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# Levels of physical dependence on tobacco among adolescent smokers in Cyprus

Costas A. Christophi [a,b,*], Despina Pampaka [a], Martha Paisi [a], Solonas Ioannou [a], Joseph R. DiFranza [c]

[a] Cyprus International Institute for Environmental and Public Health in association with Harvard School of Public Health, Cyprus University of Technology, Limassol, Cyprus
[b] Department of Environmental Health, Harvard School of Public Health, Boston, MA, USA
[c] Department of Family Medicine and Community Health, University of Massachusetts Medical School, Worcester, MA, USA

## HIGHLIGHTS

- Physical dependence on tobacco was present in 86% of the adolescent smokers.
- Withdrawal symptoms were not experienced until an average of 4 days of abstinence.
- Physical dependence was associated with greater perceived difficulty in quitting.
- Adolescent smokers in Cyprus had high levels of physical dependence.

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## ABSTRACT

*Purpose:* The purpose of this study is to assess tobacco dependence among Cypriot adolescents and examine its association to cigarette consumption and attitudes towards smoking.
*Methods:* The current study used cross-sectional data from the 2011 Cyprus Global Youth Tobacco Survey which adopted multistage cluster sampling methods to select adolescents registered in middle and high schools in Cyprus. Tobacco use, physical dependence on tobacco, and attitudes towards tobacco use were measured in 187 adolescents aged 13–18 years old who reported that they had smoked at least once in the preceding 30 days. Physical dependence was assessed using the Levels of Physical Dependence scale.
*Results:* Physical dependence was present in 86% of the adolescent smokers. The mean latency to needing among smokers in the highest dependence group was 101 h. Significant associations were observed between physical dependence and the perceived difficulty in quitting (OR = 13.1, 95% CI: 4.0, 43.0) as well as the expectation to continue smoking for the next five years (OR = 3.3, 95% CI: 1.3, 8.4). Significant associations were also observed between physical dependence and the number of smoking days per month, daily smoking, daily cigarette consumption, lifetime cigarette consumption, and perceived difficulty in abstaining from smoking for one week.
*Conclusions:* Physical dependence provides a symptom-based approach to assess dependence and it is a strong predictor of adolescents' perceptions of their ability to quit or to refrain from smoking for a week. Physical dependence on tobacco was highly prevalent among adolescent smokers in Cyprus and it was associated with greater perceived difficulty in quitting. Interventions targeting adolescent smoking must account for the high prevalence of physical dependence.


## 1. Introduction

Smokers experience nicotine withdrawal symptoms when they abstain from smoking for a long time; this is a manifestation of physical tobacco dependence. Once dependence develops, smokers experience a physiologic need to smoke every time they go without smoking for some time (Ursprung, Morello, Gershenson, & DiFranza, 2011). Clinical studies established that physical dependence (PD) develops in well-defined stages that progress similarly in all smokers (DiFranza, Sweet, Savageau & Ursprung, 2011). These stages are *wanting*, *craving*, and *needing* and can be assessed using the Levels of Physical Dependence scale (DiFranza, Wellman, & Savageau, 2012). Scores on this scale correlate well with structural alterations in the addiction circuitry of the brain (Huang et al., 2013, 2014). Although these levels only assess PD, advancement through the different stages corresponds to higher daily and lifetime consumption, and overall addiction (DiFranza et al., 2012).

* Corresponding author at: Cyprus International Institute for Environmental and Public Health, Cyprus University of Technology, 95 Eirinis Street, 3041 Limassol, Cyprus.
*E-mail address:* costas.christophi@cut.ac.cy (C.A. Christophi).

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Smokers who developed PD can only forgo smoking for so long before they begin to experience a physiologically triggered desire to smoke. The time between the last cigarette and the onset of the desire to smoke is termed the *latency* (DiFranza & Ursprung, 2008). Depending on the level of PD that the smoker has reached, during withdrawal from nicotine the desire to smoke can intensify from wanting, to craving, to needing. Thus, there is latency to wanting, latency to craving, and latency to needing (Fernando, Wellman, & DiFranza, 2006; Ursprung et al., 2011). At the onset of PD, the latencies may be measured in weeks, but over time, as tolerance develops, they shorten progressively. This shortening drives an increase in tobacco consumption (Fernando et al., 2006; Ursprung et al., 2011).

It is argued that the earlier in age smoking is initiated the higher are the odds of becoming dependent (Breslau, Fenn, & Peterson, 1993). Even simple experimentation with tobacco by adolescents significantly raises their risk of being smokers as adults (Chassin, Presson, Rose, & Sherman, 1996; McPherson, Strong, & Myers, 2008). Dependence symptoms present early in the process, driving consumption and leading to regular smoking (Fernando et al., 2006). Nicotine dependence may affect the switch from experimentation to becoming a regular tobacco user (Rojas, Killen, Haydel, & Robinson, 1998) and may escalate smoking frequency as this transition occurs (Rose & Dierker, 2010).

Social and environmental factors, such as tobacco advertising, and peer and parental smoking, are important factors for smoking initiation (Rojas et al., 1998), smoking prevalence (Christophi, Savvides, Warren, Demokritou, & Connolly, 2009), smoking dependence, and intent to quit (Savvides et al., 2014). A better understanding of how PD on tobacco develops in adolescents may be helpful for preventing tobacco use among youth.

Cyprus is an island in the eastern Mediterranean region with a population of 847,000 people (Statistical Service of the Republic of Cyprus). The Republic of Cyprus has five government-controlled municipalities, namely Lefkosia, Lemesos, Paphos, Larnaka, and Ammochostos. Despite the fact that adolescent smoking prevalence has declined in some countries, it has increased in others, such as Cyprus. According to the Eurobarometer, about one third of the adult population in Cyprus reported being current smokers (TNS Opinion and Social, 2012) and Cyprus has one of the highest cigarette consumption rates in Europe (Eriksen, Mackay, & Ross, 2012). Furthermore, smoking prevalence among adolescents in Cyprus is quite concerning, at 13% among boys and 7% among girls in middle-schools, and 36% among boys and 23% among girls in high-schools (Christophi et al., 2008). Between the 2006 and 2011 Global Youth Tobacco Survey (GYTS) in Cyprus, daily cigarette smoking increased, in relative terms, by 3.7%. This happened despite measures taken by the government of Cyprus, including smoking prevention programs within schools and a ban on smoking in all enclosed public spaces (Christophi et al., 2013).

As the levels of PD and latencies phenomena have only been studied in convenience samples, we sought to extend this work by studying a systematic sample of adolescent smokers in Cyprus. As this is the first such study in Cyprus, it is important to understand how prevalent PD is among Cypriot adolescents, and how PD influences attitudes and expectations about quitting. Understanding addiction is vital for developing effective intervention programs.

## 2. Methods

### 2.1. Study design

A two-stage cluster design was used to select a sample of adolescents registered in middle- (grades 7–9) and high- (grades 10–12) schools in Cyprus. Standardized methodology used in the GYTS was followed; details can be found elsewhere (GYTS Collaborating Group, 2003). Briefly, all middle and high schools with a school size of 40 or more students in the academic year 2009–2010 were included in the sampling frame; in the first stage schools were selected with probability proportional to their size and in the second stage classes within selected schools were chosen using a systematic equal probability sampling with a random start. All students in the selected classes were eligible to participate. The Cyprus Ministry of Education and Culture granted permission for the study and parental consents were obtained before students could participate. Participation was voluntary. The survey was administered in a class group setting in the students' classroom during school hours by trained field workers. The questionnaires were paper-based, self-administered in Greek, and completed anonymously. The overall response rate was 31% and the completed questionnaires were mailed to the US Centers for Disease Control for data entry. Because of the lower response rate, the questionnaires were not weighted for the analysis.

### 2.2. Measures

Our analysis focused on current smokers, defined as having smoked at least one cigarette during the past 30 days. All other participants were excluded from the analyses. Current smokers were further classified as daily and non-daily smokers.

The main variable of interest was tobacco PD as assessed by the Levels of Physical Dependence measure (DiFranza et al., 2012). This validated measure assigns smokers to one of four levels of PD based upon their endorsement of the following three statements:"*If I go too long without smoking the first thing I will notice is a mild desire to smoke that I can ignore*" (Level 1 PD: wanting); "*If I go too long without smoking, the desire for a cigarette becomes so strong that it is hard to ignore and it interrupts my thinking*" (Level 2 PD: craving); and "*If I go too long without smoking I just can't function right, and I know I will have to smoke just to feel normal again*" (Level 3 PD: needing). Response options were "not at all, a little, pretty well, very well." Using the standard scoring approach, endorsement of any of the three positive response options was considered to be an endorsement of the item. Participants were assigned a score from 0 to 3 reflecting the highest stage they had endorsed. Individuals who did not endorse any of the three statements were assigned a score of zero (Level 0 PD: no PD). The Levels of PD has been validated before both as a categorical and a continuous measure (DiFranza et al., 2012).

Other variables included: age, gender, number of smoking days/month (1–2, 3–5, 6–9, 10–19, 20–29, and every day), daily cigarette consumption (<1, 1–5, 6–10, 11–20, and >20 cigarettes), and lifetime cigarette consumption (<10, 10–19, 20–99, 100 cigarettes or more). The mid-point of the reported range was used to create continuous variables.

Latencies were measured as follows; a) latency to wanting: "*How long can you usually go without smoking before you feel a mild desire to smoke*?"; *b*) latency to craving: "*How long can you usually go without smoking before you feel such a strong desire to smoke that it is hard to ignore*?"; and c) latency to needing: "*How long can you usually go without smoking before you feel you need to smoke just to feel normal again*?". Participants were provided with response categories for hours, days, and weeks. Responses were converted to hours and treated as continuous variables in the analyses. In order for participants to have a latency to wanting they must have reached the wanting stage (Level 1 PD), to have a latency to craving-the craving stage (Level 2 PD), and to have a latency to needing-the needing stage (Level 3 PD).

Attitudes and expectations related to quitting were evaluated with the following: "*If you smoke now, have you thought about trying to stop smoking in the near future*?", "*Do you think you will be smoking cigarettes 5 years from now*?", "*How easy or difficult would you find it to go without smoking for as long as a week*?", "*How easy or difficult would you find it to give up smoking altogether if you wanted to*?", and "*Do you want to stop smoking now*?", with the answers converted in dichotomous variables ('yes/no' or 'difficult/easy').