

## 論文の内容の要旨

論文題目 Global tobacco use trends and projections, 1990 to 2025:  
an analysis of four tobacco use indicators

(たばこ使用における1990年から2025年の世界的傾向と将来予測  
ーたばこ使用四指標の分析ー)

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### **Background and Objectives**

Tobacco control is a global health priority. Smoking kills six million people worldwide every year accounting for one death every six seconds, and one of every two smokers die from their habit. The 2003 WHO Framework Convention on Tobacco Control formalized global commitment, and the 2011 United Nations political declaration on non-communicable diseases (NCDs) provided additional momentum for urgent and sustained control of tobacco use. The resulting 2013 WHO global monitoring framework endorsed a 30% relative reduction in tobacco use target to be achieved by 2025 with 2010 levels as baseline. Although tobacco use declined globally over the past decades, many countries are still experiencing smoking epidemics or have weak tobacco control policies, and tobacco use remains a leading health risk with 144 million NCD disability-adjusted life-years lost due to smoking in 2010 with the majority in developing settings.

To help maintain global progress in tobacco control and reduce country inequities in preventing tobacco-related health burden, quantitative assessments of tobacco use trends and projections are needed to track and evaluate tobacco control efforts and to aid in the development and implementation of tobacco control strategies. This study aimed to provide an up-to-date, comprehensive and consistent assessment of recent trends and projections for four tobacco use indicators and of achievement of tobacco use reduction targets under the WHO global monitoring framework for as many countries as feasible.

### **Data and Methods**

A Bayesian hierarchical meta-regression modeling approach was developed using

tobacco use data from the WHO Comprehensive Information Systems for Tobacco Control (CIC). After WHO-CIC data quality control procedures and application of inclusion and exclusion criteria, the final dataset for analysis encompassed 896 nationally-representative population-based surveys in 180 countries covering the period 1990 to 2014, amounting to 26,153 datapoints specific to country, year, sex, and age. Using a generalized negative binomial likelihood for the data, Bayesian hierarchical meta-regression models and multi-stage model-fitting algorithms were developed that enabled supplementation of scarce country data with regional information via prior distributions, allowed for shifts in trends due to time-varying factors via interaction terms, provided flexibility in age patterns via spline structures, and enabled simultaneous and consistent estimation of different tobacco use indicators via indicator coefficients and prior-based constraints. With the available data, models were fitted for 173 countries for men and 178 countries for women applying Markov-Chain Monte Carlo methods. Trends for current tobacco smoking, daily tobacco smoking, current cigarette smoking, and daily cigarette smoking were assessed from 1990 to 2010, baseline projections were made to 2025 and probabilities for decreased tobacco use, increased tobacco use, and achievement of tobacco use reduction targets were obtained from posterior distributions. Modeling was conducted using DisMod-MR software and Python programming language.

## **Results**

During the most recent decade (2000–2010), the prevalence of tobacco smoking in men fell in 125 countries (72%), and in women fell in 155 countries (87%). In 2010, estimated prevalences ranged from less than 24% in the first quintile to 48% or greater in the fifth quintile for men, and from less than 2% in the first quintile to 22% or greater in the fifth quintile for women. For men, 24 of the first quintile (67%) were LMI countries in Africa and the Americas with several African nations increasing in prevalence from 2000. For women, the first quintile was comprised mostly (89%) of 31 LMI countries from diverse geographies including 15 (43%) African nations. For both men and women, countries in the fifth quintile were concentrated mainly in Europe and the Western Pacific. Even if global declines continue, only 43 countries (25%) for men and 93 (52%) for women will have  $\geq 95\%$  probability of decline from 2010 to 2025, and 21 countries (12%) will have  $\geq 95\%$  probability of increase among men over the same period. Only 37 (21%) countries are on track to achieve 30% relative reduction in tobacco use targets by 2025 for men and 88 (49%) are on track for women. These trajectories translate to 1.1 billion (700 million

to 1.6 billion) current tobacco smokers globally in 2025 due to population growth. If such trends remain unchanged, country inequities in tobacco use would persist and rapid increases in prevalence are predicted in Africa for men and in the Eastern Mediterranean for both men and women.

## **Conclusions and Recommendations**

Globally, smoking prevalence trends are decreasing but tobacco use reduction targets remain out of reach for many countries, especially in the developing world. Global tobacco control efforts over the past decades have been successful, and the majority of countries have experienced declines in smoking prevalence for both men and women. Despite global progress, there currently remains wide variation in national smoking prevalence reflective of differences in tobacco epidemic stages and in control efforts between countries. Even if global declines continue, many countries will not achieve the 30% reduction target for either men or women, and because of population growth, there will be more than one billion smokers by 2025. Striking country disparities in smoking prevalence will also persist, with several low-income and middle-income nations in Africa and in the Eastern Mediterranean at risk of worsening smoking epidemics.

Tobacco control challenges can be addressed by effective policy and action. Immediate and comprehensive implementation of FCTC-based MPOWER measures to the highest WHO-endorsed levels and their strong and sustained enforcement is recommended. To further accelerate declines and to avoid potentially stagnating trends, development of and prudent implementation of innovative demand-side and supply-side tobacco control measures would be helpful. Finally, international cooperation and multisectoral approaches should be fostered in order to overcome tobacco industry interference and enhance country tobacco control capacity. If immediate, effective and sustained action is undertaken, desirable trajectories may be attained and maintained towards global convergence in tobacco use elimination.