Targeted Literature Review for Estimating Median Age of Causal Human Papilloma Virus Infection to Oropharyngeal Cancer

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INTRODUCTION

Due to the long latency of Human Papillomavirus (HPV) associated Oropharyngeal Cancer(OPC) and lack of screening program, the natural history of OPC progression is not well-characterized.

OBJECTIVES

We aimed to summarize models estimating the natural history from infection to OPC and identify the key factors determining the age distribution of causal infection.

METHODS

- Targeted literature review in PubMed and Embase identified studies reporting on natural history model and on either OPC/HPV positive (HPV+) OPC incidence, percentage of patients acquiring HPV+ OPC, or median age of causal infection
- To calculate the median age of disease causal HPV infection in studies that did not report, we calculated the cumulative percentage of OPC cases from the SEER incidence data and then subtracted it from the median latency period.

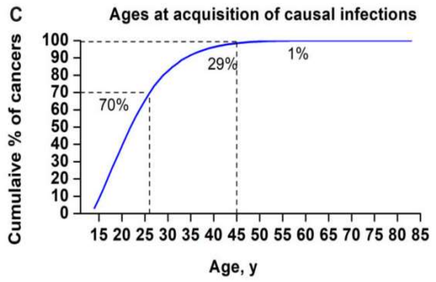
RESULTS

- Five eligible studies were identified: two utilized microsimulation models to understand the natural history of oral HPV infection and its progression to OPC, while the remaining examined the impact of increasing HPV vaccination rates on OPC using population dynamic, Markov and Age-period-cohort forecasting models.
- Incidence and prevalence were informed by SEER and NHANES in most studies
- Only Landy et al, reported a median age for disease causal HPV infection as 23 years, with a median latency period of 39 years, and 29% of patients acquiring HPV+ OPC between ages 27 and 45.
- Damgacioglu et al. developed a microsimulation model focusing on genotype-specific HPV infection persistence and OPC progression.
- Landy et al developed a microsimulation-based natural history model in the absence of vaccination and incorporated direct and indirect effects from 14 female and male vaccination scenarios to estimate the number of HPV16+ OPC prevented
- Choi et al. calibrated the progression rates from HPV infection to OPC using SEER data on HPV+ OPC incidence rates.
- Zhang et al. determined HPV-related OPC proportions from SEER tumor HPV testing data.
- Zhong et al. incorporated an epidemiologic model, validating predictions against SEER incidence rates.
- Overall, the shape of the age distribution for acquisition of causal infection was influenced by data inputs and assumptions underlying the OPC progression, oral HPV acquisition, oral HPV clearance, and heterogeneity in oral sexual behaviors and partnerships.

RESULTS : Estimation of median age at acquisition of disease causal HPV infection*

Median Age of Causal Infection = Median Age of OPC Diagnosis - Median Latency Period

Landy et al_2023

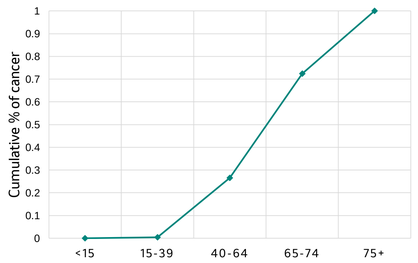


- Median latency period: **39 years**
- Median age : **23 years**
- **29% acquired during ages 27 to 45 years**

➢Incidence data: SEER (2009-2016)

- Estimated median age(Simulation data): 25.26

Choi ES et al_2022



- Estimated Median age : 70.1-39 = **31.11 years**

➢Incidence data: SEER (2003-2019)

	Age (Years)	95 % CI	
Mean	27.4	24.88	29.87
STD	2.54		

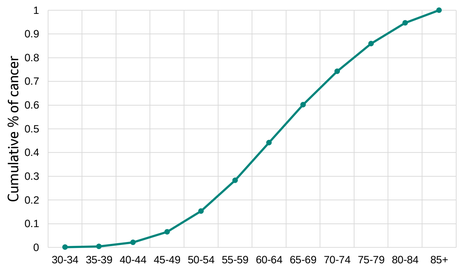
The overall calculated mean age is 27.4 years, higher than the median age of 23 years reported in Landy et al. as it is unadjusted.

Reported

Estimated

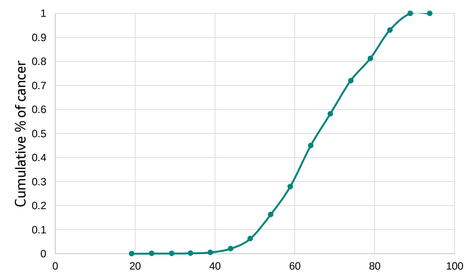
*Value calculation is based on a highly simplified assumptions and does not assume any heterogeneity

Damgacioglu H et al 2022



- Estimated Median age : 66.8-39 = **27.8 years**
- Incidence data: NPCR-SEER (2009- 2017)

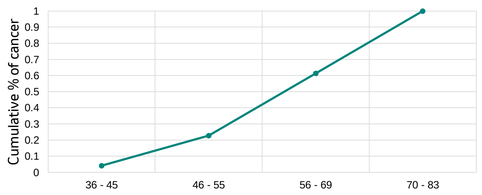
Zhong C et al_2021



- Estimated Median age : 66.9-39 = **27.9 years**

➢Incidence data: Texas 2012

Zhang Y et al_2021

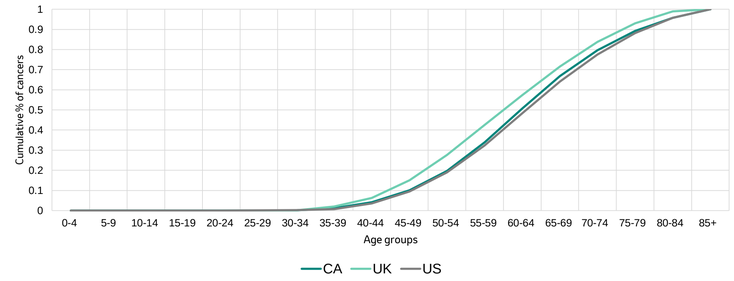


- Estimated Median age : 65.8-39 = **26.9 years**

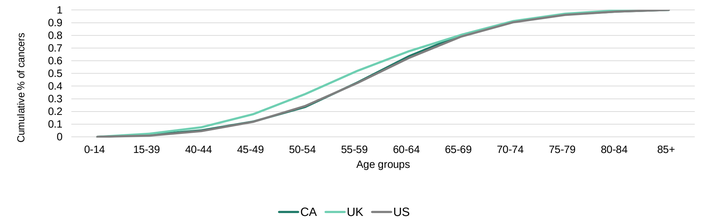
➢Incidence data: 1992 to 1999; 2000 to 2017

RESULTS : Median age of OPC diagnosis is 3-4ys earlier if the estimation is based on incidence case number than if the estimation based on incidence rate

Incidence rate



Incidence case



Median age of causal infection

Data source	Data input	UK	US	CA	Mean	95% CI
hpvcentre.net	Incidence case	20.48	22.93	22.75	**22.05**	(20.96-23.14)
HPV INFORMATION CENTRE	Incidence Rate	23.50	26.54	25.79	**24.51**	(23.11-25.92)

CONCLUSION

- Our study highlights that there are few studies estimating the median age of causal infection which are all US specific.
- Results may not be generalizable to countries with varying key determinants of median age of causal HPV infection.

CONTACT

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