we used longitudinal data with repeated measures of future orientation, which allowed us to begin to unpick the direction of association between future orientation and smoking cessation. We also used a robust measure of smoking cessation and, we believe, the most robust measure of future orientation currently available.

Several measures of future orientation have been used previously [36]. All have limitations, and there is currently no agreement concerning the most valid or reliable measure [9,37]. Scores on the CFCS correlate well with other measurements of future orientation and with other personality variables likely to be convergent with future orientation [9]. However, CFCS has a high reading age, and it may be inaccessible to a number of potential participants [37]. Scores on the CFCS correlate well with other measures of future orientation and with other personality variables likely to be convergent with future orientation [9]. However, CFCS has a high reading age, and it may be inaccessible to a number of potential participants [37].

The Russell Standard for smoking cessation is the gold standard for use in monitoring clinical practice and research [31]. Biochemical confirmation of smoking cessation increases validity. An intention-to-treat approach was used in the analysis, where all participants lost to follow-up were assumed to have quit, reducing the chance that reporting bias influenced the results.

**DISCUSSION**

Summary of findings

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The Russell Standard for smoking cessation is the gold standard for use in monitoring clinical practice and research [31]. Biochemical confirmation of smoking cessation increases validity. An intention-to-treat approach was used in the analysis, where all participants lost to follow-up were assumed to have quit, reducing the chance that reporting bias influenced the results.
confounding variables. In particular, systematic review evidence suggests that nicotine dependence is the most consistent predictor of quit success [33]. Only one previous longitudinal study of future orientation and smoking cessation has adjusted for nicotine dependence [21]. Adjustment for a range of potential confounders did not change the conclusions of this study.

We had data on CFCS for all participants at baseline. However, participants were only likely to attend follow-up at 4 weeks post-quit date if they were still actively trying to quit. We know from earlier contacts that the majority of non-attenders were not abstinent, and we confirmed smoking status in 88% of participants at 4 weeks. At 6-month follow-up participants were only invited to attend a clinic in person if they claimed abstinence, although we knew the smoking status of 84%. It is, therefore, very unlikely that non-attendance threatens the association between future orientation at baseline and abstinence at 4 weeks or 6 months.

There is more possible threat to the validity of the association between abstinence at 4 weeks post-quit date and change in future orientation, as CFCS was assessed in only 61% of participants at 4 weeks—and mainly in those who were abstinent. However, as we were exploring the possibility that those who achieve abstinence become more future orientated, the validity of the null finding is not threatened by failing to follow-up those who were not abstinent.

All participants agreed to set a quit day in 2 weeks and almost all attempted to quit. This indicates that almost all participants had high motivation to quit. However, even within this group there is likely to be some heterogeneity in motivation.

The sample size for this study was calculated to assess the difference between trial arms. However, the precision of the estimates reported here excluded all but small-to-moderate-sized associations. A 1-point increase in CFCS, which was larger than the IQR in this sample, was associated with an upper 95% confidence interval for the odds ratio for 4-week abstinence of 1.38.

**Interpretation and implications of findings**

Cross-sectional studies have reported that current smokers tend to be less future orientated than ex-smokers [7,13–18], but these cannot determine the direction of association between future orientation and cessation. Longitudinal studies in population cohorts have reported that smokers with greater future orientation are more likely to quit [10,23]. However, these results cannot differentiate between future orientation promoting more quit attempts or greater success of each quit attempt made.

In the current cohort of individuals who were motivated to quit and who were given help and support to achieve this, future orientation was not associated with successful quitting. This suggests that previous associations between future orientation and cessation reported in population cohorts [10,23] reflect an influence of future orientation on motivation to quit and the number of quit attempts made, rather than the overall success of those attempts.

Previous studies in cohorts of people making quit attempts have shown that greater future orientation during a quit attempt that has already lasted at least 4 weeks is associated with abstinence at 6 months [21,22]. Thus, while our results suggest that future orientation before a quit attempt has begun is unrelated to quit success, future orientation may help to maintain quit attempts that have already been successful in the short term, when tobacco withdrawal symptoms are beginning to abate. Longitudinal studies that measure future orientation repeatedly during and after quit attempts, in those who are both successful and unsuccessful, would help to confirm that future orientation has an influence both on motivation to quit and on the success of established, but not all, quit attempts.

If it is confirmed that future orientation is particularly important in terms of motivating smokers to pursue quit attempts, interventions to increasing future orientation may be helpful. Although future orientation is generally considered a stable trait, there is some evidence that it can be manipulated, at least in the short term [39]. However, delivering interventions to those currently not motivated to quit is likely to be difficult in practice. Alternatively, public health messages that emphasize the short term as well as, or instead of, the long-term benefits of smoking cessation may be more motivating to the majority of smokers and more practical to deliver. Previous attempts to tailor health promotion messages to future orientation have increased intention to use sunscreen and attend for screening [40–42].

We found no influence of abstinence at 4 weeks on future orientation. This provides reason to exclude the possibility of cessation influencing future orientation. As only quitters were followed-up at 6 months, we were unable to assess any differential impact of quitting (versus relapsing) by 6 months on future orientation. Future work should explore this.

Finally, while we have focused here on the role of future orientation in smoking cessation and rational theories of addiction, other theories call attention to other constructs that may be associated with addiction. We do not propose that future orientation is the only, or even the main, cognitive determinant of addictive behaviour.
CONCLUSIONS

In a cohort of individuals enrolled into a smoking cessation trial, we found no evidence that future orientation was associated with abstinence at 4 weeks or 6 months. Future orientation changed little between baseline and 4 weeks, and there was no evidence that change was different in those who were or were not abstinent at 4 weeks. Future orientation may influence motivation to engage in a quit attempt. Future orientation may influence longer-term success in a quit attempt that has already been successful in the short term.

Declaration of interests

N.L.-H. and P.A. have received consultancy fees and hospitality from manufacturers of smoking cessation and harm reduction products.

Acknowledgements

The trial was funded by the British Heart Foundation and this analysis received no special funding. J.A. is funded in part as a staff member of Fuse, the Centre for Translational Research in Public Health, and P.A. and N.L.-H. are members of the UK Centre for Tobacco and Alcohol Studies. Both Fuse and UKCTAS are UKCRC Public Health Research Centre of Excellence. Funding for Fuse and UKCTAS from the British Heart Foundation, Cancer Research UK, Economic and Social Research Council, Medical Research Council, the National Institute for Health Research, under the auspices of the UK Clinical Research Collaboration, is gratefully acknowledged. N.L.-H. is funded by a grant from the NIHR HTA (09-110-01).

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