

RESEARCH ARTICLE

The marginal causal effect of opium consumption on the upper gastrointestinal cancer death using parametric g-formula: An analysis of 49,946 cases in the Golestan Cohort Study, Iran

Neda Mohammadi¹, Masoomeh Alimohammadian^{2,3}, Akbar Feizesani², Hossein Poustchi², Ahad Alizadeh⁴, Mehdi Yaseri^{1*}, Mohammad Ali Mansournia^{1*}, Alireza Sadjadi^{2,5}

1 Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran, **2** Digestive Oncology Research Center, Digestive Disease Research Institute, Tehran University of Medical Sciences, Tehran, Iran, **3** Department of Human Ecology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran, **4** Metabolic Diseases Research Center, Research Institute for Prevention of Non-Communicable Diseases, Qazvin University of Medical Sciences, Qazvin, Iran, **5** No Way New Way Company, The Hague, The Netherlands

* M.Yaseri@gmail.com (MY); Mansournia_Ma@yahoo.com (MAM)



OPEN ACCESS

Citation: Mohammadi N, Alimohammadian M, Feizesani A, Poustchi H, Alizadeh A, Yaseri M, et al. (2021) The marginal causal effect of opium consumption on the upper gastrointestinal cancer death using parametric g-formula: An analysis of 49,946 cases in the Golestan Cohort Study, Iran. PLoS ONE 16(1): e0246004. <https://doi.org/10.1371/journal.pone.0246004>

Editor: Christy Pu, National Yang-Ming University School of Medicine, TAIWAN

Received: July 1, 2020

Accepted: January 12, 2021

Published: January 25, 2021

Copyright: © 2021 Mohammadi et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: The data of the Golestan Cohort Study are not approved public release by the ethics committee, and the data supporting the findings of this study will be available upon reasonable request. Data requests can be sent to the corresponding authors or the Digestive Diseases Research Institute, Mailing Address: Shariati Hospital, North Kargar Street, Tehran, Iran, Tel: (+98) 2182415000, Email: info@ddri.ir.

Abstract

Upper gastrointestinal (UGI) cancer, including esophageal and gastric, is one of the most common cancers in the world. Hence, the determination of risk factors of UGI helps to reduce the economic and social burden of this cancer in communities. In Iran, the consumption of opium because of its neighborhood with Afghanistan are considerable. In this study, we examine the causal effect of opium use on the time to UGI cancer death. Based on the Golestan Cohort Study (GCS) in northeastern of Iran, about 50000 adults were enrolled to the study for four years (2004–2008) and followed annually until July 2018. We used “parametric g-formula” to study the causal effect of opium use on the time to death due to UGI. In this study, the information of 49946 individuals due to missingness were analyzed. So the median of follow-up time was 144 months and the prevalence of opium use was 17% (about 8489 persons). During the follow-up period, 593 (1.2%) death from upper gastrointestinal cancer were reported. The study showed that the effect of opium use on the time to UGI death was statistically significant (adjusted risk-ratio based on parametric g-formula = 1.31, 95% CI: [1.04, 1.65]). Additionally, the Population Attributable Fraction (PAF) in UGI cancer deaths of opium use was estimated 5.3% (95% CI: [0.6%, 11.3%]). Our results showed a causal effect of opium use on the intensity of upper gastrointestinal cancer death.

Introduction

According to the World Health Organization (WHO), in 2016, 71% of all deaths were related to Non-communicable diseases that 22% of such deaths were caused by cancers [1]. Upper