



## Research article

# Barriers and facilitators of prevention of infections related to cancer: A systematic literature review

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## A B S T R A C T

Chronic infections such as *Helicobacter pylori* (Hp), Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human papillomavirus (HPV) are a major cause of gastric, liver, and HPV-related cancers that contribute significantly to the global burden of human cancers. Infections related to cancers can be prevented by preventing infection through vaccination, timely detection through screening, and eradication of the underlying infections. These strategies have proven effective in different countries, but the participation rates of vaccination, screening, and eradication programs for Hp, HCV, and HPV are less than optimal. Research has shown that participation rates are influenced by various social, cultural, economic, and personal barriers and facilitators. To uncover the current evidence and enhance the understanding of the factors of prevention of infections related to cancer, we conducted a systematic literature review of such barriers and facilitators. We searched Web of Science, PubMed, and Scopus databases to identify relevant original articles published between 2013 and 2023. After screening 685 articles, a total of 23 studies were included for full-text analysis. Most of the studies analyzed factors related to the prevention of HBV, HPV, and HCV infections, while there was a relative lack of studies for Hp infections. Vaccination as a prevention measure of infections related to cancer was analyzed in most of the studies, followed by screening and treatment. We found several personal, social, economic, and cultural factors that act as barriers to the prevention of infections related to cancer and classified and connected these barriers and facilitators through the prism of health capital. Knowledge about the barriers that influence individuals' engagement with prevention measures of infections related to cancer has the potential to inform and guide health policymakers by targeting vulnerable populations through effective educational programs and improvements to the quality of healthcare services.

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## 1. Introduction

Chronic infections represent a major cause of human cancer: on a global scale, they are responsible for an estimated 13 % of human cancers. *Helicobacter pylori* (Hp), Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Papilloma Virus (HPV) are responsible together for more than 90 % of these cases, or nearly 12 % of total cancer burden [1].

Hp infection is the main risk factor for gastric cancer while liver cirrhosis due to chronic HCV infection is one of the leading causes of liver cancer [1]. The evidence for chronic hepatitis B virus (HBV) infection and hepatocellular carcinoma (HCC) incidents is also well-established [2]. HPV infection is the main driver of cervical cancer and also increases the risk of developing five other types of cancer such as anogenital and oropharyngeal cancers [3].

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Infections related to cancers can in principle often be prevented by preventing or treating the underlying infections [4]. In the case of gastric cancer, a possible preventive strategy is to screen for Hp and eradicate Hp in the individuals found to be infected with Hp. For liver cancer, a dual strategy is to prevent HBV and HCV infections in the first place while screening for and eradicating existing infections using direct-acting antivirals. For cervical cancer, increasing HPV vaccination rates in high-income countries have demonstrated the potential of prevention through vaccination, with therapeutic vaccines on the horizon [5] providing the basis for screening and eradication initiatives of the infection. The evidence also shows that secondary prevention in the form of screening for cervical cell changes has led to substantial declines in cervical cancer occurrence in areas with established screening programs [6].

While these prevention strategies have the potential to significantly reduce the incidence of infections related to cancers, in many countries, their full impact is hindered by less-than-optimal participation rates in screening, vaccination, and eradication programs for Hp, HBV, HCV, and HPV [7,8]. Extant studies on infection-related cancer prevention indicate a strong impact of different factors on intended and actualized participation rates, i.e., participation rates are modulated by various social, cultural, economic, and personal barriers and facilitators. However, the results of separate studies are often incomparable, sometimes inconsistent, and in a few cases even contradictory. Extant reviews that include sociocultural aspects are limited in scope to one type of infection such as HPV [9], to a particular aspect of prevention such as the role of social media and COVID-19 in vaccine hesitancy [10], or to both such as social values in HPV screening, diagnosis, and treatment [11].

To fill this gap in the extant literature, in this article, we aim to identify, aggregate, and validate social, cultural, economic, and personal barriers and facilitators regarding the prevention of infections related to cancer such as Hp, HBV, HCV, and HPV infections. Here, by prevention, we refer to both intended and actualized participation in screening, vaccination, and eradication programs for such infections. To achieve this aim, we conduct a systematic review of the pertinent literature.

## 2. Theoretical perspective

In the wake of a rising focus on personalized healthcare and health inequalities, viewing health through the lens of capital, understood as individual assets in a social system, offers a promising way to understand the heterogeneity of individuals' health behaviors and attitudes, especially in the context of illness prevention. In this review, we adopt a recent conceptualization of health capital [12] as an integrative framework to understand the barriers and facilitators in preventing infections related to cancer. Health capital is defined as the aggregate of actual or potential resources possessed by an agent that have the capacity to affect the position of agents in the social field of health [12]. Health capital comprises resources available to individuals that can be employed to maintain good health and manage illness. These resources can be social, cultural, economic, or personal [13].

The health capital perspective allows understanding how health-related resources at the disposal of individuals can act as barriers or facilitators in the prevention of infections related to cancer. While possessing cultural resources such as basic health literacy can be assumed to facilitate the participation in screening and vaccination programs, lacking economic resources might create barriers to successfully participate in the prevention or treatment of infections related to cancer. Understanding these barriers and facilitators can provide insights and help formulate recommendations to address sociocultural and behavioral barriers by providing the appropriate resources to mitigate their effects. Additionally, it can guide the exploitation of sociocultural and behavioral facilitators by activating and repurposing existing resources to increase participation in and adherence to prevention programs.

## 3. Materials and methods

We conducted the systematic literature review following a structured research process, ensuring rigorous scientific standards and the reliability and validity of our findings. First, we identified the most prevalent and preventable infections related to cancer and defined the research aim of this study. Next, we searched selected databases for eligible studies and screened the records based on our

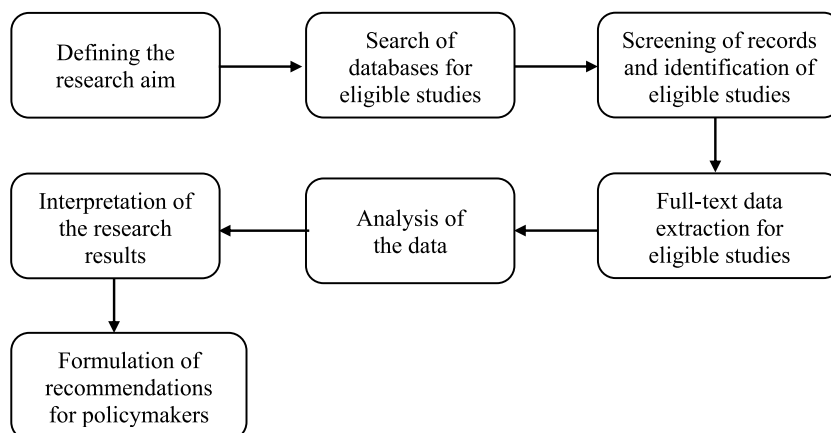


Fig. 1. The flow of the research process.

eligibility criteria. We then extracted data from the included studies and conducted a data analysis. Finally, we interpreted the results of the systematic literature review and provided recommendations for health policymakers. This research process is illustrated in Fig. 1.

The systematic literature review was conducted and reported following PRISMA 2020 guidelines [14] with the aim of fueling a qualitative data synthesis inspired by work on barriers to hormonal contraception [15].

### 3.1. Design and search strategy

The records from Web of Science, PubMed, and Scopus databases published in the last 10 years from 2013 to 2023 were searched (last searched in November 2023) using a combination of carefully selected keywords crafted jointly with experts in the epidemiology of infection-related cancers. In the final search strategy used, we combined the following terms and searched for them in the title and abstract metadata.

(i) [HPV OR hepatitis B OR hepatitis C OR Helicobacter pylori]

AND.

(ii) [prevent\* OR vaccin\* OR screen\* OR treatm\* OR eradicat\*]

AND.

(iii) [social OR sociocultur\* OR cultur\* OR econom\* OR behavior\* OR behaviour\*]

The search strategy generated 353 records from the Web of Science, 234 from the PubMed database, and 98 from the Scopus database, which resulted in a total of 685 records that were assessed regarding their eligibility (Fig. 2).

### 3.2. Screening and eligibility assessment

The results of the 685 records were screened based on title and abstract. We excluded articles that were not original, involved neither HPV, Hp, HBV, or HCV infections, were not related to prevention (as defined in our aims subsection) such as screening,

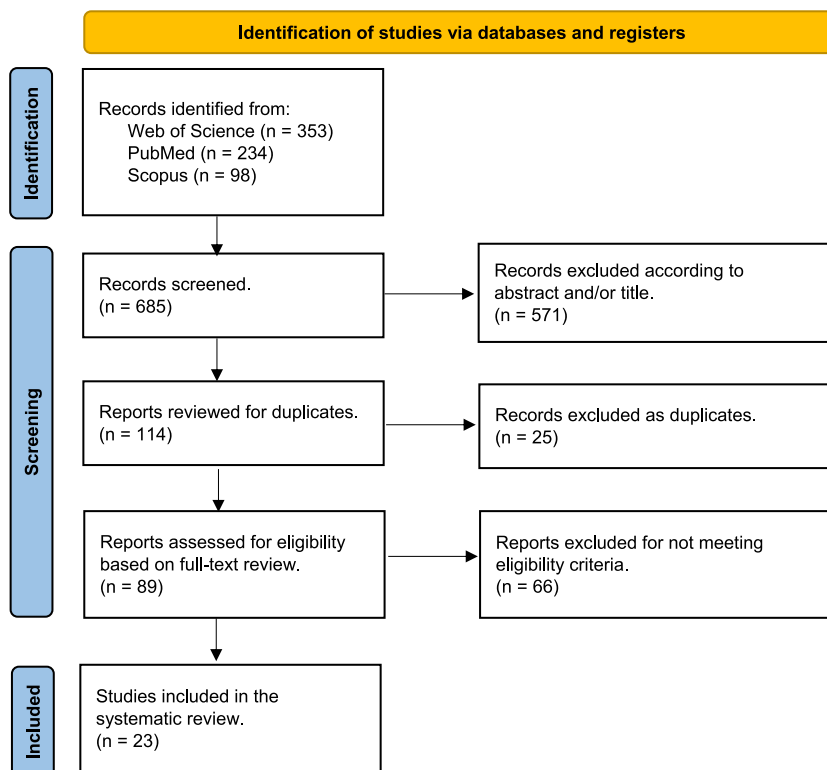


Fig. 2. PRISMA 2020 chart of the study selection.

**Table 1**  
Pre-specified eligibility criteria.

Inclusion criteria	Specifications
<i>Participants</i>	<ul style="list-style-type: none"> <li>• Participants representing the population in general.</li> <li>• Without severe physical or mental/intellectual disabilities.</li> <li>• Participants with some other special conditions such as being pregnant, having addictions, noncommunicable diseases, or other chronic conditions.</li> <li>• We refrain from restricting the context to high-income countries as studies set in low- and middle-income countries can be expected to deepen our understanding of the social, cultural, economic, and behavioral factors regarding the prevention of infections related to cancer.</li> </ul>
<i>Participants' age</i>	<ul style="list-style-type: none"> <li>• The mean age of participants was &gt;25 and &lt;65 years;</li> <li>• Studies, where the mean age of the participants was below 25 years old and above 65 years old were excluded. The rationale behind this criterion is to limit the scope to social, cultural, economic and personal barriers and facilitators of intended and actual participation, excluding populations groups such as children or adults in need of care where the intention and decision-making often lies with secondary parties such as parents, family members, or other guardians.</li> </ul>
<i>Perspective</i>	<ul style="list-style-type: none"> <li>• This study focuses on the perspective of the workers/people from the general population. Therefore, we included only studies that investigated the preventive behavior or intention to perform such behavior from the participants' own perspective.</li> <li>• We excluded studies that investigated the preventive behavior from the perspective of secondary parties such as parents, healthcare providers, or general practitioners but not the direct recipients of infection-related preventive measures.</li> </ul>
<i>Cancer-related infections</i>	<ul style="list-style-type: none"> <li>• Only records related to <i>Helicobacter pylori</i>, Hepatitis B and Hepatitis C, and HPV were included. The rationale is that (a) the related gastric, liver, and cervical cancers account for over 3 out of 4 of infection-related cancers (b) there are viable prevention strategies for these cancers.</li> </ul>
<i>Medical history</i>	<ul style="list-style-type: none"> <li>• We were interested in preventive behavior of specific cancer-related infections. Therefore, we excluded studies where participants were previously diagnosed with liver, gastric, or HPV infection-related cancer such cervical or throat cancer.</li> </ul>
<i>Original research Language</i>	<ul style="list-style-type: none"> <li>• We excluded review articles, editorials, opinion, and theoretical articles, as well as commentaries and other non-empirical articles.</li> <li>• We excluded articles written in languages other than English from the analysis.</li> </ul>
<i>Quality</i>	<ul style="list-style-type: none"> <li>• We exclude articles that do not provide sufficient details regarding their methodological and analytical frameworks or where the constructs analyzed were not clearly defined and explained.</li> </ul>

vaccination, or treatment of infections related to cancer, or were written in a language other than English. To limit the scope of our review to social, cultural, economic, and personal barriers and facilitators, as the subsequent step, we excluded the extensive number of articles evaluating the cost-effectiveness or effectiveness of different types of interventions related to cancer prevention and articles that analyzed different psychological factors. Examples of the latter include personality or cognitive factors except health-related knowledge and risk perception of infection or perception of risk/benefits of preventive measures since it was indicated in previous studies that knowledge and risk perception are important factors interplaying in individual health-related decision-making process [16–18].

Consequently, this left 114 papers potentially eligible papers, which we subjected to full-text analysis based on the pre-specified eligibility criteria presented in [Table 1](#). We applied these eligibility criteria one by one from top to down for each of the retrieved articles, immediately excluding articles when they failed to meet one of the criteria. This process resulted in a final sample of 23 articles. No articles were excluded later in the process. The PRISMA 2020 chart for the study selection ([Fig. 2](#)) presents the screening process results. We ensured full compliance with the PRISMA 2020 checklist for this systematic review, marking points 11–15 (except for 13d), 18–22, and 24 as non-applicable as our research did not employ quantitative synthesis methods such as meta-analysis or -regression and was exempt from any registration requirements.

### 3.3. Data extraction

For each of the 23 studies included in the systematic review, we analyzed the following elements in the full-text articles: a) preventive behavior measures taken or intention to take preventive measures such as screening, vaccination, or eradication for infections related to cancer; b) social, cultural, economic, and personal factors related to intended and actual participation in prevention activities and other relevant results; and c) study setting and design.

### 3.4. Analysis and synthesis

For the analysis, we employ the resource-based view of factors based on the conceptualization of health capital presented in [Section 2](#). Health capital encompasses and integrates social, cultural, economic, and personal resources, thus providing a framework for simultaneously classifying and unifying the identified factors during the qualitative synthesis.

## 4. Results

According to the pre-specified inclusion criteria, in total 23 studies were included in the analysis. A description of the studies included is presented in [Table 2](#). All studies included were peer-reviewed journal articles. In most of the studies, hepatitis B virus (43.48 %) and HPV infection (30.43 %) were the main research topics, and very few studies explored sociocultural, economic, and behavioral factors related to Hp infection (8.7 %). In the rest of the studies factors related to hepatitis C infection (17.39 %) were analyzed. Vaccination as a prevention measure of infections related to cancer was analyzed in most of the studies (43.48 %), following

**Table 2**  
Description of included studies.

Variable	Total – n (%)
Total – N	23
<b>Country/countries where data was collected</b>	
Australia	2 (8.7)
China	7 (30.43)
Denmark, Norway, and Sweden	1 (4.35)
UK, France, Germany, Italy, Spain, Portugal, and Switzerland	1 (4.35)
Mayotte Island (Indian Ocean)	1 (4.35)
Netherlands	1 (4.35)
Turkey	1 (4.35)
Uganda	1 (4.35)
United States of America	8 (34.8)
<b>Publication type</b>	
Journal article	23 (100)
<b>Study design</b>	
<i>Qualitative</i>	6 (26.1)
Interview	3 (13.04)
Focus group	1 (4.35)
Case study	2 (8.7)
<i>Quantitative</i>	17 (73.91)
Cross-sectional	15 (65.22)
Discrete choice experiment	1 (4.35)
An observational cohort study	1 (4.35)
<b>Study population</b>	
General population	11 (47.83)
Minorities in the society	8 (34.78)
<i>People with special conditions</i>	5 (21.74)
Pregnant women	1 (4.35)
Previously or currently injecting drugs	3 (13.04)
Patients undergoing HCV treatment	1 (4.35)
<b>Cancer related infection</b>	
HPV	7 (30.43)
Helicobacter pylori	2 (8.7)
Hepatitis B	10 (43.48)
Hepatitis C	4 (17.39)
Hepatitis B & Hepatitis C	1 (4.35)
<b>Prevention measure</b>	
Screening	7 (30.43)
Vaccination	10 (43.48)
Screening & vaccination	2 (8.7)
Treatment	4 (17.39)

by screening (30.43 %), and treatment (17.39 %), while some studies explored factors related to screening and vaccination in the same study (8.7 %).

Most studies were performed in the USA (34.8 %) and China (30.43 %). The rest of the studies were conducted in different countries such as Australia (8.7 %), The Netherlands (4.35 %), Turkey (4.35 %), Uganda (4.35 %), and others. In most of the studies, quantitative research methods (73.91 %) were applied. The cross-sectional design (65.22 %) was selected most often for quantitative studies. For studies that used qualitative research methods (26.1 %), most of the studies used interviews (13.04 %), some studies used case study design (8.7 %), and only one study used a focus group design (4.35 %). Participants in most of the studies were from the general population (45.83 %), followed by different minorities (33.3 %). Approximately one-fifth of the studies consisted of participants with special conditions (21.74 %) including participants who were injecting drugs previously or currently (13.04 %), patients undergoing HCV treatment (4.35 %), or pregnant women (4.35 %).

The main findings and characteristics of the 23 studies (abbreviated S1 to S23) that met the inclusion and quality criteria are presented in Table 3. Different methodologies were used to explore social, cultural, economic, and personal barriers and facilitators of infections related to cancer. In the studies that used quantitative methods, social, cultural, economic and personal factors related to the prevention of infections related to cancer were examined by collecting the data about participants' age (12 of 23, S1, S3-4, S9-15, S17-18), gender (5 of 23, S8-10, S14, S18), sex (3 of 23, S10-12) education (13 of 23, S1, S3-4, S8-12, S14-18), income (8 of 23, S1, S3-4, S8-9, S14, S17-18), occupation or employment status (6 of 23, S8-9, S11, S14, S16-17) marital status (7 of 23, S1, S4, S9, S11-12, S16, S18), ethnicity (4 of 23, S1, S3-4, S9), religion (3 of 23, S3, S9, S11), knowledge (6 of 23, S1, S8-10, S12, S18) and awareness (2 of 23, S1, S8) of infection related to cancer. Fig. 3 visualizes the intersections of the four most prevalent factors, showcasing that most reviewed studies combine two (56.5 %) of these factors.

The different studies also analyzed various social, cultural, economic and personal factors such as health behaviors (in relation to screening or vaccination) (2 of 23, S8, S18), sexual behavior (3 of 23, S2-3, S16), adherence to prevention guidelines (S1), self-rated health status (3 of 23, S12, S15, S17), perceived risk of infection (4 of 23, S4, S12-13, S15), risk aversion (S13), perceived benefits of preventive measure and health beliefs (S4), social-cognitive and socio-cultural determinants of screening, social support, social norms

**Table 3**  
Characteristics and main findings of the included studies.

Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
Infection related to cancer - HPV						
<i>Quantitative studies</i>						
Screening	USA	N = 1190 female caregivers, 21–65 years	A cross-sectional study	Awareness, knowledge, and adherence to screening guidelines, age, ethnicity, health insurance type, education, income, marital status, the intensity of caregiving.	Caregivers who were older than 50, Hispanics of ethnicity compared with Black/African Americans, with a high school education or less, and with intense caregiving duty compared with light-duty had poor adherence to the screening guidelines. Caregivers who were older, racial minorities, and less educated showed lower HPV awareness than their counterparts.	Study S1 [19] Kim et al., 2022
Vaccination	Denmark, Norway, Sweden	N = 48,788; 18–46 years women	A cross-sectional study	Sexual behavior	The age at first intercourse was similar for women who were vaccinated and women who were not vaccinated. The number of sexual partners was not significantly higher among women vaccinated prior to sexual debut. HPV vaccinees were less likely to have an unprotected sexual debut than were non-vaccinees.	Study S2 [20] Hansen et al., 2014
Vaccination	USA	N = 232 American Muslim women, 18–36 years	A cross-sectional study	Age, ethnicity, nativity, education, income, religion, sexual behavior	Contraceptive use is associated with higher odds of being vaccinated. Older age was associated with lower odds of receiving vaccination. Religion, education, income, ethnicity, and nativity were not significant predictors of being vaccinated.	Study S3 [21] Heard & Budhwani, 2020
Vaccination	China	N = 15,967 female healthcare workers, 18–45 years (M = 30.6, SD = 6.2 years)	A cross-sectional study	Age, ethnicity, educational level, monthly income, marital status, health beliefs, perceived susceptibility, perceived benefits	Participants who perceived susceptibility to HPV, believed in the benefits of vaccination were more likely to receive the HPV vaccination. Barriers induced by the vaccine (such as high cost, inconvenient vaccination, and adverse effects) were negatively associated with vaccination behavior. Intention to take vaccine was higher in younger age group. Participants with lower income were	Study S4 [22] Shao et al., 2023

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Table 3 (continued)

Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
Qualitative studies Screening, Vaccination	USA	N = 23 Black adults, M 50 years (SD = 4.1)	Qualitative descriptive study, interviews	Challenges and opportunities	more unlikely to intend to receive vaccination.  Opportunities: create more awareness through community health fairs and presentations at various social groups in the community including churches. Involve religious organizations in preventive efforts because religion is a determinant of screening engagement. Challenges: Availability and eligibility for government-funded programs to promote access to free or reduced-cost cancer screening and vaccinations; community trust in the government and healthcare; mistrust in healthcare and fear of cancer screening diagnosis and its consequences; economic limitations such as lack of insurance, limited financial resources; lack of adequate information on HPV and its consequences; lack of recommendation and counseling by healthcare providers.	Study S5 [23] Adegboyega et al., 2023
Screening	Uganda, Africa	N = 36 women with no previous history of cervical cancer symptoms or diagnosis, 25–49 years	Focus groups	Beliefs, attitudes, perceptions, and health-seeking behaviour in relation to cervical cancer	Women feel unprotected and unsafe due to their fear of becoming infected in the health service settings and fear of contracting cervical cancer infection from their husbands. Failure to attend screening was explained by past experiences, rumours, fear of male practitioners, economic constraints, organisational reasons, and fear of the testing procedure. Barriers for screening are availability difficulties (few diagnostic and treatment facilities, understaffed centers), economic (costly journeys to screening centers from rural areas) and lack of knowledge.	Study S6 [24] Hasahya et al., 2016

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Table 3 (continued)

Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
Vaccination	China	N = 40 women, 18–59 years	In-depth individual semi-structured interviews	Individual, societal, and cultural factors involved in the decision-making process.	Perceived worthiness of vaccines, which was in turn influenced by vaccine cost, marriage plans, and experiences of sexual activities; history of experiencing gynecological conditions, stigma associated with vaccination, acquisition of information on vaccines, distrust on vaccines, and absence of preventive care in the healthcare practice were significant factors influencing decision-making process. Vaccination is promoted in a “feminized” manner and “moralized” under the patriarchal value system, further imposing the burden of disease on women, and leading to health inequality of women.	Study S7 [25] Siu et al., 2019
<b>Cancer related infection – <i>Helicobacter pylori</i></b>						
<i>Quantitative studies</i>						
Screening	China	N = 1042, 18–78 years, M = 35.40 (SD = 13.3) years	A cross-sectional study	Knowledge, awareness, health behaviors related to HP, gender, education level, occupation, income	Workers, students, farmers and those with low income and low knowledge scores were less likely to undertake screening. Participants with symptoms of stomach discomfort (and stomach-related diseases) were more likely to undertake the HP test. The general population has poor knowledge of HP, and that few people have undertaken HP test. The main reasons for reluctance to take a test are being asymptomatic and having inadequate knowledge about the benefits of the test.	Study S8 [26] Wang et al., 2022
Screening	China	N = 197 first degree relatives of patients with gastric cancer, 23–63 years (M = 40.73 years)	A cross-sectional study	Age, gender, occupation, ethnicity, religious beliefs, education, marital status, family monthly income, knowledge	Physical examination organized by an employer was a motivating factor for screening. Main reasons for not screening were considering screening to be unnecessary when not feeling symptoms, and fear of potential discomfort caused by the examination. Factors related to higher incidence of undergoing	Study S9 [27] Zhou et al., 2022

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Table 3 (continued)

Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
					screening included younger age, being employed, higher education, and knowledge of gastric cancer. Religious beliefs, income, marital status, ethnicity, and place of residence were insignificant.	
<b>Cancer related infection – Hepatitis B &amp; Hepatitis C</b>						
<i>Quantitative studies</i>						
HBV screening	USA	N = 877 Chinese, Korean, and Vietnamese Americans, M = 45.1 years	A cross-sectional study	Sex, age, education, knowledge, family history of HBV	Knowledge was associated with higher likelihood of screening. More acculturated participants were less likely to have screening than those less acculturated (e.g., recent immigrants). The higher education level was associated with higher screening probability. For some participants family history of HBV infection was related with screening.	Study S10 [28] Le et al., 2021
HBV screening intention	Netherlands	N = 335 Turkish Dutch, 16–40 years	A cross-sectional study	Sex, age, marital status, education, religion, health insurance, occupation, and social-cognitive and socio-cultural determinants of screening, social support, social norms	Knowledge, social support and social norm, and the level of satisfaction with Dutch healthcare are associated with screening intention. Participants with lower screening intention experienced less social support and less positive subjective norms related to screening and scored higher for feelings of shame and stigma regarding HBV.	Study S11 [29] Van der Veen et al., 2014
HBV screening & vaccination	USA	N = 502 Chinese Americans, N = 487 Korean Americans	A cross-sectional study	Knowledge, physician recommendation, perceived risk, sex, age, education, marital status, health insurance status, self-rated health status.	A physician recommendation was associated with screening and vaccination. Having heard of HBV was associated with screening and vaccination among Chinese males and screening among Korean males and females. For Chinese males being insured was related to screening, and higher education, younger age to vaccination, while for Korean males, higher education was related to screening (sex and ethnicity differences). Screening and	Study S12 [30] Li et al., 2017

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Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
HBV vaccination	China	N = 353, ≥24 years adults	A discrete choice experiment	Perceived risk of infection, age	vaccination barriers include lack of knowledge and feeling well/having no health issues, lack of doctor recommendations. Other barriers reported were not having insurance, lack of knowledge where to get screened or how to get vaccinated. The main facilitators were doctor recommendation, having a family member who is a carrier, free screening/covered by insurance and encouragement by family members. Respondents demonstrated a negative preference for out-of-pocket costs. Those who were older and those who perceived a high risk of infection were more likely to choose an HBV vaccine.	Study S13 [31] Guo et al., 2020
HBV vaccination	Turkey	N = 1230, 22–89 years	A cross-sectional study	Gender, age, education, professional status, income, area of residence, area of residence during childhood	Participants who lived in the rural district during their childhood were more likely to be vaccinated for HBV than those, who lived in a city or abroad. Vaccination rate was statistically lower in participants with lower income compared with individuals with higher incomes.	Study S14 [32] Kahraman et al., 2018
HBV vaccination, willingness to receive HBV vaccine	China	N = 1684 migrant workers, 16–45 years (M = 32.6 years)	A cross-sectional study	Age, education, vulnerability (perceived risk), self-rated health, medical insurance, distance from healthcare facility	The vaccination rate decreased with increasing age, and the vaccination probability was significantly greater for the high education group, the medical insurance group, and the self-rated good health group, as well as for the near-middle distance from a health service group than the far distance from a health facility group. Vulnerability was related to the higher probability of having received vaccine and willingness to receive the vaccine.	Study S15 [33] Liu et al., 2016
HBV vaccination	Mayotte Island (Indian Ocean)	N = 671 pregnant women, Most women in 20–24 and 25–29 groups age groups.	A cross-sectional study	Marital status, birthplace, qualification (employment and education status), sexual behavior.	Education, employment, and condoms use are predictors of being vaccinated. Vaccination remained negatively	Study S16 [34] Saindou et al., 2013

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Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
HBV vaccination	China rural areas	N = 21,783; 15–59 years	A cross-sectional study	Education, age, income, health insurance, occupation & health status	associated with being born on Comoros compared to be born in Mayotte/France. The higher income and education, occupations with higher social status and good health status are positively associated with higher coverage rate. Having health insurance increased the likelihood of complete vaccination. The user fee, time, and travel cost all had negative effects on the probability of complete vaccination. The coverage rate declined with age but there were no gender differences.	Study S17 [35] Zhu et al., 2014
HBV vaccination	USA	N = 167 adult Laotian immigrants, 31–65 years	A cross-sectional study	Age, gender, marital status, education, income, level of English, health insurance status, health seeking behaviors, knowledge.	Participants who were fluent speaking in English were more likely to get vaccinated than those who were not. Those who knew of HBV were more likely to initiate vaccination and be screened. There was no statistically significant difference in the distributions of age, gender, marital status, education, or income between vaccinated and not vaccinated individuals.	Study S18 [36] Xiong et al., 2013
HCV treatment	Australia	N = 415 patients with a history of injecting drug use and chronic HCV infection, M = 41 years	An observational cohort study	Social functioning (money problems, conflict with partner, relatives, or employer, and living with/time spent with people who use/do not use illicit opioids), HCV treatment intent.	There was no difference in terms of treatment intent, specialist assessment or treatment uptake between those with unstable and those with stable housing. Lower social functioning was independently associated with reduced early treatment intent and lower specialist assessment, but not treatment uptake. Living with someone (both with and without children) was independently associated with treatment uptake, but not early treatment intent. Part- or full-time employment and education was associated with higher odds of treatment uptake.	Study S19 [37] Fortier et al., 2015

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Table 3 (continued)

Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
HCV treatment	Europe (UK, France, Germany, Italy, Spain, Portugal, Switzerland)	N = 124, 25–67 years people who had injected opioids or stimulants (currently or in the past) and had completed direct-acting antiviral treatment	A cross-sectional study	Non-clinical impact that HCV treatment and reasons for accessing and completing treatment.	The most common reasons for starting treatment were: becoming aware of treatments that were well tolerated and effective; and understanding the potentially severe long-term consequences of HCV. Most of the participants reported that someone else (healthcare provider (for most of participants), family member, social worker, friend, peer, key worker, partner) encouraged them to start treatment.	Study S20 [38] Torrens et al., 2020
<i>Qualitative studies</i> HBV screening	USA	N = 20 Hmong American adults, 18–64 years old	A collective case study	Social-cultural, health beliefs, and healthcare system barriers	Protecting a family's reputation; lack of family support; the man of the household making health decisions for the family; fear of doctors, medical procedures, and test results; lack of trust in medical doctors and medical care services; and using herbal medicines and practicing spiritual healing were identified as social-cultural and traditional health beliefs barriers. Healthcare costs, perceived discrimination, linguistic discordance, lack of transportation, and poor quality of care were identified as barriers to accessing high quality healthcare services and obtaining screening.	Study S21 [39] Fang & Stewart, 2018
HCV treatment	Australia	N = 3 women who had HCV infection (41, 46 & 43 years)	A case study	Social-material relations, cure as a broader construct, cure gathered through a complex web of relations.	The broader social and material forces interplay together with biomedical intervention and are important for successful treatment. The scope of elimination should be broadened beyond removal of the virus by incorporating a range of other forces active in the lives of those affected by it, and considering such factors as sufficient housing, flexible treatment access, supportive social relationships, and careful and considered	Study S22 [40] Farrugia et al., 2022

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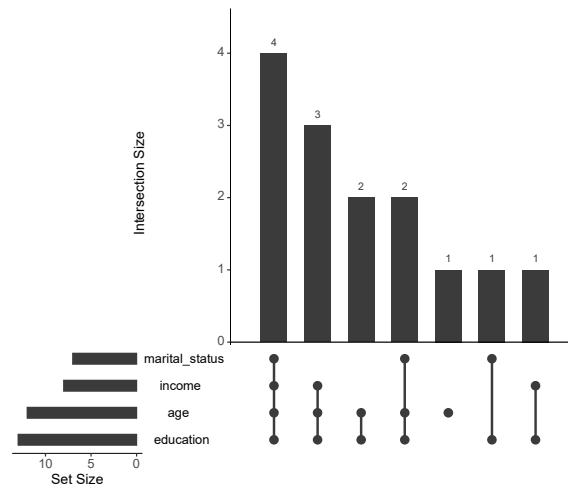
Table 3 (continued)

Preventive behavior measures	Setting/geographic focus	Participants (N, age)	Study design	Social, cultural, economic, personal factors analyzed	Main findings	Study no. and reference
HCV treatment	USA	N = 200 HCV patients undergoing treatment, M = 51.5 (SD = 9.0) years	Semi-structured interview	Effects on HCV treatment on patients' life	<p>treatment practices. To understand treatment success and failure background forces of social and material relations which impact uptake of the cure and are intrinsically part of cure itself should be considered. HCV elimination efforts may need a broad focus too, one that accounts for the social and material relations generating cure alongside traditional public health efforts to increase treatment uptake, completion and follow up.</p> <p>Side effects may last several months after treatment for many patients, revealing a need to continue treatment-related care beyond the end of treatment. Some patients reported discontinuing treatment prematurely due to side effects. The most difficult challenges for patients were physical side effects, psychiatric issues, and employment. Patients desired help with arranging for modified work hours or leaves of absence. Patients expressed a need for peer support and improved provider support during treatment. Patients treated by nurses or clinical pharmacists felt more supported than those treated directly by physicians.</p>	Study S23 [41] Manos et al., 2013

(S11), physician recommendation (S12), area of residence and area of residence during childhood (S14), birthplace (S16), and health insurance (6 of 23, S1, S11–12, S15, S17, S18). We find it interesting to note here that only 3 studies (S12, S15, S17) out of those 6 that were collecting data about health insurance used health insurance as a factor related to preventive behavior, while the other 3 studies (S1, S11, S18) just used health insurance as a covariate. Further factors include the distance from healthcare facilities (S15), the level of English (S18), the intensity of caregiving (S1), family history of HBV (S10), social functioning, and HCV treatment intent (S19), and non-clinical impact on HCV treatment and reasons for accessing and completing treatment (S20).

In studies that used qualitative methods, barriers and facilitators of infections related to cancer prevention were researched by analyzing individual, societal, and cultural factors involved in the decision-making process (S7), beliefs, attitudes, perceptions, and health-seeking behavior (S6), cure as a broader construct involving complex social-material relations (S22), effects of treatment on patients' life (S23), collective health beliefs (S21), and perceived challenges and opportunities for prevention (S5). Although at first glance disparate in their particular focus, the six qualitative studies share a common interest in social complexity and the importance of individual perception.

The findings of quantitative studies regarding HPV revealed that women who were vaccinated against HPV were less likely to have an unprotected sexual debut (S2) and use contraceptives more often than those who were not vaccinated against HPV (S3). It was also



**Fig. 3.** Intersections of the four most prevalent factors.

found that perceived susceptibility to HPV and beliefs in the benefits of vaccination are linked to higher vaccination uptake (S4). Age was found to be a significant factor in HPV vaccination behavior. It was indicated that older age was associated with lower vaccination rates (S3), while intention to take vaccine was higher in the younger age group (S4).

Contradictory results were observed in different contexts. While religion, education, income, and ethnicity were not found to be significant predictors of being vaccinated against HPV in the context of American Muslim women (S3), it has been discovered that participants with lower income were more unlikely to intend to receive vaccination (S4) in the context of Chinese female healthcare workers, with barriers negatively associated with vaccination cited as the high cost of the vaccine, the inconvenience of vaccination, and the fear of adverse effects of the vaccine (S4). Such contradictions indicate that the cultural and social settings have to be considered.

The results of studies regarding the screening of HPV infection showed that older age, belonging to racial minority groups, and lower education were associated with poor adherence to the screening guidelines and lower HPV awareness (S1). Barriers to HPV screening are related to mistrust in the healthcare system (S5). For example, women exhibit fear of becoming infected in health service settings, of testing procedures, and of male practitioners (S6). Fear of cancer screening diagnosis and its consequences, lack of adequate information on HPV, and lack of recommendation and counseling by healthcare providers were also noted as barriers to adherence to HPV screening and vaccination recommendations (S6).

Other barriers identified were economic constraints such as costly journeys to screening centers from rural areas, availability difficulties due to few diagnostic and treatment facilities, and lack of knowledge (S6). Economic limitations such as lack of insurance, limited financial resources, and availability of government-funded programs for free or reduced-cost screening and vaccinations were also noted as barriers in another qualitative study (S5). To facilitate the screening and vaccination behaviors in the general population increased awareness could be raised through community health fairs and presentations at various social groups in the community including churches, because religion was found to be a determinant of screening engagement (S5). It is worth noting that in all HPV studies included in this review except one study, participants were women, implying that the HPV virus is still firmly feminized even in the research setting and thus inciting the further narrative of the HPV virus being relevant only for, and among, women, further inducing health inequalities between different sexes.

Only two studies out of 23 included in the systematic review analyzed factors related to the prevention of Hp infection. Both studies examined factors related to screening for Hp infection and no studies were found regarding social, cultural, economic, or personal factors related to the treatment of this infection. It was found that most people have a positive attitude toward Hp screening, however, the general population has poor knowledge of Hp, and only a few people have undertaken the Hp test (S8). The main barriers to taking the Hp test were being asymptomatic and therefore considering screening to be unnecessary (S8-9), having inadequate knowledge about the benefits of the test (S8), and fear of potential discomfort caused by the examination (S9). It was also discovered that participants with lower income and low knowledge about Hp were less likely to undertake screening (S8). Facilitating factors related to the higher incidence of undergoing screening were found to be younger age, being employed, higher education, and having knowledge of gastric cancer (S9). Physical examination organized by an employer as well as having symptoms of stomach discomfort could work as facilitators to take an Hp test (S8-9). However, religious beliefs, income, marital status, ethnicity, and place of residence were disclosed to be insignificant factors for determining screening behavior for HP (S9).

Regarding the screening for Hepatitis B virus, studies uncovered that knowledge (S10-11) and awareness of HBV (S12), higher education level (S10, S12), social support, social norms, satisfaction with the healthcare system (S11) and being insured (S12) are associated with a higher likelihood to be screened for HBV. There are also some differences regarding sex, ethnicity, and cultural context (S10, S12). Other facilitators for HBV screening were a doctor's recommendation (S12), a family history of HBV infection (S11-12), and encouragement by family members (S12). Feelings of shame and stigma regarding HBV (S11), protecting a family's

reputation, lack of family support, fear of doctors, medical procedures, and test results; and lack of trust in medical doctors and medical care services were identified as barriers for HBV screening (S21).

Cultural barriers such as traditional health beliefs and linguistic discordance, social barriers such as perceived discrimination, perceived poor quality of healthcare, and economic barriers such as healthcare costs and lack of transportation were noted as barriers to obtaining HBV screening (S21). Factors related to HBV vaccination were explored in 7 quantitative studies out of 23 included in this systematic review. Perceived greater risk of infection (S13, S15), as well as knowledge of HBV and speaking English fluently (S18), were related to the higher probability of receiving the HBV vaccine. Higher education (S15-17) and income (S14, S17), being employed (S16), occupations with higher social status (S17), self-rated good health status, and having health insurance (S15, S17) were found to increase the likelihood of complete vaccination, and can, therefore, be considered as facilitators of increasing HBV vaccine coverage rate.

Some studies argue that age is an important predictor of HBV vaccination, older participants were more likely to choose an HBV vaccine (S13). However, opposite results were indicated in other studies where no significant differences in age, education, or income were found between vaccinated and non-vaccinated individuals (S18), and the vaccination coverage rate declined with age (S15, S17). Barriers to completing vaccination included lack of knowledge of HBV, feeling well, and lack of doctor recommendations (S12), time and travel cost (S17), cost for the vaccine (S13, S17), not having insurance, and lack of knowledge how to get vaccinated (S12).

Socio-geographical factors were also found to be a significant predictor of vaccination coverage (S14-16). The vaccination rate was greater for participants who lived in a rural district during their childhood than those who lived in an urban context or abroad (S14). Similarly, those who lived at short or medium distances from a health service facility displayed higher vaccination rates than those at a far distance (S15). There are also significant differences when being born on closely located but separate islands (S16).

The main facilitators for undergoing HCV treatment were becoming aware of treatments that are well tolerated and effective, understanding the potentially severe long-term consequences of HCV, and encouragement to start treatment from someone else such as healthcare providers (for most of the participants), family members, social workers, or friends (S20). The importance of social relationships was also underlined in another study where it was found that cohabitation was associated with treatment uptake (S19). The same study indicated that lower social functioning was associated with reduced early treatment intent and lower specialist assessment, while employment and higher education were linked with higher odds of treatment uptake (S19). An economic factor such as stable housing was found to be insignificant for treatment intent, uptake, or specialist assessment (S19).

Barriers to undergoing HCV treatment were physical side effects that might last a few months after treatment, psychiatric issues, and incompatibility with employment (S23). Patients noted that peer and provider support (especially the support provided by nurses or clinical pharmacists) during treatment would be beneficial as well as receiving help with the arrangement of working hours and leaves of absence (S23). This is in line with the results of another study, where it was disclosed that the broader social and material forces have a significant impact on biomedical interventions and are essential for successful treatment (S22). Eradication of HCV should be extended by incorporating a range of other forces active in the lives of those affected by it and considering such factors as sufficient housing, flexible treatment access, supportive social relationships, and careful and considered treatment practices (S22).

A summary of the main findings is presented in [Table 3](#), which specifies the type of preventive measures investigated in each study, the setting and geographic area, the number and demographics of the participants, the study design, and the social factors that might act as barriers or facilitators of prevention. Last, but not least, the main findings of each study are summarized.

## 5. Synthesis and categorization of the findings

To summarize the findings of this systematic review, we first classify the factors that were found to be significant to participation in prevention measures such as screening, vaccination, and treatment of infections related to cancer. The categories applied are based on the key categories from the health capital model [12,13] and were processed according to the following criteria.

- *Social factors:*

We classified factors related to family relationships, formal and informal associations, social participation and engagement in social networks, and other personal resource that emerges from social networks where individuals have better access to information, services, and support [13,42] into the category of social factors.

- *Cultural factors:*

Factors related to language competencies, education, health knowledge, health experience, normative beliefs, behavioral norms, attitudes, behaviors, communication skills, and interactional styles between individuals and healthcare service providers were classified into the category of cultural factors [12,43,44].

- *Economic factors:*

They include factors related to the purchase of medical services or products or other factors based on monetary and market-convertible resources [43,45].

- *Personal factors (or antecedents):*

Age, ethnicity, gender, response patterns, and perception of risk or benefits of preventive measures were assigned to the personal factors category [12,13,46].

### 5.1. Dominant social factors

In this systematic review stigma associated with HPV and HBV infections was discovered to be a pertinent social barrier for HPV and HBV prevention. This might be related to the way these infections are spread including sexual contact which was found to be associated with societal stigma and shame [47–50]. Furthermore, occupation with higher social status was discovered to be a social facilitator for HBV vaccination as well [35] when having a lower qualification occupation was identified as a social barrier to Hp screening [26]. Protecting a family's reputation was identified as a social barrier to HBV screening [39].

### 5.2. Dominant cultural factors

Cultural factors such as knowledge and education were identified as being able to serve as both barriers and facilitators for the prevention of all 3 infections related to cancer that were considered in this review. It was found that lower education and knowledge are linked to lower adherence to screening [19], vaccination [24,26], and treatment [37]. And vice versa, higher education and knowledge about infections are associated with higher compliance to prevention measures [27,28,30,33–35]. This might be interpreted to signify that higher knowledge and education lead to a higher awareness of infections and their consequences, which in turn might lead to a higher willingness to take preventive measures [51,52].

Other cultural barriers that were found to be relevant for HPV and HBV prevention were lack of trust in the healthcare systems and services and lack of recommendations by healthcare providers for screening and/or vaccination [24,30,39], which might be explained by the limited time that primary care physicians have for patients' consultations [53] that might lead to the poor patient-physician relationship [26,54], which in turn might lead to reduced trust and lack of recommendations regarding infections prevention measures such as screening and vaccination given to patients. Fear of the testing procedure was determined as another cultural barrier of HPV and Hp screening [24,27]. That fear of testing procedures was not identified for HBV and HBC screening might be linked to the different nature of the testing procedures [55–57] since HPV-related procedures such as cervical cancer screening and screening for Hp might be perceived by the people as being more invasive and/or causing more discomfort than serology test taken by the blood sample [27,58]. Increasing patients' knowledge about the process and benefits of screening procedures might help to reduce fear of screening procedures and increase positive attitude towards it so the perceived benefits would outweigh the discomfort caused by the screening procedure. Lesser levels of acculturation were determined as a cultural barrier to HBV screening [28], and the absence of preventive care and distrust of vaccines as a cultural barrier to HPV screening [25].

### 5.3. Dominant economic factors

Personal finance-related economic factors such as income were found to be relevant for all three infections related to cancer analyzed in this review. Low income was determined as an economic barrier to HPV, Hp, and HBV prevention, and higher income as an economic facilitator for HBV prevention. Employment was identified as an economic facilitator for Hp, HBV, and HCV prevention. Additional economic barriers to HPV prevention were identified as inconvenient vaccination, not enough services for all women, and understaffed screening centers [22,24], while lack of transportation was described as an economic barrier to HBV prevention [39]. These economic factors might explain how employment secures financial stability and provides individuals with income, thus enhancing the availability and affordability of healthcare services [59,60].

### 5.4. Dominant personal factors

Regarding personal factors, age (for HPV, Hp, HBV) [19,22,24,27,31], feeling or not feeling symptoms (for Hp) [26,27], perceived risk to get infection (for HPV and HBV) [22,31,33], and perceived worthiness of getting a vaccine (for HPV) [22,25] were common factors linked to the prevention of infections related to cancer. Regarding HBV vaccination it was found that older age was found to be a contradictory factor since it was identified as a personal barrier [33,35] and a facilitator for HBV prevention [31] in different studies. Older age as a personal barrier might be explained by the health policy for the HBV vaccination since most countries aim first to vaccinate young individuals from HBV [61] which is also a policy in China, where the studies were conducted [62], while older age serving as a personal facilitator to choose HBV vaccine might be related to older persons have a higher awareness about HBV [63] since susceptibility to infections is increasing with age [64]. Finally, personal facilitators such as contraceptive use were associated with HPV [20,21] and HBV vaccination [34], while self-rated good health was also linked with HBV vaccination [33].

## 6. Classification of barriers and facilitators by type of prevention

Following this classification and to facilitate overview, we highlight the key findings for each of the involved types of prevention, HPV, Hb, and HBV/HCV respectively. Finally, everything is summarized in [Table 4](#).



**Table 4**

Social, cultural, economic, and personal barriers and facilitators for the prevention of infections related to cancer. Summary of the systematic review findings.

Summary of review finding	Studies contributing to review finding
<b>Cancer related infection – HPV.</b>	
<b>Social barriers:</b>	Studies S1, S7.
<i>Family-related:</i> Intensive caregiving duty to a family member and fear of contracting cervical cancer infection from women's husbands.	
<i>Society-related:</i> Stigma associated with vaccination was found to be significant social barrier for screening and vaccination.	
<b>Social facilitators:</b>	Studies S5, S7.
<i>Social networks:</i> Spreading information among various social groups in the community, for example, community health fairs, churches, and religious organizations could help increase incidence of screening and vaccination.	
<i>Social changes:</i> Having marriage plans was perceived as an important factor in decision-making process to make a vaccine worthy to have for non-vaccinated women.	
<b>Cultural barriers:</b>	Studies S1, S5, S6, S7.
<i>Trust and health experience related:</i> Lack of trust in the government and healthcare systems, fear of cancer diagnosis.	
<i>Vaccination/screening procedure related:</i> Fear of male practitioners and fear of the testing procedure.	
<i>Communication and interaction:</i> Cultural barriers related to the healthcare system are lack of recommendation and counseling by healthcare providers and absence of preventive care in the healthcare practice.	
<i>Knowledge:</i> Education (lower), lack of knowledge and adequate information on HPV and its consequences as well as not being able to acquire information on vaccines, and distrust on vaccines.	
<b>Cultural facilitators:</b>	Study S7.
<i>Experience of previous health conditions:</i> Women who have history of experiencing gynecological or other physical conditions before felt the higher need of getting vaccinated.	
<b>Economic barriers:</b>	Studies S4, S5, S6, S7.
<i>Personal finance-related:</i> having limited financial resources, lower income, and lack of health insurance.	
<i>Cost-related:</i> high cost of the vaccine, costly journeys to screening centers from rural areas.	
<i>Policy-related:</i> Lack of government-funded programs for free or reduced-cost screening and vaccinations, inconvenient vaccination, experiencing availability difficulties because of few diagnostic and treatment facilities, not enough services for all women, understaffed screening centers.	
<b>Economic facilitators:</b>	NA
No economic facilitators were identified in the studies.	
<b>Personal barriers:</b>	Study S1.
<i>Demographics-related:</i> Age (older), ethnicity (Hispanics in USA)	
<b>Personal facilitators:</b>	Studies S2, S3, S4, S7.
<i>Demographics-related:</i> Age (younger)	
<i>Behavior-related:</i> Contraceptive use and sexual debut using protection.	
<i>Perception-related:</i> Perceived worthiness of getting vaccine due to experiences of sexual activities, perceived susceptibility to HPV and belief in the benefits of vaccination.	
<b>Cancer related infection – <i>Helicobacter pylori</i>.</b>	
<b>Social barriers:</b>	Study S8.
<i>Occupation/profession-related:</i> Having occupation such as a worker (lower qualification), farmer or being a student can be a social barrier to Hp screening.	
<b>Social facilitators:</b>	Study S9.
<i>Occupation/profession-related:</i> Physical examination organized by an employer.	
<b>Cultural barriers:</b>	Studies S8, S9.
<i>Knowledge:</i> Low and inadequate knowledge about the benefits of the screening test.	
<i>Screening procedure-related:</i> Fear of potential discomfort caused by the examination.	
<b>Cultural facilitators:</b>	Study S9.
<i>Knowledge:</i> Education (higher), and knowledge of gastric cancer	
<b>Economic barriers:</b>	Study S8.
<i>Personal finance-related:</i> Low income.	
<b>Economic facilitators:</b>	Study S9.
<i>Personal finance-related:</i> Being employed.	
<b>Personal barriers:</b>	Study S9.
<i>Physical condition-related:</i> Being asymptomatic.	
<i>Perception-related:</i> Thinking that screening is unnecessary when not feeling symptoms.	
<b>Personal facilitators:</b>	Studies S8, S9.
<i>Demographics-related:</i> Age (younger)	
<i>Physical condition-related:</i> Symptoms of stomach discomfort (and stomach-related diseases).	
<b>Cancer related infection – <i>Hepatitis B &amp; Hepatitis C</i></b>	
<b>Social barriers:</b>	Studies S11, S21.
<i>Society-related:</i> Feelings of shame and stigma regarding HBV, perceived discrimination, protecting a family's reputation.	
<i>Family-related:</i> Lack of family support, the man of the household making health decisions for the family.	
<b>Social facilitators:</b>	Studies S10, S11, S12, S19, S20, S22, S23.
<i>Family-related:</i> family history of HBV, having a family member who is a carrier, encouragement by family members, living together with someone (both with and without children).	

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Table 4 (continued)

Summary of review finding	Studies contributing to review finding
<p><i>Social relationships-related:</i> social support, supportive social relationships, peer support during treatment, encouragement from someone else (healthcare provider for most of the participants) to start treatment, improved provider support (especially by nurses or clinical pharmacists) during treatment.</p> <p><i>Occupation/profession-related:</i> occupations with higher social status.</p>	
<p><b>Cultural barriers:</b></p> <p><i>Knowledge:</i> lack of knowledge in general, lack of knowledge where to get screened or how to get vaccinated.</p> <p><i>Trust and health experience related:</i> fear of doctors, medical procedures, and test results; lack of trust in medical doctors and medical care services.</p> <p><i>Health policy-related:</i> poor quality of care.</p> <p><i>Communication and interaction:</i> linguistic discordance, lack of doctor recommendations.</p>	Studies S12, S21.
<p><b>Cultural facilitators:</b></p> <p><i>Knowledge:</i> Knowledge of HBV, education (higher), having heard of HBV and becoming aware of treatments that were well tolerated and effective.</p> <p><i>Communication and interaction:</i> A physician recommendation, fluent speaking in English</p> <p><i>Social norms-related:</i> Positive social norms related to screening.</p> <p><i>Policy-related:</i> satisfaction with the healthcare system, flexible treatment access, careful and considered treatment practices.</p> <p><i>Social status-related:</i> Acculturation (less) (people new in the culture).</p>	Studies S10, S11, S12, S15, S16, S17, S18, S19, S20, S22, S23.
<p><b>Economic barriers:</b></p> <p><i>Personal finance-related:</i> lower income, not having health insurance, threat for employment due to side effects of the treatment.</p> <p><i>Cost-related:</i> healthcare costs, out-of-pocket costs for the vaccine, the user fee, time, and travel cost, lack of transportation.</p>	Studies S12, S13, S14, S17, S21, S23.
<p><b>Economic facilitators:</b></p> <p><i>Personal finance-related:</i> Employment, higher income, having health insurance, sufficient housing, a possibility to arrange modified work hours or leaves of absence to take the treatment to save employment.</p> <p><i>Cost-related:</i> Free screening or covered by insurance, the near-middle distance from a healthcare service.</p>	Studies S12, S15, S16, S17, S19, S22, S23.
<p><b>Personal barriers:</b></p> <p><i>Demographics-related:</i> age (older), being born in Mayotte (context specific).</p> <p><i>Religion-related:</i> Using herbal medicines and practicing spiritual healing.</p> <p><i>Physical condition-related:</i> Experiencing physical and psychiatric side effects of the treatment.</p>	Studies S15, S16, S17, S21, S23.
<p><b>Personal facilitators:</b></p> <p><i>Demographics-related:</i> Age (older), younger age to vaccination, who lived in the rural district during their childhood,</p> <p><i>Perception-related:</i> perceived a high risk of infection, the self-rated good health group, perceived vulnerability, understanding the potentially severe long-term consequences of HCV.</p> <p><i>Physical condition-related:</i> feeling well/having no health issues, good health status,</p> <p><i>Behavior-related:</i> condoms use.</p>	Studies S12, S13, S14, S15, S16, S17, S20.

### 6.1. HPV-related prevention

The main social barriers to HPV prevention identified in the included studies were family-related barriers such as providing intensive care for a family member or having a fear of contracting cervical cancer infection from one's husband, and society-related barriers such as stigma for screening and vaccination. Participation in social networks and important social changes such as marriage were determined as social facilitators for HPV prevention.

Trust in the healthcare systems, fear of cancer diagnosis and testing procedure, lower education, and lack of knowledge of HPV as well as communication and interaction-related barriers such as lack of recommendation and counseling by healthcare providers were found to be relevant cultural barriers, while experience of previous gynecological or other physical conditions serves as cultural facilitator for HPV prevention.

No economic facilitators for HPV prevention were recognized in the studies included. However, limited financial resources, lack of health insurance, cost of the vaccine, availability difficulties, and lack of government-funded screening and vaccination programs were identified as economic barriers to HPV screening and vaccination. Personal barriers to HPV prevention included older age and Hispanic ethnicity, while personal facilitators were younger age, perceived susceptibility to HPV, and belief in the vaccination benefits.

### 6.2. Hp prevention

Regarding the prevention of Hp, lower occupation-related qualification was identified as a social barrier to Hp screening, while physical examinations organized by employers can serve as a facilitator of Hp screening. Higher education and knowledge of gastric cancer are cultural facilitators for Hp prevention. Contrarily, inadequate knowledge and fear of testing procedures were determined as cultural barriers to Hp screening. Being employed was found to be a facilitator, while low income is an economic barrier to the prevention of Hp. Finally, experiencing symptoms of stomach discomfort and younger age were described as personal facilitators while being asymptomatic can be a personal barrier to Hp screening.

### 6.3. HBV/HCV prevention

Among social barriers to HBV prevention were perceived discrimination and feelings of shame and stigma, while family-related barriers included lack of family support and patriarchate health decision-making in the family. On the other hand, family encouragement can be a significant facilitator for HBV prevention as well as a family history of HBV, social support, and having an occupation with a higher social status. Supportive social relationships and living with someone were also found to be facilitators for HCV treatment.

Higher education, knowledge of HBV, a doctor's recommendation, speaking English (valid for migrants to English-speaking countries), including satisfaction with the healthcare system, and positive social norms for screening were identified as prominent cultural facilitators for HBV prevention. Becoming aware of effective treatments, having a higher education, and flexible treatment access were also noted as relevant cultural facilitators for HCV treatment. Cultural barriers to HBV prevention were determined by such factors as lack of knowledge of the illness and/or the process, fear of doctors, medical procedures, and test results along with lack of trust in medical care services, lack of doctoral recommendations, and linguistic discordance.

Economic barriers to HBV prevention were found to be lower income, lack of health insurance, and cost-related expenses related to vaccination such as a vaccine fee, time and travel cost, while the threat to employment due to side effects of the treatment was an economic barrier for HCV treatment. Regarding economic facilitators such as employment, higher income, being insured, having access to free or covered insurance screening and near-middle distance from a healthcare service are significant factors for HBV prevention, while being employed, having flexible working hours or leaves of absence to take the treatment, and sufficient housing were identified as economic facilitators for HCV treatment.

Younger age, having no health issues, and perceived a high risk of infection, and condom use were found to be personal facilitators for HBV prevention, while understanding the potentially severe long-term consequences of HCV was defined to be a personal facilitator for HCV treatment. Personal context-specific barriers such as one's birthplace and the practice of spiritual healing were also identified in some studies as relevant for HBV prevention, while older age was found to be a contradictory factor since it was identified as a personal barrier and a facilitator for HBV prevention in different studies. Experiencing physical and psychiatric side effects of the treatment was an important personal barrier to HCV treatment.

## 7. Discussion

As demonstrated in the preceding section, a multitude of conditions shape the openness and ability to participate in prevention programs. The navigation of the healthcare system, thus, indeed depends on the availability and types of resources at the disposal of the social individual, confirming the utility of the chosen theoretical perspective of health as being related to and dependent upon a socially embedded but individualized and privatized health capital [12] that encompasses the health-related skills, competencies, social relationships, financial means, and status that can, immediately or mediated through conversion from other forms of capital, be employed towards the preservation of good health and the management of illness.

The health capital perspective we employed for this review thus invites a closer look not only at the different factors evoked above but also at their gaps and – not least – the interrelations between them and their embeddedness in the experiences from interacting with and evaluating information from a variety of health agents pertinent to the individual's life: public health agents, digital health platforms and fora, networks of friends and relatives and commercial medical agents. Tying health capital to the role of such health agents will allow for a deeper understanding of the individual dispositions towards different health-related programs. We will briefly evoke a few of such domains of relationships between factors of health capital and the health agentic system that, based on our systematic literature review, could use further investigation.

### 7.1. Social factors

The extant research points to several significant social factors acting as barriers and facilitators for prevention programs. These results are thus each pointing to the relevance of considering the social formation of beliefs and practices concerning health-related issues. But our overview also reveals how such social factors are most often considered in isolation or, at best, in partial correlations. Since we know that people's lives unfold in ways that might constitute distinct fields that are nevertheless overlapping and connected, this compartmentalization of social factors points to the relevance of the health capital model as a more integrative way of looking at the social background for individual knowledge, beliefs, dispositions and practices concerning health.

### 7.2. Cultural factors

The general role of health and health knowledge in society constitutes an important context of context [65] for the understanding of barriers and facilitators of participation in prevention programs. The plethora of sources for health information is a key component of the health capital model [12,13]. However, from the extant studies, it is not clear to what extent health knowledge is included in formal educational systems of different cultures, and what other sources of knowledge besides a person's formal education are the most relevant for obtaining information about infections related to cancer. The mechanism (including motivational factors) of how this knowledge is internalized and applied, as well as how much knowledge is enough to impel individuals to take preventive measures for infections related to cancer, remains obscure and points to a possible direction for further research. It is also obvious from our findings that trust in the healthcare system is an important factor to consider.

### 7.3. Economic factors

As many studies demonstrate, economic factors are often a significant element in the individual's considerations of participation in prevention programs, obviously depending on the different national and regional models for the financing of healthcare services, we still do not know if economic factors are the most important in determining individual decision-making processes regarding whether to take preventive measures for infections related to cancer, and how these economic factors interplay with other types of factors such as personal, cultural, and social factors of the management of personal finances with regard to health-related expenses. Other economic cost-related factors such as the cost of the vaccines, travel costs to vaccination and screening centers, and lack of health insurance were revealed to be significant barriers to HPV and HBV prevention, while free or covered-by-insurance screening was found to be a relevant facilitator for HBV prevention. Therefore, health policymakers should make efforts to address these financial barriers to HPV and HBV prevention by ensuring the availability and affordability of vaccination and screening services, ultimately contributing to public health outcomes.

### 7.4. Contradictory and non-discriminatory factors

However, one should also keep in mind, that contradictory results were found in this systematic review since certain studies indicated that, for example, religion, education, income, and ethnicity were not significant predictors of HPV vaccination [21], while religion, income, marital status, ethnicity, and place of residence were also not found to be significant predictors for Hp screening [27]. Individual health beliefs and perceptions can significantly impact health decisions [22,66] more than religious considerations, which might explain why religion was an insignificant predictor for HPV vaccination and Hp screening. On the other hand, education being an insignificant predictor among American Muslim women might be related to cultural beliefs and family influence. Ethnicity not being a significant predictor may be due to health policies promoting vaccination and screening for the general population including individuals from different ethnic backgrounds [67,68]. Likewise, health insurance policies may explain the lack of significance of income for HPV vaccination [69].

That marital status and place of residence were found to be insignificant predictors for Hp screening might be explained by the high prevalence and increasing awareness of Hp in China [27,70]. It could also be that other factors play a more important role in healthcare-seeking behavior such as Hp screening than marital status or place of residence [26,27].

Finally, it was found that gender [35,36], age, marital status, education, and income did not differ significantly between HBV-vaccinated and non-vaccinated individuals [36]. The absence of significant gender differences can be explained by the HBV vaccination policy which does not include different vaccination schemes for different genders, while non-significant demographics could be related to the specific cultural context and population of Laotian immigrants where this study was performed [36]. The results of this systematic review revealed that the number of sexual partners was not significantly higher among women who were vaccinated for HPV before their sexual debut [20]. This might be explained by the results of other studies that have shown that the number of sexual partners is influenced by a variety of factors, including cultural norms, personal beliefs, and socioeconomic factors [71,72]. Therefore, it is unlikely that HPV vaccination alone can significantly impact these complex determinants of sexual behavior.

Lastly, it should be noted that the discrepancies in findings may be rooted in biases inherent in the methodological designs. It is well known that survey designs impact results [73] and that qualitative questioning techniques, used either individually or in groups, generate particular social logics that form and inform the investigative outcomes [74].

Despite these exceptions – which we largely ascribe to differing socio-cultural contexts and methodological differences – the overall picture from our study is that personal, cultural, economic, and social factors are significant for preventing infections related to cancer. This is the case in several studies included in this systematic review. Therefore, these factors should not be underestimated and might be considered by both researchers and policymakers aiming to increase the population's adherence to guidelines for vaccination, screening, and treatment of infections related to cancer such as HPV, Hp, HBV, and HCV.

### 7.5. Recommendations for health policymakers

Based on the results of our systematic review, we suggest the following recommendations for healthcare policymakers to increase adherence to prevention programs for infections related to cancer. While, biomedically, HPV, Hp, and HBV/HCV represent quite different infections related to cancer, our review found a set of common facilitators that include social support, knowledge and education, access to healthcare services, employment and financial stability, and personal health perception. These factors should be carefully considered by healthcare policymakers when designing strategies to deal with these infections, as addressing these facilitators can enhance prevention efforts and improve health outcomes for affected individuals.

To enhance factors acting as facilitators and address factors acting as barriers, policymakers must implement actions across individual, societal, and policy levels. Actions at the individual level may include individual counseling and personalized healthcare services. At the societal level, actions may include educational campaigns and peer support networks. At the policy level, actions include the allocation of resources to fund actions at the individual and societal levels, as well as the development of clear prevention policies. Separately and jointly, such actions have the potential to address the main barriers of prevention programs for infections related to cancer.

Table 5 presents our detailed recommendations for policymakers targeting the individual, societal, and policy levels. For each type of infection related to cancer, we recommend actions addressing social, cultural, economic, and personal factors.

**Table 5**  
Recommendations for healthcare policymakers on how to tackle infections related to cancer.

	Individual level	Societal level	Policy level
<b>Cancer related infection - HPV</b>			
<b>Social factors</b>			
<i>Family-related:</i> Intensive caregiving duty to a family member and fear of contracting cervical cancer infection from women's husbands. S1.	Offer family caregivers remote consultations where possible to reduce time away from the home, as well as targeted online information material to address their doubts and fears.	Establish peer support groups where women can share experiences, provide mutual support, and receive education on HPV and cervical cancer.	Establish and fund respite care services for family caregivers, along with financial subsidies for participating in vaccination and screening programs.
<i>Society-related:</i> Stigma associated with vaccination was found to be a significant social barrier for screening and vaccination. S7.	Address concerns, dispel myths, and provide reliable information about HPV vaccination during healthcare visits.	Launch culturally-sensitive education campaigns dispelling myths that equate HPV infection with irresponsible behaviors.	Counteract HPV stigma by vaccination policies, public funding for educational campaigns, and partnering with relevant NGOs.
<b>Cultural factors</b>			
<i>Trust and health experience related:</i> Lack of trust in the government and healthcare systems, fear of cancer diagnosis. S5.	Offer individual counseling with the aim to address fears, provide accurate information, and build trust.	Launch culturally-sensitive education campaigns on the safety and efficacy of HPV vaccination across mass and social media.	Establishing training regimes for healthcare providers on cultural competence and effective communication strategies.
<i>Vaccination/screening procedure related:</i> Fear of male practitioners and fear of the testing procedure. S6.	Assess and accommodate, where possible, preference for female practitioners. Assess and address individual fears before the testing procedure.	Involve female practitioners and cervical cancer survivors to increase the trust in the health care system and practitioners.	Enact policies that promote the availability of female practitioners and research and development into less invasive testing procedures.
<i>Communication and inter-action:</i> Lack of advice and counseling by healthcare providers and insufficient preventive care in the healthcare practice. S5, S7.	Develop personalized preventive care plans for patients during healthcare visits, explaining benefits of preventive measures and addressing cultural concerns.	Partner with cultural and community organizations to disseminate information about preventive care and the importance of regular health check-ups.	Develop policies for the integration of preventive care services in all areas of healthcare practice.
<i>Knowledge:</i> Education (lower), lack of knowledge on HPV, and inability to acquire information on vaccines, and distrust on vaccines. S1, S5-7.	Establish easily accessible and services such as telephone or online portals that address individual questions and concerns about HPV and vaccination confidentially.	Integrate education about HPV and vaccination into school curricula, targeting adolescents to ensure awareness and understanding.	Allocate resources for HPV education and counseling as part of routine healthcare visits.
<b>Economic factors</b>			
<i>Personal finance-related:</i> having limited financial resources, lower income, and lack of health insurance. S4-5.	Offer HPV screening and vaccination free or at income-discounted price points for individuals with limited resources.	Increase funding for community health centers that provide low-cost or free healthcare services to underserved populations.	Subsidize HPV vaccination programs at heavily reduced or no cost to individuals, particularly for teenagers before their sexual debut.
<i>Cost-related:</i> high cost of the vaccine, costly journeys to screening centers from rural areas. S4, S6-7.	Subsidize HPV vaccination and travel to screening centers for individuals living in rural areas.	Implement HPV screening and vaccination as part of occupational health surveillance programs.	Improving healthcare access and infrastructure in rural areas, including establishing new centers and clinics.
<i>Policy-related:</i> Lack of or inconvenient access to screening and vaccination facilities. S4-S6.	Offer HPV vaccination as part of individual healthcare services through general practitioners.	Organize community health fairs that offer free or reduced-cost screening and vaccinations.	Expand funding for additional facilities and adequate staffing of existing facilities.
<b>Personal factors</b>			
<i>Demographics-related:</i> Age (older), ethnicity (Hispanics in USA). S1.	Target educational materials on HPV and cervical cancer prevention to older individuals and Hispanic communities.	Support and conduct targeted community health outreach programs in Hispanic communities.	Allocate resources for vaccination and screening prioritizing older individuals and Hispanic communities.
	Individual level	Societal level	Policy level
<b>Cancer related infection - Helicobacter pylori</b>			
<b>Social factors</b>			
<i>Occupation/profession-related:</i> Being a student or having a lower-qualified occupation such as a worker or farmer. S8.	Offer HPV screening and vaccination at convenient locations and times for students and lower-qualified individuals.	Promote Hp screening by engaging with community organizations, agricultural associations, labor unions, schools, and student groups.	Integrate Hp screening into occupational health services provided by employers, agricultural cooperatives, and educational institutions.
<b>Cultural factors</b>			
<i>Knowledge:</i> Low and inadequate knowledge about the benefits of the screening test. S8.	Offer individual counseling to address concerns, explain benefits, and encourage participation.	Organize community events and workshops to inform about Hp screening and its benefits.	Fund health education and promotion programs advocating for Hp screening.
<i>Screening procedure-related:</i> Fear of potential discomfort caused by the examination. S9.	Offer individual counseling before the screening procedure to explain the process and dispel fears about discomfort.	Launch public awareness campaigns addressing fears and misconceptions about Hp screening.	Implement flexible Hp screening policies that prioritize the minimization of patient discomfort.
<b>Economic factors</b>			

(continued on next page)

Table 5 (continued)

	Individual level	Societal level	Policy level
<b>Cancer related infection - Helicobacter pylori</b>			
<b>Social factors</b>			
<i>Personal finance-related:</i> Low income. S8.	Offer Hp screening free or at income-discounted price points for individuals with limited financial resources.	Launch public awareness campaigns highlighting the availability of financial assistance options, if any.	Subsidize Hp screening programs at heavily reduced or no cost to individuals.
<b>Personal factors</b> <i>Physical condition-related:</i> Being asymptomatic & <i>Perception-related:</i> Thinking that screening is unnecessary when not feeling symptoms. S9.	Encourage discussions on Hp screening with asymptomatic patients during routine healthcare visits, highlighting the benefits of early detection and prevention.	Launch public awareness campaigns emphasizing the importance of Hp screening also for asymptomatic individuals.	Implement policies that recommend Hp screening for certain high-risk populations regardless of their symptomaticity status.
	Individual level	Societal level	Policy level
<b>Cancer related infection - HBV &amp; HCV</b>			
<b>Social factors</b>			
<i>Society-related:</i> Feelings of shame and stigma regarding HBV, perceived discrimination, protecting a family's reputation. S11, S21.	Offer counseling for individuals and families affected by HBV, providing a safe space to address feelings of shame, stigma, and discrimination.	Launch community campaigns to destigmatize HBV and challenge misconceptions and discriminatory attitudes.	Implement policies against the discrimination of individuals living with HBV in employment, educational, and healthcare contexts.
<i>Family-related:</i> Lack of family support, the man of the household making health decisions for the family. S21.	Inform individuals during healthcare visits that participation in HBV screening is confidential and their choice.	Educate community leaders and health providers on gender sensitivity in healthcare decision-making.	Advocate for policies that promote autonomy and gender equity in healthcare decision-making.
<b>Cultural factors</b>			
<i>Knowledge:</i> lack of knowledge in general, lack of knowledge on practicalities of screening and vaccination. S12.	Offer individual counseling sessions during healthcare visits to discuss HBV, answer questions, and guide patients on practicalities.	Partner with community organizations to disseminate information about HBV screening and vaccination.	Funding public health campaigns focused on HBV education, ensuring continuous and widespread information dissemination.
<i>Trust and health experience related:</i> fear of doctors, medical procedures, and test results; lack of trust in medical doctors and medical care services. S21.	Provide detailed, easy-to-understand information about HBV, the benefits of screening and vaccination, and what to expect during healthcare visits.	Launch campaigns that demystify medical procedures and emphasize the safety and importance of HBV screening and vaccination.	Establish policies that mandate patient-centered care practices, ensuring that healthcare providers prioritize building trust and providing compassionate care.
<i>Health policy-related:</i> poor quality of care. S21.	Establish easy-to-access patient feedback systems to collect input on the quality of care received during HBV screening and vaccination.	Launch public awareness campaign to inform on the standards of care expected regarding HBV screening and vaccination.	Develop and enforce stringent standards and guidelines for HBV screening and vaccination.
<i>Communication and interaction:</i> linguistic discordance, lack of doctor recommendations. S12, S21.	Provide health education materials in multiple languages that reflect the linguistic diversity of the community.	Employ community health workers and/or advisors who speak the languages of the community.	Develop policies that require healthcare facilities to provide services in multiple languages.
<b>Economic factors</b>			
<i>Personal finance-related:</i> lower income, not having health insurance, perceived threat for employment due to side effects. S12, S14, S23.	Establish financial assistance programs that cover the costs of HBV and HCV screening, vaccination, and treatment for individuals with lower income or no health insurance.	Increase the number of community-based health clinics offering free or low-cost HBV and HCV screening, vaccination, and treatment services.	Fund subsidized programs specifically for HBV and HCV screening and vaccination, making them available at reduced or no cost.
<i>Cost-related:</i> healthcare costs, out-of-pocket costs for the vaccine, the user fee, time, travel cost and opportunity. S13, S17, S21.	Develop financial assistance programs to cover healthcare costs, out-of-pocket expenses for vaccines, and user fees for low-income individuals.	Deploy mobile health clinics in underserved and rural areas to provide on-site HBV and HCV screening and vaccination.	Create subsidized healthcare programs that reduce or eliminate out-of-pocket costs for HBV and HCV screening, vaccination, and treatment.
<b>Personal factors</b>			
<i>Demographics-related:</i> age (older). S15-17.	Provide individual counseling sessions for older individuals during healthcare visits, highlighting the importance of HBV vaccination and addressing age-related concerns.	Launch public awareness campaigns focused on older individuals, emphasizing the importance and safety of HBV vaccination.	Introduce policy incentives for healthcare providers to prioritize and actively recommend HBV vaccination to older patients.
<i>Religion-related:</i> Using herbal medicines and practicing spiritual healing. S21.	Train healthcare providers to counsel individuals who prefer alternative medicine, pointing out benefits of mainstream screening and treatment.	Partner with spiritual leaders to endorse HBV screening and convey its importance through community gatherings and channels.	Formulate health policies that encourage dialogue and collaboration between different health traditions and practices.
<i>Physical condition-related:</i> Experiencing physical and psychiatric side effects of the treatment. S23.	Educate patients on the benefits of the treatment and offer personalized support services to help patients manage side effects.	Establish support groups for individuals undergoing HCV treatment to share experiences and discuss managing side effects.	Develop integrated care models that include physical and mental health services as part of HCV treatment.

## 7.6. Directions for future research

The results of our systematic review suggest several directions for future research on the barriers and facilitators regarding the prevention of infections related to cancer. For instance, the issue of social stigma has been linked to chlamydia screening [75] but remains relatively underexplored in the context of HPV and HBV prevention. It is unclear how stigma is formed and manifested in different cultural contexts and what factors could help mitigate its impact on prevention. Health policymakers need to consider these factors to enhance preventive measures in the general population.

Details regarding other social factors, such as social networks, interactions, workplace relationships, and the influence of peers and family members on adherence to prevention programs also remain uncertain and require further investigation. Differences in HBV vaccine hesitancy in occupational cohorts indicate a potential role for horizontal peer health education [76], pointing towards the need for further research regarding the role of occupational health surveillance in addressing common barriers and capitalizing on facilitators of prevention programs.

Furthermore, the current state of research does not allow a full assessment of how critical economic factors are in determining individual decision-making processes regarding preventive measures for infections related to cancer. The interplay between economic factors and personal, cultural, and social factors, such as the management of personal finances related to health expenses, needs further exploration.

Regarding future research on cultural factors, a promising avenue might be to investigate the impact of specific health policy measures and the general geopolitical and economic situation of different countries on trust in healthcare systems, in general, and prevention programs for infections related to cancer, in particular. The influence of trust in the healthcare system on e.g. vaccine hesitancy has been demonstrated in the context of COVID-19 vaccination [77].

Another interesting aspect for further investigation is the degree to which reduced-cost or free vaccination, screening, and eradication programs contribute to improving public health. While subsidies might increase adherence to prevention programs in the short run, they also might contribute to an erosion of autonomous health decision-making of the individual. Furthermore, subsidies might distort perceptions of the value of preventive measures, potentially undermining adherence in the long run.

Finally, to alleviate the fear of testing procedures, further research is needed to understand how factors such as pre-existing relationships with healthcare personnel, trust in the healthcare system, and past health experiences interact with the nature of the testing procedure itself in shaping the perception of individuals. This understanding has the potential to inform policy strategies and educational programs, increasing adherence to screening programs.

## 7.7. Limitations

This systematic review is limited in at least four ways. First, we restricted our search to English-language studies, excluding studies reported on in other languages. Second, there is an insufficient number of cross-cultural studies and similarly scoped studies in distinct contexts to fully unravel how the cultural, sociodemographic, and geopolitical contexts impact the importance and role of the various types of factors identified and analyzed in this review.

Third, most of the participants of the studies that investigated barriers and facilitators of HPV infection were female, pointing to an underrepresentation of the male population, likely due to the feminization of HPV and general sex-related health inequalities. While cancer related to HPV infections is more prevalent among females, approx. 10 % of cancers caused by HPV occur among males [1]. Further, HPV infections are prevalent in the general population and, thus, prevention is an inherently relevant topic for both sexes [78]. Further research into the prevention of male HPV infections and its barriers and facilitators is directly needed.

Fourth and last, in the scope of our review, we restrict our attention to four types of infections related to cancer. While these cover more than 90 % of preventable cancers, future research is needed to investigate whether and to which extent socially-determined barriers and facilitators considered in this review might also impact the prevention of other infections related to cancers such as Epstein-Barr Virus, Human T-cell Lymphotropic Virus, Human Herpesvirus 8 or Kaposi's Sarcoma-Associated Herpesvirus, Human Immunodeficiency Virus, and others.

## 8. Conclusions

This systematic review mapped the variety of barriers and facilitators of preventive measures in order to avoid infections related to cancer such as HPV, HBV, HCV, and Hp that are highly prevalent in the population worldwide and could be prevented by preventive measures such as screening, vaccination, and/or treatment of infections. We found several personal, social, economic, and cultural factors that act as barriers to the prevention of infections related to cancer that health policymakers need to be made aware of so that effective prevention services can be provided to the relevant populations. We classified and connected these barriers and facilitators through the prism of health capital. Knowing which are the barriers that influence individuals' engagement with prevention measures of infections related to cancer could inform and guide health policymakers by targeting vulnerable populations by providing effective educational programs and improving the quality of healthcare services. Regarding facilitators for preventing infections related to cancer, the results of this review could help inform health policymakers to consider these facilitators while designing and implementing effective health policy solutions and prevention programs.

Additionally, health policymakers should aim to understand how the various barriers and facilitators interact and where the efforts to promote prevention measures of infections related to cancer should be directed. It is important, as culture defines the context for defining economic and social factors, which in turn can determine the personal experiences of the patients involved in the healthcare

system, which is responsible for screening, vaccinating, and treating infections related to cancer. Understanding interactions of factors allows for effectively addressing the types of barriers and employing facilitators for increasing the uptake of preventive measures for infections related to cancer. Therefore, as pointed out in the discussion, more research is needed to understand personal, cultural, economic, and social factors and how they can be used for infections related to cancer prevention, as well as to understand interactions between them and what impact they have on individuals' health maintenance, disease prevention and treatment, and overall well-being.

### Data availability statement

This manuscript does not contain a “Data Availability Statement” since it is a review article and no other data beyond that extracted from the full-text published articles was used.

### CRedit authorship contribution statement

**Tija Ragelienė:** Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Anna Schneider-Kamp:** Writing – review & editing, Visualization, Project administration, Methodology, Funding acquisition, Conceptualization. **Søren Tollestrup Askegaard:** Writing – review & editing, Funding acquisition, Conceptualization.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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