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Struggling to make ends meet: exploring pathways to understand why smokers in financial difficulties are less likely to quit successfully

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Background: In high-income countries, those with low-to-middle incomes have been observing stagnating median wages and marginal improvements in their living standards. Smokers in financial difficulties appear to be less likely to quit smoking. Understanding the reasons for this is essential to intervening to improve cessation outcomes in this population, and reduce smoking-related health inequalities. **Methods:** We used longitudinal data from Waves 4 to 7 of the ITC Four Country Survey (ITC-4), and included those with data from at least two consecutive waves. Associations between financial difficulties and making a quit attempt, and quit success were analysed using generalised estimating equations, with adjustment for confounders. Mediation analysis was conducted to identify potential mediators of the observed effects of financial difficulties on cessation outcomes. **Results:** Having financial difficulties had little impact on making quit attempts (adjusted OR 0.84, 95% CI 0.70-1.01). Smokers with financial difficulties were substantially less likely to succeed at quitting (adjusted OR 0.55, 95% CI 0.39-0.76); an effect which was consistent over the survey years. Among the potential mediators examined, those relating to cognition of health-related and quality of life-related consequences of smoking were the most important mediators, though the proportion of the effect mediated by the largest mediator was small (6.8%). **Conclusion:** Having financial difficulties remains an important barrier to smokers achieving quit success. This effect does not appear to be due to anticipated factors such as reduced use of cessation services or treatment. Further research is required to determine strong mediators of the financial difficulties effect on quit success and to tailor more effective cessation programmes.

Introduction

Even before the 2008 financial crisis in several high-income countries, people in poverty and those with low-to-middle incomes had observed stagnating median wages and experienced little improvement in their living standards. For national tobacco control policies aimed at making further reductions in the socioeconomic inequalities in smoking prevalence, a challenge remains given the downcast long-term economic trends and independent associations between socioeconomic factors and smoking and cessation behaviour.[1,2,3]

Recently, studies have demonstrated that smokers in financial difficulty have a reduced likelihood of beneficial cessation behaviour.[4,5] Similar to other socioeconomic position (SEP) indicators, financial difficulties should not be considered as independent predictors of smoking cessation outcomes but rather risk regulators,[6] conditions that are likely to influence the likelihood of having proximal predictors of cessation behaviour, from motivational factors (e.g. health worries) to nicotine dependence.[7,8,9] Financial difficulties typically refer to people in poverty or having low-middle incomes. However, whilst absolute income indicates monetary resources that can help smokers achieve cessation, financial difficulties represent the capability of utilizing these monetary resources for cessation, as well as potentially influencing the level of predictors of cessation through multiple pathways such as stress and use of cessation support.

There are two main policy responses to reducing socioeconomic inequalities in smoking prevalence. One advocates for the redistribution of the fundamental socioeconomic determinants of health, thereby improving material and social assets.[3,10,11] The second focuses on further improving specific tobacco control initiatives such as increasing the accessibility and availability of cessation treatments and services.[3,4] Whilst the former response is worthwhile, it is yet uncertain whether such action would result in an increase of adult smoking cessation rates. Furthermore, such policies are unlikely to be fully supported by governments and electorates wishing to reduce public spending. Regarding the second, much progress has been made in recent years to increase access to cessation support[12,13] but other issues such as improving treatment adherence[14] and creating environments that are conducive for maintaining cessation remain important barriers to greater reductions in socioeconomic inequalities in smoking prevalence.

Given this, a better understanding of, and action on the mechanistic pathways between financial difficulties and smoking cessation behaviour will be required to make further improvements to reducing SEP inequalities in cessation rates. Whilst there have been a few studies examining the mechanisms between SEP and smoking cessation behaviour, to our knowledge there are no studies that have examined the mediators of financial difficulties.

We have used three wave periods of data from large nationally representative samples of adult smokers in four countries, to initially determine whether the effect of financial difficulties on cessation outcomes, previously seen for this cohort,[5] were robust over time. Furthermore, we subsequently attempted to identify potential mediators of the impact of financial difficulties.

Methods

Study Design and Participants

We used data from Waves 4 to 7 of the International Tobacco Control Four Country Survey (ITC-4), a longitudinal telephone survey designed to evaluate national tobacco control policies on smoking cessation behaviour. Since 2002, participants have been

followed-up annually and data on socio-demographic, psychosocial and behavioural factors collected. Wave-wave retention rates were 61%-75%.[1]

The original ITC-4 cohort comprised approximately 2000 adult smokers from each of the following four countries - the UK, US, Canada and Australia. Participants were recruited by geographical stratification. The number of participants sampled was proportional to the estimated stratum-specific adult population size. An identical sampling approach was used for each country and to replenish the study population due to attrition at each wave. Eligible participants were ≥18 years old who had smoked at least 100 cigarettes in their lifetime, and had smoked at least once in the past 30 days prior to recruitment. Financial difficulties were ascertained in Waves 4 (2004/5) to 7 (2008/9), and participants surveyed during these waves were included in our study if they had data from at least two consecutive waves. A more detailed description of the ITC methodology, sample profile and survey rates are available at http://www.itcproject.org.[15]

Measurements

Outcome measures

The primary study outcomes were binary indicators of (1) making a quit attempt and (2) quit success. Making a quit attempt was defined in a participant who was a smoker at wave *t*, as a positive response to the question ''Have you made any attempts to stop smoking since we last talked with you, this is since [last survey date]?'' at the subsequent wave, $t+1$. Quit success was defined in a participant who was a smoker at wave *t,* if they reported not to be smoking by the subsequent wave, $t+1$. Quit success was defined only for respondents who reported at wave $t+1$ to have made a quit attempt in the previous year.

Primary exposure

The primary exposure of the study were financial difficulties measured at time *t*, ascertained through the survey question: ''In the last month, because of a shortage of money, were you unable to pay any important bills on time, such as electricity, telephone or rent bills? [Yes/No]''. This question is an item from a multi-item financial difficulties scale used in previous research on low income smokers and cessation.[4]

Unlike absolute income, financial difficulties specifically reflect an individual's material capability to meet basic needs such as rent/mortgage, utility bills and other essential expenses. In our sample financial difficulties were more common in those with low incomes, whilst also being reported by those with medium- or even high-incomes (low-income: 15.9%, medium: 9.7%, high: 5.6%).

Other measures

Socioeconomic and demographic variables were education, annual household income, age, gender, ethnicity, marital status, number of five close friends who smoked, quit attempt in previous wave, nicotine dependence (using the Heaviness of Smoking Index, a short form of the Fagerstrom tolerance questionnaire[16]), and country of residence. In the analysis, income was not adjusted for, since part of the financial difficulties' effect may work through a lack of sufficient material capital.

Age, gender, ethnicity, country of residence, education, prior quit attempt and nicotine dependence were considered as *a priori* confounders. Marital status and number of five close friends who are smokers were considered as potential confounders. Potential mediators of the effects of financial difficulties on cessation outcomes were:

Operationalised as binary measures- price of cigarettes influencing quitting thoughts, perceived stress,[17] any use of cessation services (cessation assistance from a health professional, NRT/stop-smoking medications, quitline/internet/local stop smoking services), frequency of stubbing out cigarette because of thinking about smoking harms, and thinking of quitting due to personal health concerns;

Operationalised as continuous measures- planning to quit, self-efficacy, worried smoking will damage future health, health outcome expectancy, smoking has lowered quality of life, worried smoking will lower future quality of life, and lifestyle outcome expectancy. Details about these variables are shown in the online supplementary table 1.

Statistical Methods

Analysis

Generalised estimating equations (GEE) logistic regression were used to estimate the population-averaged effect of smokers having financial difficulties on the odds of quit attempts and quit success over 2005-2009, allowing for an exchangeable correlation structure between repeated measures on individuals over time,[18] with robust standard errors.

A time-lag approach was used to model the exposure, confounders, and outcomes; the exposure and confounders (unless specified otherwise) at time *t* were related to the smoking cessation behaviour outcome at time $t+1$ (i.e. one follow-up wave later). Accordingly, the analysis was limited to individuals who were smokers at the beginning of each wave-period. All confounders were considered time-dependent expect for age, gender, ethnicity and country. *A priori* confounders were included in all models; however, potential confounders (marital status and close friends smoking) were not included as their addition to models did not alter the financial difficulties' effect estimate by ≥10%.

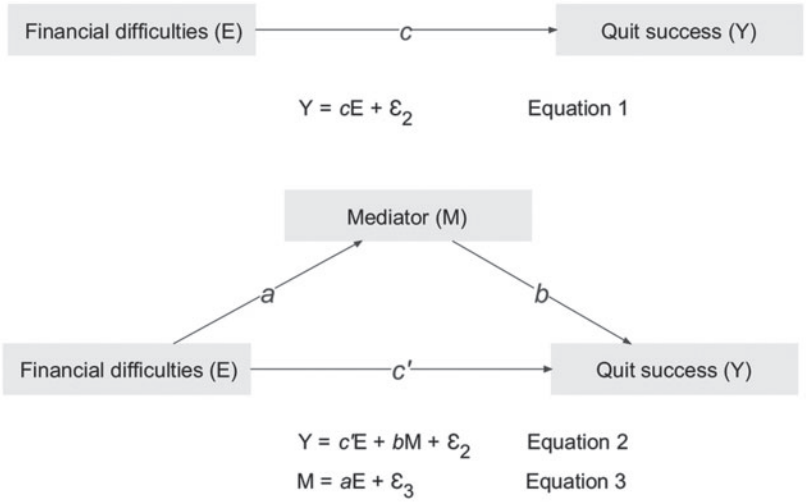
For continuous and ordinal categorical confounders, we compared the fit of the model including the confounder as a linear term and as a categorical term using the QIC (Quasilikelihood under the Independence model Criterion) statistic. Confounders which had a non-linear relationship with the outcome were included as a categorical term. Effect modification of wave and country on the financial difficulties-outcome relationship was assessed using the QIC statistic.

Complete case analysis method was used to deal with missing values. Longitudinal survey weights were used for all analyses, except for computing descriptive statistics where cross-sectional weights were used. All analyses were conducted using Stata 10.1.

Assessment of mediation

Mediation analysis was used to explain any large and significant effects of financial difficulties on smoking cessation. Since there was no substantial or significant effect of financial difficulties on making any quit attempt, mediation analysis was conducted only for its effect on quit success. We used single-mediator models (Figure 1) where three regression models were fitted to estimate the Financial difficulties → Mediator → Quit success relationship, thereby providing regression coefficients used to assess mediation by following the causal steps criteria.[19] Mediator models were evaluated adjusting for *a priori* confounders.

The mediated effect size and statistical significance was estimated by computing the product-of-coefficients, *ab* and calculating Sobel's standard error and test statistic to derive confidence intervals and a p-value.[19] The proportion of the effect mediated was estimated by dividing the estimated mediated effect (*ab*) by the total effect of financial difficulties on quit success ($ab/ab+c'$) x 100%. The mediated effect and proportion mediated was only computed for variables meeting criteria 2-3. Standardised regression coefficients were computed to allow for the binary nature of the outcome variable and to compare the magnitudes of effect for the mediators.[20]



Criterion		Regression coefficient
1	Demonstrate that financial difficulties (exposure) have a moderate to strong association with quit success (outcome), thereby establishing that there is a substantive and statistically significant effect that maybe mediated.	*c* coefficient in Equation 1
2	Demonstrate that financial difficulties are associated with each potential mediator.	*a* coefficient in Equation 3
3	Demonstrate that each potential mediator is associated with the outcome, after adjustment for the potential confounding role of financial difficulties.	*b* coefficient in Equation 2
4	Mediated effect (product of coefficients, *ab*) is statistically significant	*ab*

Figure 1 Diagram for single mediator model of the effect of financial difficulties on quit success and criteria used to establish a mediator. *Y* is the outcome variable (quit success), *E* is the exposure (financial difficulties) and *M* is the mediator. Y = logit(Y) since quit success is a binary variable. Three regression equations are used to estimate the mediated effect. Letters *a*, *b*, c, *c′* are regression coefficients derived from the three equations displayed. ε_1, ε_2 and ε_3 represent unexplained variability. *c* quantifies the total association between the exposure and outcome; *c′* is the coefficient quantifying the exposure's effect on the outcome adjusted for the mediator; *a* is the coefficient quantifies the exposure's effect on the mediator; *b* is the coefficient quantifying the mediator on the outcome variable, adjusted for the exposure

Results

Sample characteristics by wave are summarised in table 1. Over time, the proportion of smokers reporting financial difficulties was fairly constant from 12.0% (Wave 4) to 10.3% (Wave 6). Across waves, just under a third of smokers tended to have an annual household income below £15,000 (or $30,000 for US, Canadian or Australian smokers) and approximately half had a high school or less educational attainment level. Age distributions were similar at each wave, with two-fifths of smokers aged 40-54 years, and over time there was no change in nicotine dependence, with approximately 11% smokers classified as being heavily dependent. By wave, the proportion of smokers using any NRT/Stop smoking medications made a slight increase from Wave 4 (16.1%, 587/3552) to Wave 6 (21.3 %, 758/3494), whilst there was no indication of a change in the median level of smoking and cessation related psychosocial constructs over time.

Differences in socio-demographic variables and nicotine dependence at each wave period, between respondents with follow-up and those who were lost to follow-up were examined. Generally in each wave period, the two groups were similar with respect to these variables although respondents who were lost to follow-up were more likely to be either 18-24 or 25-39 years old and residents of the US. In wave period 6-7, respondents lost to follow-up were also more likely to have reported financial difficulties.

Financial difficulties, making any quit attempt, and quit success over time

In each wave-period, the proportion of smokers making any quit attempt was generally around over a third, whilst the proportion who achieved quit success amongst smokers reporting making a quit attempt was around a third (table 2).

There was no evidence of effect modification of wave and country implying constant effects of financial difficulties on cessation behaviour outcomes over time and across countries. Therefore we present pooled results across waves and countries.

Effect of financial difficulties on making any quit attempt

Smokers reporting financial difficulties in the preceding wave seemed less likely to report making a quit attempt than smokers who did not, but this effect was non-significant (OR = 0.90, 95% CI: 0.76, 1.05). Adjusting for *a priori* confounders, increased the effect size marginally, but the magnitude of effect remained non-significant (adjusted OR = 0.84, 95% CI: 0.70, 1.01).

Effect of financial difficulties on quit success

Smokers reporting financial difficulties had a substantial 49% significant reduction in the likelihood of quit success compared to smokers not reporting financial difficulties (OR = 0.50, 95% CI: 0.37, 0.70). Adjusting for *a priori* confounders had marginal effects (adjusted OR = 0.55, 95% CI: 0.39, 0.76).

Associations between financial difficulties with mediators (Criterion 2, a *coefficient), and mediators with quit success (Criterion 3,* b *coefficient)*

Table 3 presents single mediator models for financial difficulties-quit success mediator analysis, with significant associations highlighted in bold. Financial difficulties → Mediator : The largest standardized *a* coefficients were seen for: price of cigarettes

Table 1 Characteristics of the sample by Wave (weighted), ITC Four Country Survey, 2004/5-2008/9

	N	Wave 4 (N = 4926*)	*N*	Wave 5 (N = 4470*)	*N*	Wave 6 (N = 4633*)
Primary Exposure						
Financial difficulties, n (%)	4920	539 (12.0)	4464	473 (11.4)	4626	461 (10.3)
Socioeconomic & demographic characteristics						
Annual household income per annum, *n (%)*						
Low (under £15K/$30K)	4612	1484 (30.0)	4185	1365 (30.7)	4331	1412 (29.8)
Middle (£15-30K/$30-60K)		1722 (37.0)		1511 (35.9)		1521 (35.2)
High (over £30K/$60K)		1406 (32.9)		1309 (33.4)		1398 (35.1)
Educational attainment, *n (%)*						
Low (high school or less)	4908	2587 (52.7)	4451	2312 (52.2)	4618	2408 (51.5)
Moderate (college/some university)		1566 (32.3)		1405 (31.7)		1437 (31.8)
High (university or higher)		755 (14.8)		734 (16.2)		773 (16.7)
Age (years), *n (%)*						
18-24	4926	369 (13.5)	4470	276 (10.7)	4633	257 (9.0)
25-39		1319 (32.2)		1161 (31.2)		1116 (30.1)
40-54		2026 (32.7)		1880 (37.5)		1985 (39.1)
55+		1212 (18.5)		1153 (20.5)		1275 (21.8)
Male, *n (%)*	4926	2129 (53.1)	4470	1871 (52.2)	4633	1947 (52.1)
Married, *n (%)*	4910	2190 (43.0)	4460	1965 (42.9)	4628	1986 (43.3)
Country, *n (%)*						
UK	4926	1241 (25.2)	4470	1108 (24.8)	4633	1142 (24.6)
US		1066 (21.6)		1064 (23.3)		1054 (21.8)
Canada		1241 (25.5)		1163 (26.0)		1171 (25.3)
Australia		1354 (27.7)		1135 (25.8)		1266 (28.3)
Exposure to peers who smoked*						
Number of 5 close friends who are smokers	4912	2 (1, 4)	4442	2 (1, 4)	4619	2 (1, 4)
Past cessation experience						
Prior quit attempt, *n (%)*	4742	1578 (32.9)	4298	1312 (30.7)	4455	1328 (29.7)
Nicotine dependence						
Heaviness of Smoking Index, *n (%)*						
Light (HSI: 0-1)	4885	2121 (45.0)	4444	1927 (44.6)	4607	1976 (43.6)
Medium (HSI: 2-4)		2226 (44.6)		2026 (44.7)		2110 (45.6)
Heavy (HSI: 5-6)		538 (10.4)		491 (10.7)		521 (10.9)
Potential Mediators						
Price of cigarettes as a reason for quit attempt/helped stay quit, *n (%)*	4921	3656 (74.3)	4460	3158 (70.6)	4622	3240 (70.2)
Perceived stress, n (%)	4918	2316 (46.5)	4456	1868 (41.9)	4621	2028 (43.8)
Planning to quit smoking, (1-4)						
not quitting (1), ≥6 mo (2), ≤6 mo (3), next month (4)	4870	2 (1, 3)	4393	2 (1, 3)	4558	2 (1, 3)
Self-efficacy of quitting, (1-5)						
''not sure at all'' (1) to ''extremely sure'' (5)	4899	2 (1, 3)	4434	2 (1, 3)	4599	2 (1, 3)
Any Use of smoking cessation services						
Use of any cessation assistance from a health professional, *n (%)*	3533	1599 (43.3)	3374	1481 (42.4)	3503	1707 (46.7)
Use of any NRT/Stop-smoking medications, *n (%)*	3552	587 (16.1)	3377	677 (19.5)	3494	758 (21.3)
Use of Quitline/internet/LSS, *n (%)*	4926	449 (9.0)	4470	432 (9.2)	4633	467 (9.8)
Smoking and cessation related psychosocial constructs						
Cognitions and behaviours related to health consequences of smoking						
Stubbing out cigarette due to thinking about smoking harms, *n (%)*	4920	469 (9.4)	4465	392 (8.7)	4632	496 (10.4)
Quitting thoughts due to thinking about personal health concerns, *n (%)*	4921	2129 (42.8)	4458	1908 (42.8)	4628	2018 (43.7)
Worried smoking will damage future health, (1-4) *''not at all worried'' (1) to ''very worried'' (4)*	4913	3 (2, 4)	4447	3 (2, 4)	4615	3 (2, 3)
Expected amount of health benefits on quitting smoking permanently, (1-5) *''not at all'' (1) to ''extremely'' (5)*	4884	3 (2, 4)	4422	3 (2, 4)	4588	3 (2, 4)
Cognitions on QOL consequences of smoking						
Smoking has lowered quality of life, (1-4) *''not at all'' (1) to ''a great deal'' (4)*	4900	2 (1, 2)	4437	2 (1, 2)	4599	2 (1, 2)
Worried smoking will lower future quality of life, (1-4) ''not at all worried'' (1) to ''very worried'' (4)	4907	2 (2, 3)	4444	2 (2, 3)	4603	2 (2, 3)
Expected ability to enjoy life on quitting, (1-5) *''made much worse'' (1) to ''improve a lot'' (5)*	4852	3 (2, 4)	4401	3 (2, 4)	4561	3 (2, 4)

*Number of eligible smokers at each wave

LSS = Local stop smoking services. Data presented as median (interquartile range) unless otherwise stated. Price of cigarettes as a reason for quit attempt/stay quit and Any use of cessation services were measured at each respective follow-up wave.

influencing quitting thoughts, perceived stress, use of Quitline/Internet/Local stop smoking services, and thinking of quitting due to personal health concerns. The majority of smoking and cessation-related psychosocial constructs (excluding health outcome expectancy) were significantly associated with financial difficulties but with smaller effect sizes.

Mediator → Quit Success: Smoking and cessation-related psychosocial constructs (excluding frequency of stubbing out cigarette, health outcome expectancy) were all negatively associated with quit success, with the strongest effects being seen for thinking of quitting due to personal health concerns, smoking has lowered QOL, and lifestyle outcome expectancy.

Mediated effect of M for the association between financial difficulties and quit success (Criterion 4, ab *coefficient)*

Among variables that were associated with both financial difficulties and quit success (satisfying criteria 2-3), the single-mediator models suggested that the effect of financial

Table 2 Percentages of smokers with making a quit attempt, quit success by financial difficulties, the ITC Four Country Survey, 2004/5-2008/9

	Wave periods		
	4-5 N = 3559* Number (% of total wave)	**5-6 N = 3381* Number (% of total wave)**	**6-7 N = 3517* Number (% of total wave)**
Quit attempt, yes	1321 (37.3)	1262 (37.5)	1321 (37.3)
Quit success among smokers who made a quit attempt, yes	423 (31.4)	412 (34.0)	431 (34.2)

Cross-tabulations of outcome by financial difficulties	***n***	**Number (% of total)**	***n***	**Number (% of total)**	***n***	**Number (% of total)**
Quit attempt, yes						
Financial difficulties						
Yes	355	138 (37.2)	338	132 (36.9)	300	118 (35.5)
No	3202	1182 (37.2)	3038	1128 (37.5)	3210	1199 (37.4)
Quit success among smokers who made a quit attempt, yes						
Financial difficulties						
Yes	138	28 (16.5)	132	35 (27.0)	118	23 (21.5)
No	1182	395 (33.3)	1128	377 (35.0)	1199	407 (35.4)

*Complete financial difficulties-quit attempt data
Percentages presented are weighted

Table 3 Analysis of potential mediators for financial difficulties effect on quit success, ITC Four Country Survey, 2004/5-2008/9

			Mediated effect		*Sobel's test*		
Mediator	***a* (Se)**	***b* (Se)**	***ab* (Se)**	**95% LCL, UCL**	**p value***	***c′***	**% Med**
Price of cigarettes as a reason for quit attempt/helped stay quit	**0.122** (0.031)	−0.013 (0.026)	−0.002 (0.003)	−0.008, 0.005	0.632	−0.095	
Perceived stress	**0.163** (0.034)	−0.009 (0.027)	−0.001 (0.004)	−0.004, 0.010	0.746	−0.095	
Plan to quit (1–4)	0.017 (0.011)	−0.054 (0.028)	−0.001 (0.001)	−0.002, 0.001	0.219	−0.094	
Self-efficacy (1–4)	0.009 (0.013)	0.043 (0.262)	0.000 (0.003)	−0.005, 0.005	0.873	−0.097	
Any Use of smoking cessation services							
Use of any cessation assistance from a health professional	0.001 (0.022)	−0.018 (0.026)	0.000 (0.000)	−0.001, 0.001	0.958	−0.096	
Use of any NRT/Stop-smoking medications	−0.027 (0.023)	0.037 (0.027)	−0.001 (0.001)	−0.003, 0.001	0.374	−0.096	
Use of Quitline/Internet/Local stop smoking services	**0.073** (0.034)	−0.035 (0.028)	−0.002 (0.002)	−0.007, 0.002	0.280	−0.094	
Smoking and cessation related psychosocial constructs							
Cognitions and behaviours related to health consequences of smoking							
Frequency of stubbing out cigarette because of thinking about smoking harms	0.058 (0.032)	−0.055 (0.031)	−0.003 (0.003)	−0.008, 0.002	0.206	−0.095	
Thinking of quitting due to personal health concerns	**0.063** (0.023)	**−0.105** (0.026)	−0.007 (0.003)	−0.012, −0.001	0.023	−0.090	6.8
Worried smoking will damage future health (1–4)	**0.040** (0.011)	**−0.060** (0.027)	−0.002 (0.001)	−0.005, 0.000	0.058	−0.092	2.5
Health outcome expectancy (1–4)	**0.032** (0.009)	−0.039 (0.027)	−0.001 (0.001)	−0.003, 0.001	0.185	−0.090	
Cognitions on QOL consequences of smoking							
Smoking has lowered quality of life (1–4)	**0.044** (0.011)	**−0.089** (0.027)	−0.004 (0.002)	−0.007, −0.001	0.010	−0.087	4.3
Worried smoking will lower future quality of life (1–4)	**0.031** (0.011)	**−0.080** (0.027)	−0.003 (0.001)	−0.005, 0.000	0.041	−0.092	2.6
Lifestyle outcome expectancy (1–5)	**0.037** (0.012)	**−0.110** (0.027)	−0.004 (0.002)	−0.007, −0.001	0.015	−0.088	4.4

*Results of Sobel test significance test using a normal distribution approximation ($\alpha = 0.05$, $z = 1.96$)
a = regression coefficient for financial difficulties on mediator adjusting for confounders, *b* = regression coefficient for the association between mediator and quit success, adjusting for financial difficulties and confounders, *ab* = product of *a* and b, Se = standard error, LCL = lower confidence limit, UCL = upper confidence limit. All regression analyses adjusted for age, gender, ethnicity, country, education, prior quit attempt and nicotine dependency level. Regression coefficients and their 95% LCL & UCL presented are standardized. Proportion mediated metric only calculated for mediator variables satisfying Criteria 2–4. Where p-values are not presented, bold figures indicate statistically significant coefficients. All single mediator models based on N = 2581 respondents with complete data.

difficulties on reducing the likelihood of quit success was mediated by smoking has lowered current quality of life (4.3%), and lifestyle outcome expectancy (4.4%), with the strongest mediation effect being seen for thinking about quitting due to personal health concerns (6.8% proportion mediated). Converting the standardised estimates to adjusted odds ratios to allow for interpretation of the strongest mediator, showed smokers reporting financial difficulties were 46% more likely to think about quitting due to personal health concerns (adjusted OR = 1.46, 95% CI: 1.12, 1.92), and in turn smokers who think about quitting due to personal health concerns, adjusted for financial difficulties and confounders, were 32% less likely achieve quit success in the follow-up wave (adjusted OR = 0.68, 95% CI: 0.56, 0.82).

Discussion

The aim of this study was to estimate the effect of financial difficulties on making a quit attempt and quit success, and to identify potential mediators of the effect of financial difficulties on quitting behaviour. Across wave-periods, the proportions of smoking cessation behaviour outcomes were fairly constant. After adjustment for confounders, smokers reporting financial difficulties were 16% less likely to make any quit attempt and were 41% less likely to achieve quit success, compared to smokers not reporting financial difficulties. These findings suggest that financial difficulties appeared to reduce the likelihood of making a quit attempt, but confidence intervals include the possibility of no effect. However, there is strong evidence that having financial difficulties substantially reduced the odds of quit success.

As stated in the methods, we only assessed the mediators of the effect of financial difficulties on quit success. Thinking about quitting due to personal health concerns, smoking has lowered current quality of life, and lifestyle outcome expectancy, were found to partly mediate the effect between financial difficulties and quit success. This tentatively suggests that having financial difficulties is associated with an increase in levels of cessation related psychosocial constructs, but that these increases are subsequently associated with a significant decrease in likelihood of quit success. The largest mediated effect was found for the binary construct 'thinking of quitting due to personal health concerns'; however this mediator only explained 6.8% of the financial difficulties effect.

Particular strengths of this study include its novelty given the paucity of studies investigating potential mechanisms for the financial difficulties effect on quit success likelihood, and extending previous work which used one wave-pair of data (Waves 4-5).[5] Additionally, our findings are likely to be generalisable and representative given utilization of data from four countries.

A single item measure of self-reported financial difficulties status in the past month was used in this study. Financial difficulties status is considered a multi-dimensional construct consisting of objective indicators (material capital measures, employment status) and subjective indicators (perceived adequacy of one's financial position with attendant financial concerns and worries),[21] and is also likely to vary over time within a year. Consequently, there is potential exposure to under-ascertainment. However a single item measure of financial difficulties was demonstrated to be strongly and consistently, over time and across countries, associated with quit success likelihood. Additionally, there is potential for misclassification of smoking behaviour cessation outcomes, financial difficulties and other study variables. However in previous studies, self-reported smoking status appears to be generally valid, with studies showing little difference in validity between socio-economic or other groups. Consequently, any outcome misclassification is likely to be non-differential, resulting in financial difficulties-cessation outcome associations tending to be underestimated. Whilst some effects may have been missed, the effects observed are likely to be valid.

Whilst having financial difficulties is likely to exert its effect on quitting success through multiple mediators, single mediator models were used as a first step to identifying these factors. Furthermore, very few of the potential mediators considered had any substantial effect. Financial difficulties and potential mediators were recorded at the same time, which may reduce confidence in interpreting exposure-mediator associations as causal. In our sample, financial difficulties were more prevalent in smokers with low-middle incomes. However, there were marginal differences in the size of the financial difficulties-quit success associations for each wave, between the population of smokers with only low-middle incomes versus the whole income distribution. Therefore, findings are based on financial difficulties derived from the whole income distribution.

Our findings using data from a longer time span (Waves 4-7), regarding the total effect for financial difficulties on quit attempts and quit success are consistent with previous work.[5] If considering income as a proxy for the capability of meeting material needs our findings are consistent with previous longitudinal[1,22] and several cohort studies.[2,23,24,25]

In our sample, current health or QOL concerns, and lifestyle outcome expectancy had the strongest mediator effects. Previous studies suggest that these factors, whilst motivating quitting, are not sufficient to maintain successful abstinence.[7,9,24] PRIME theory, a comprehensive theory of motivation, would suggest that motivational beliefs (evaluations) of post-cessation health, QOL, or lifestyle expectancies, do not have a direct influence on cessation maintenance, unless they generate motives (wants / positive emotional states) for continued abstinence.[26,27] An individual-level explanation for the financial difficulties-quit success association may involve the combination of a lack of motives for cessation maintenance,[8] a lack of swift realisation of post-cessation benefits and the tendency of smokers in financial difficulties being more likely to have ''moments'' where pro-smoking emotional states and urges overwhelm pro-maintenance plans and evaluations.[26,27]

From existing literature, the price of cigarettes influencing thoughts about quitting,[28] perceived stress and use of cessation services were anticipated to be important mediators. For example, a North American study demonstrated that households with higher incomes were more likely to use resources for smoking cessation, and were more likely to achieve abstinence than those with lower incomes, though they did not conduct formal mediation analysis.[29] Results have been mixed however, with one study finding that composite SEP differentials in quit success are not explained by use of pharmacotherapy or local cessation services.[14] In our study, broad measures of use of smoking cessation services and cessation treatments utilized demonstrated variables weak and non-significant mediator effects, suggesting that failure to seek or access this type of support does not explain how financial difficulties reduce the likelihood of quit success.

Whilst a strong association between financial difficulties and perceived stress was demonstrated, perceived stress did not have a significant association with quit success after adjustment for confounders. However, findings from two previous studies suggest perceived stress is a mediator of cessation outcomes. Data from a smoking cessation program in Chicago, for single mothers (who might be presumed to experience frequent financial difficulties), had higher perceived daily stress which reduced the likelihood of non-smoker status at six months.[30] Additionally, in a study in smokers motivated to quit for at least 30 days and who were provided with smoking cessation support, smokers with lower SEP was associated with reduced abstinence at four weeks, which was possibly due to increasing negative affect/ stress.[31] A possible explanation for the discrepancy with our own findings is that our study population is more representative of the smoking population than either of these select groups.

Smokers having financial difficulties demonstrated a reduced likelihood of quit success, of which a small part of the effect was explained by individual-level smoking related health and quality of life concerns and expectations of post-cessation lifestyle improvements. Specific research is needed to support our findings and examine other plausible mediators of financial difficulties on quit success. This may require utilising qualitative research to identify relevant inter-personal and accessibility to local services (community-level) factors. The impact of the recession in the early 1980s still has an influence on our current ability to improve cessation rates in ex-industrial towns and cities[32,33] and yet the

decline in living standards may have an even greater pernicious effect on people with lower-to-middle incomes.

Even if downbeat expectations about future economic prosperity in high-income countries are only partly realised, there is still likely to be a greater proportion of smokers with financial difficulties than in previous years. Consequently, it will become essential to identify and act upon strong modifiable mediators of the financial difficulties effect on quit success. This will not only lead to tailoring of more effective cessation programmes, but contribute to sustaining the previous decade's work in tobacco control policies aimed at reducing social inequalities in smoking prevalence.

Supplementary Data

Supplementary Data are available at *Eurpub* online.

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Key points

- Smokers with financial difficulties were substantially less likely to succeed at quitting, an effect which was consistent over the survey years (2004/5-2008/9).
- Among potential mediators examined, those relating to cognition of health-related and quality-of-life related consequences of smoking, and post-cessation expectations of lifestyle improvements were the most important mediators, though the proportion of the effect mediated by the largest mediator was small (6.8%).
- The effect of financial difficulties on quit success does not appear to be explained by anticipated potential mediators such as perceived stress or reduced use of cessation services or treatment.
- Further research is required to determine the strong and plausible mediators of the effect of financial difficulties on quit success to tailor more effective cessation programmes.

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