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Review

Digital Marketing: A Unique Multidisciplinary Approach towards the Elimination of Viral Hepatitis

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Abstract: New technologies are supported by the global implementation of the internet. These improvements have deeply affected various disciplines of sciences and consequently changed services such as daily business, particularly health sectors. Innovative digital marketing strategies utilize the channels of social media and retrieved user data to analyze and improve relevant services. These multidisciplinary innovations can assist specialists, physicians and researchers in diagnostic, prophylaxis and treatment issues in the health sector. Accordingly, compared to recent decades, health decision makers are more accurate and trustful in defining new strategies. Interestingly, using social media and mobile health apps in current pandemics of SARS-CoV-2 could be an important instance of the key role of these platforms at the local and global level of health policies. These digital technologies provide platforms to connect public health sectors and health politicians for communicating and spreading relevant information. Adding influencers and campaigns to this toolbox strengthens the implementation of public health programs. In 2016, the WHO adopted a global program to eliminate viral hepatitis by 2030. Recent constructive measures that have been used in the battle against COVID-19 could be adopted for the elimination of viral hepatitis program. The presented evidence in our narrative review demonstrates that the application of digital marketing tools to create campaigns on social media, armed with professional influencers, can efficiently consolidate this program. The application of different strategies in using these popular tools will raise the public awareness about viral hepatitis. Subsequently, the availability of an effective vaccine for HBV and antiviral medication for HCV can motivate the audience to take steps towards prophylaxis and screening methods against these infectious illnesses. The encouragement of health policy makers to apply digital communication technologies and comprehensive roadmaps to implement this global program will certainly decrease the burden of viral hepatitis worldwide.

Keywords: digital marketing; viral hepatitis; elimination; WHO; program; global; social media; influencer; campaign; management; virtual

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1. Introduction

Digital Marketing and Its Tools

The global implementation of the internet has undoubtedly supported the fast and unprecedented growth of new technologies at individual and institutional level [1]. These improvements have deeply affected various disciplines of sciences and consequently changed daily services and business. Accordingly, users of these new generation digital devices have adapted to significant alterations in daily behavior, interests, and expectations. These changes in human habits root from innovations in technologies, such as artificial intelligence (AI), block chain, virtual reality (VR) and autonomous vehicles [2]. The digital revolution in marketing has created enormous advantages as well as challenges that have led to the development of new concepts [3]. For instance, digital marketing has been recognized as one of the recent emerging transdisciplinary concepts in the world of technology. Of note, digital trends in human society have enabled individuals to communicate across boundaries of time and space, to access information around the world and apply it in marketing and business [4].

From a transdisciplinary perspective, digital marketing with the support of communicative tools can create strategic plans and forward these to a favorable destination. In other words, digital marketing has provided a series of customized platforms for communicating with specific stakeholders through channels and related tools using computers, smartphones and tablets [5]. These channels allow the gathering of information and include websites as well as different platforms of social media such as Facebook, YouTube, Twitter, Pinterest, TikTok and LinkedIn. These communication platforms provide an effective environment for interactions between the organization, stakeholders and end users. The easy accessibility, message customization, cost-effectiveness, ability to design and execute strategies and support of stakeholders are the main beneficial characteristics of this type of marketing. Therefore, marketing strategies utilize these channels and user data to analyze and improve relevant services [5]. Recent investigations show a dramatic increase in internet users, spanning all age groups, genders and ethnicities in developing countries [6]. Depending on their skill, suitability and competence in social networking, a considerable percentage of people are use more than one platform of social media [7].

Innovation in communicative technology is the main pillar of the abovementioned improvements, which has led to the development of social media [8,9]. A general characteristic of social media is to engage users and create a sense of "being and functioning virtually". Different types of social media allow their own users not only to find and maintain communication with friends and followers, but also to observe and react to global news together with gathering and sharing this information [10–12].

Digital marketing through social media encourages users to engage by posting message, comments, videos or pictures [12]. In addition, viewers become reactive agents by liking, sharing, retweeting and following these posts [13]. Interestingly, digital marketing takes advantages of the interactive characteristics of social media and attempts to exert an impact on different disciplines such as human health.

In the frame of a narrative review, we tried to dive into all available scientific evidence linked to the application of digital technologies in the establishment of health programs. From both a technological and medical perspective, previous and current experiences helped us to evaluate the benefits, drawbacks, challenges, hurdles and gaps confronted with implementation of digital marketing for the viral hepatitis elimination program of WHO. Previous positive experiences with the use of digital technology on the management of health issues, particularly in the control of vaccine-preventable infectious diseases, highlight the message of this review. Here, we are addressing a series of appropriate strategies in the use of a digital toolbox to tackle a threatening public health issue. Based on our presented data, health authorities can accelerate action plans of viral hepatitis elimination and achieve the goals of the global program.

The first chapter of this review evaluates a list of digital innovations and the impacts on human health through alterations in daily behavior and interests. In this part, several examples demonstrate that data from communicative digital customized platforms have revolutionized health services (such as surveillance of pathogens or on time and appropriate actions) and stakeholders' expectations.

In the following part of the text, we refer to the application of social media platforms and mobile apps during the COVID-19 pandemic. Furthermore, we shed light on the misuse of these digital tools by antivax movements. In the final part, we discuss the global burden of viral hepatitis and available medical tools for controlling this public health threat. We address digital tools that have been used for COVID-19 but are still missing in the viral hepatitis elimination program. Accordingly, to fill in these existing large gaps in public awareness and to use appropriate screening, vaccination and antiviral therapy against viral hepatitis, we urge health policy makers to apply digital marketing tools such as social media. Of note, the use of these platforms and the recruitment of influencers is highly advised.

2. Health and Digital Technologies

2.1. Social Media's Impact on Health Care System

The future of health sectors is deeply linked to the application of advanced technologies. New technologies can lead to a massive change in healthcare practice and its related business sectors in a variety of ways. Companies involved in the food and pharmaceutical industry as well as hospital and producers of laboratory equipment take advantage from new technologies to deliver their products and services to the customers and end users. Furthermore, digital innovations can assist specialists, physicians and researchers in diagnostic, prophylaxis and treatment issues [14,15]. Compared to recent decades, health decision makers are more accurate and trustful in defining new strategies. Different national and international health organizations use these social media platforms to communicate, design and disseminate their health strategies [16]. The World Health Organization (WHO) has already used social media platforms, such as Twitter and other social networks, to communicate and report on health care information [17]. This organization calls for social media to be more active in broadcasting health messages to the public, under normal circumstances and during a health crisis [18]. Based on data collected from different regions, the WHO anticipates a shortage of human resources in the health care of nearly 12.9 million worldwide by 2035. To counter the shortage of personnel, the WHO is ambitious to apply new technologies for attracting and allocating people with different specialties in healthcare [19,20]. Additionally, the management of patients has substantially improved, and personalized contact between patients and the healthcare staff is straightforward and more convincing [21]. There is an ongoing evolution in communication platforms, and those that have implement these advanced digital technologies in their health system have significantly benefited by attracting larger audiences and consumer groups (Figure 1) [22].

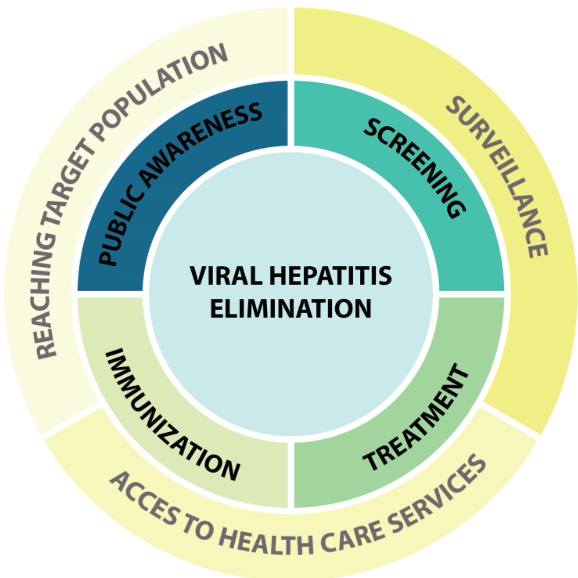

Figure 1. Application of digital marketing in program of viral hepatitis elimination. Center of diagram shows the goal of program. This goal is achieved by measurements such as increases in public awareness, screening, treatment and immunization against viral hepatitis (middle zoon). Medical apps, social media influencers and campaigns support and facilitate those medical services through surveillance, reaching target population and access to healthcare services (outer zoon).

In parallel with health service providers, digital technologies are frequently used by ordinary people who search and look for answers on questions about their health on the internet [23,24]. Surprisingly, monitoring health-seeking queries on the web in different geographical regions and seasons can provide big data, which can be used to analyze real world health associated developments. For instance, it has been shown that the frequency of certain key words in the web correlate with the number of patients with influenza-like illnesses who refer to physicians in some geographical regions [25]. This sort of digital-based data analysis can support innovative surveillance systems that can assist epidemiologists in the identification of seasonal influenza epidemics [26]. The same approach has been used in the surveillance of Dengue virus [27]. Furthermore, in some tropical countries such as India, Indonesia, Singapore, Bolivia and Brazil, web search query data corresponded with the resurgence of Dengue virus [28]. Beyond pathogen surveillance, data on web behavior can be utilized as a health indicator of web users and to determine their access to healthcare facilities, including screening tests, vaccine, physicians and therapies (Figure 1) [24]. Additionally, the utility of web-based data can be beneficial for the assessment of other health issues such as contraception [29,30], diabetes [31,32], obesity [33] or cardiovascular diseases [34]. However, in the case of communicable diseases, the application of digital technology has extraordinary relevance.

The relevance of digital innovations is highlighted when we are confronted with human pathogens that cause significant morbidity/mortality, especially during the early days of epidemics. In moments when there is lack of information and few effective therapies (e.g., vaccines and medication), a unified and appropriate response is very critical. Accordingly, it has been demonstrated that access to digitally generated data on platforms of social media can empower an immediate response or/and control the spread of viral diseases such as HIV and Ebola [24,35]. For instance, during the Ebola epidemics in Africa, a global massive web search was observed. Interestingly, a significant positive correlation was reported between social media behavior (e.g., number of tweets) and an increasing prevalence of HIV, which exemplifies the massive potential of social media's impact on health status information of users (Figure 1) [36,37]. The analysis of such geographical location specific data retrieved from web searches helps the health authorities implement appropriate and timely actions. Via social media networking, public health researchers or clinicians have access to a wide/global audience (Figure 1) [38,39]. This allows the rapid communication of health-related information and might contribute to the improvement of the society's health status. Several studies have shown that users follow up the advice of messages posted on social media by health advisers [6,40–42]. Therefore, communicating the implementation of interventions alongside messages to support healthy behavior could have tremendous value and interests. For example, research projects that offered home HIV testing through social media platforms, known as app-based intervention, has been well accepted. [41,43].

Antimicrobial resistance is another serious health concern that is highlighted in human digital communication. By 2050, 10 million deaths due to antimicrobial resistance are estimated per year, which highlights an eminent threat to human health [44]. Recent investigations have demonstrated that misunderstandings and wrong public perceptions underlie antibiotic overconsumption [45–47]. Furthermore, self-medication, off-label use (e.g., for curing viral infections) and suboptimal dosing of antibiotics are examples of misconception that occur in both developing and developed countries [48,49]. Several strategies, such as different assessments or educational programs, have been implemented to increase knowledge concerning antibiotic use and infectious diseases [47]. Among a variety of tools, social networking platforms such as Facebook pages, Twitter and YouTube have been efficiently used change public perception (Figure 1) [39,50,51]. The dissemination of an educational program called "antimicrobial stewardship" (ASP) on Facebook and Twitter for students of medicine is a worthy example of the application of social media technologies [50,52]. Further, to increase students' awareness, online games about antibiotics have been launched in the UK and USA, which had a positive impact [53]. However, the use digital marketing in health system is not always a success story, as has been demonstrated in the case of measles. Despite the availability of an effective vaccine, measles is still a worldwide public health concern, with several measles outbreaks, even in developed countries, in recent years [54]. Health policy makers have used social media to promote vaccination programs; however, antivaccine movements have applied similar tools to spread disinformation [55]. More so, the activity of the antivaccination (anti-vax) movement on social media seems much higher and more successful compared to the pro-vaccines movement, which contributes to the increased vaccine hesitancy. [56,57]. A survey showed that activities of the anti-vax movement on Twitter positively correlated with the incidence of measles outbreaks and a drop in vaccine coverage [58]. Antivaccine discourses on social media majorly highlight potential vaccine side effects and deaths. Additionally, they try to link the deaths to conspiracy theories and attempt to minimize the effectiveness of vaccines. However, none of them use scientific arguments to support their claims [58]. Contrasting the anti-vax movement, communication that reverberate on social media has been able to transmit well-informed information about measles infection sequela and has assisted parents in making the correct decision for vaccination [59]. Vaccination against influenza and HPV are experiencing the same scenarios on social media in which misinformation is propagated by antivaccine movements [60–62].

Besides monodirectional communication and the dispatch of health messages, social media platforms enable the interactions between stakeholders, such as healthy individuals and patients, patients and specialists and ordinary people who are interested in a healthy lifestyle [63]. Nowadays, patients can communicate through social media with health specialists rather than planning visits and speaking in person [64]. This can decrease the number of hospital visits [64]. In addition to social networking sites, different applications and algorithms offered by authorities of digital markets can be used as blueprints for this bidirectional interaction [65]. The term Mobile Health (mHealth) implies the use of different applications (apps) on mobile phones or tablets, which assist in monitoring the personal health of users [66]. In such platforms, advice on daily physical or mental behavior, such as diets, activities and treatments, are suggested to the users. Eventually, the daily functioning of the user is monitored, and personalized reports are delivered [67–71].

2.2. Current Pandemic and Digital Revolution

From the first days of the SARS-CoV-2 pandemic, which started in December 2019 in China, digital marketing tools (e.g., social media) demonstrated their potential use in times of crisis [72,73]. Not surprisingly, the first diagnostic report of a suspected pneumonia case with unknown etiology was posted on WeChat by Dr. Li Wenliang, who later died from the same illness. Although the use of social media to disseminate information was adopted in previous epidemics such as Ebola outbreaks [74], Zika virus [75], Influenza [76], Dengue [77] and MERS-CoV [78], the wide application of digital technology in the SARS-CoV-2 pandemic was beyond previous experiences. The World Health Organization (WHO) noted that "the coronavirus disease 2019 (COVID-19) is the first pandemic in history in which technology and social media are being used on a massive scale." [79]. Accordingly, by applying social media, health information spread quickly and was instantly shared with the public to inform people about the epidemic, prophylactic measures and treatments [80–82]. Furthermore, through different channels of social media, bidirectional communication was implemented during phases of lockdown for people with health-related questions and/or to increase their own awareness [82,83]. This demand was partially linked to the current COVID-19 pandemic, and other needs were related to other illnesses in which patients needed remote care, relevant advice, and medical services (Figure 1) [84,85].

Access to trustable information is very important, and the spread of fake news has been a major threat for the credibility of social media during the COVID-19 pandemic [86]. In the first months of 2020, plenty of disinformation was shared social media that included conspiracy theories, in which bioweapons, the involvement of Bill Gates and the implementation the 5G network were introduced as the main causes or catalyzers of COVID-19 spread [87,88]. In contrast, following the approval of SARS-CoV-2 vaccines, social media was a crucial platform for the roll-out of vaccines. However, similar to previous vaccination campaigns, individuals used social media channels to spread conspiracy theories and antivaccination disinformation to disturb the immunization program and avoid vaccinations [89–91]. Unfortunately, the view rate of vaccine-opposing posts related to SARS-CoV-2 was much higher than the views of pro-vaccine messages [92–95]. Besides vaccine inequity, vaccine hesitancy, which counters public health messages, is now considered a real hurdle for vaccination against SARS-CoV-2 [96,97].

The current pandemic has been a trigger for users to innovate digital marketing. These initiatives are taken by users to intensify and amplify their activities. Often, people utilize more than one platform of social media. It allows them to disseminate information from one platform to another. This type of activity, which is called cross-platform use [79,98], is often applied by the antivaccine movement to support tweets with links to YouTube. This nimble strategy tries to boost the dispersal of vaccine-opposing videos by re-tweeting antivaccine contents [99]. Unfortunately, this strategy has not been thoroughly used by health authorities so far.

"EpiTweetr" is another innovative tool that was developed by the European Center for Diseases Control (ECDC). This tool allows epidemiologist to track possible emerging threats through searches on different platforms particularly Twitter. This tool automatically monitors, collects and processes data on Twitter and informs experts when the posted material on Twitter is not ordinary. For instance, when an increasing number of Tweets include keywords, such as the name of a pathogen, EpiTweetr automatically informs the end-user. The generated information is the result of massive data collection that has been filtered and validated by the tool. In detail, the signaling of a threat at the early stages is detected in Twitter by EpiTwittr; however, the validation of these data is necessary. Therefore, these signals are checked and approved by public health institutes and international organizations. However, to not miss potential risks, the received signals are rechecked in other platforms of social media as well.

Although EpiTweetr is a free package tool that can be used for any potential threat, the current pandemic helped the ECDC to improve this tool in terms of data collection, processing and visualization for end users. [100].

The current pandemic has highlighted the importance of mobile health apps and digital technologies on human health [101–103]. To combat the pandemic, huge numbers of mobile applications are available in different countries to share health information and/or trace contacts [104,105]. These applications can track the health situation of the users and prevent the dispersal of SARS-CoV-2 [106]. Eventually, these tools successfully reduced the global costs/health burden COVID-19 [107]. Apps such as mHealth have frequently been used during vaccination processes against COVID-19 and are currently used in campaigns for vaccination against HPV and influenza [108–110]. Undoubtedly, without digital marketing health tools, the roll-out of mass vaccinations would be more challenging. These tools have been used to contact eligible persons for vaccinations. Furthermore, individuals are regularly invited or reminded by phone message or app notifications to make an appointment and to ensure the completion of the full vaccination program (e.g., the administration of booster vaccines). In addition to the dispersal of vaccines, apps can be used to monitor post-vaccination side effects. After finalizing the vaccination program, a digital immunity certificate or vaccination passport can be issued, which is always presentable by vaccinees [111]. This final key service of digital health is online issued evidence, which allows vaccinees to travel and access public places without restrictions. Recent evaluations showed that the digital vaccine passport had a positive impact on re-opening economies [112]. Importantly, the usage of mobile applications during the COVID-19 pandemic was confronted with some restrictions that originated from cultural, demographic and political issues in some country [107,113,114]. For instance, using mHealth for contact tracing and the registration of vaccine passports is highly controversial in some regions [115].

The COVID-19 pandemic has not only accelerated the digitalization of the health sector but also added new concepts by the introduction of digital vaccination passports, a series of nexuses such as the "Diplomacy for digital health," "Digital health for diplomacy," and "Digital health in diplomacy". These developments have become more widespread on a global scale [114,116–119]. Undoubtedly, the COVID-19 pandemic was an important scene for the development and implementation of digital marketing tools, including social media and mobile apps, for health-related issues at a global level. These tools assisted health policymakers to implement a series of efficient responses to pandemic and will certainly be applied in pandemic preparedness programs.

2.3. Engagement of Influencers in Public Health Issues

For market managers, the power of influencers is worthy [120]. Individuals with a large number of followers on social media can efficiently increase the selling rates of a products [121]. It has been shown that people like to follow individuals that have created their own follower community and are directly accessible and responsive to the audience. This contrasts with traditional celebrities that have a mass audience and are not tangible for ordinary people. Influencers, or micro-influencers, are trusted by the audience, and compared to known celebrities, their recommendations and advocations are often accepted by their followers [122,123]. Accordingly, influencers have an impact on decisions makers and can turn/drive the decisions of followers towards some specific products or opinions. There is an increasing body of evidence that social media influencers have a positive impact on public health issues [124,125] such as reducing smoking [126,127] and vaccination against HPV or influenza [95,128,129]. The use of influencers in public health is an intervention that can transmit tailored messages and inspire social media users to change their behaviors [95]. Furthermore, influencers can collaborate with public health policy makers and support them in the use of social media. Additionally, influencers' population-targeted engagement has a positive impact on the health improvement of high-risk populations, e.g., immigrants [130–134].

It seems that all mentioned worthy experiences and knowledge from different disciplines in digital marketing have created a paved path for supporting health programs such as the elimination of widespread pathogens.

3. Viral Hepatitis Elimination and Applicable Digital Marketing

The eradication of infectious diseases requires a series of health measurements. If these tools are efficiently and correctly put in place, the infection of a targeted pathogen will be consequently controlled and eliminated (Figure 1) [135]. For instance, regulations that aim at the implementation of effective screening and identification of infected individuals provide a detailed picture of the epidemic. This information can be used for the distribution and administration of medicines and immunization efforts. The goal is to reduce the burden of disease and achieve long-lasting protection, which is crucial for a successful elimination program. However, in all elimination programs implemented by the WHO, vaccination plays a key role. Vaccination has the ability to block the transmission of pathogens and avoid new infections. For instance, mass vaccination supported the eradication program of smallpox, which succeeded in 1980, fourteen years after infections began in 1966 [136]. In addition to smallpox vaccination, the rapid development and implementation of vaccination strategies encourage public health policy makers to launch elimination programs for several pathogens such as rubella, measles and HPV [137–139].

3.1. Burden of Viral Hepatitis

Viral hepatitis is a global public health problem in which several viruses including hepatitis A (HAV), hepatitis B (HBV), hepatitis C (HCV), hepatitis D (HDV) and hepatitis E (HEV) are major causes of the infection and inflammation of liver tissue [140]. Considering its worldwide distribution, routes of transmission, virological characteristics, natural history and clinical outcomes, the global burden of viral hepatitis is mostly dedicated to HBV and HCV [141–143]. Globally, 58 million people live with chronic HCV and 296 million with HBV [140]. Furthermore, 90% of the annual global death rate of viral hepatitis (1.4 million) is related to HBV and HCV [144]. Geographical regions with limited access to safe water and sanitation also suffer from waterborne viral hepatitis agents (HAV and HEV) [145].

A broad spectrum of diagnostic platforms for HBV and HCV, including serological, molecular and biotechnological assays, are available [146–148]. Furthermore, several approaches can support diagnostic assays when different geographical distributions of viral genotypes or subgenotypes have an impact on diagnostic assays and clinical findings [149–153] or when different strains exert different responses to therapeutic measures [154,155]. Additionally, to stop viral hepatitis outbreaks, different investigation strategies have been proposed [156,157]. All these facilities have paved a path for an elimination program.

In 2016, the WHO adopted a global program to eliminate viral hepatitis by 2030 [158]. This program aims to decrease the incidence of chronic viral hepatitis infection and the mortality rates of infected patients by improving access to screening, universal vaccination and therapies [159]. This program was implemented when an efficient antiviral HCV therapy entered the market. These medications supported other available tools such as HBV vaccines and diagnostic assays. Different countries with variable levels of income and available facilities have tried to join this elimination program [160,161].

Because of the different prevalence of HBV and HCV, the success of the viral hepatitis elimination program relies on the application of tailored policies based on geographical region requirements [162]. In the implementation of a strong surveillance system in order to screen donated blood, pregnant women and persons with high-risk behavior are critical policies. This facilitates a series of effective prophylactic measures that can suppress the viral transmission in human communities [163]. In the case of HBV, the administration of vaccines and hepatitis B immune globulin (HBIG) to infants born to HBsAg-positive mothers is an important and time-dependent measurement [164]. In countries that included HBV vaccination in the national vaccination schedule, the prevalence of HBV has dramatically decreased [144]. Further, depending on the available infrastructures, different interventions have been applied to combat HCV [165]. The implementation of innovative strategy named "micro-elimination" has assisted policy makers in accelerating tackling HCV [166]. In micro-elimination, national elimination goals target subpopulations, and tailored services including treatment and prevention are quickly delivered to these groups. These populations are determined by some epidemiological factors, such as HIV/HCV coinfection, the need for blood transfusion (e.g., thalassemia, hemophilia, hemodialysis patients), prisoners, organ transplant recipients, people who inject drugs (PWID), children of HCV-infected mothers and immigrants originating from high-HCV-prevalence countries. Countries that apply micro-elimination are trying to achieve their goals within the WHO timeline [167]. Adding digital health technologies to these applied strategies can assist health authorities in monitoring and analyzing indicators and eventually filling in the existing gaps in this program. Compared to the other health issues, particularly infectious disease with a lack of vaccines (e.g., HIV), human pathogens with non-human hosts (e.g., Rabis) or infectious agents with a complicated control of their transmission (e.g., Influenza or Coronaviruses), viral hepatitis is well-known, and relying on advanced medical tools is controllable. Regarding this background, using digital tools can accelerate and catalyze measurements in line with an elimination program.

3.2. Current Status of Viral Hepatitis and Digital Technologies

Recent studies suggest that countries that use digital technology in their public health sectors are more active and successful in applying screening tests, disease monitoring and surveillance. These digital technologies provide platforms to connect public health sectors and politicians for the communication and dispersal of relevant information [168,169]. There are several ongoing global health programs, such as the viral hepatitis elimination issued by the WHO, that can benefit from the use of digital technologies. Many of these technologies have been used in the battle against COVID-19 but not yet for the viral hepatitis elimination program [170,171]. There are significant differences between these two infectious diseases, which also require different approaches in the use of digital health strategies. In contrast to COVID-19, viral hepatitis is a health problem with etiologies that have already evolved into different mounted genotypes and subgenotypes with particular geographical distribution [147,172]. Furthermore, there is a highly efficient and safe vaccine against HBV infection available, which is able to stop virus transmission. Although vaccinated individuals are well-protected against severe disease and death, the currently available SARS-CoV-2 vaccines only have a limited effect on transmission [173,174]. HBV vaccines provide long-term protection after three doses, while recent studies demonstrate that COVID-19 antibodies gradually wane after vaccination [174,175]. The waning of SARS-CoV-2 antibodies encouraged governments to offer booster vaccines to the population. In the case of HCV, no vaccine is currently available, although the recent antiviral medication is highly effective [142,176]. For both HBV and HCV, effective treatment and/or prevention strategies are available, and their proper implementation will significantly contribute to the success of the WHO elimination program.

There is a large gap in the public perception of viral hepatitis, which needs an increase in public awareness and interest. Raising public awareness of viral hepatitis is a key step of the elimination program (Figure 1). In this regard, digital marketing platforms such as social media can play a significant role. Through different platforms of social media, knowledge about different types of hepatitis, modes of transmission viruses, clinical outcomes, diagnostic tests, available vaccines, prophylaxis and treatment can be promoted [177]. For instance, based on social media resources, researchers found that among Moroccan university students, knowledge about viral hepatitis and its routes of transmission and immunization is limited [178]. This gap of knowledge was also recognized by policy makers. In response, an "action plan for the health sector response to viral hepatitis in the WHO European Region" was developed in 2017. This plan included several targets that should be reached by 2020. One of the targets was to raise awareness in 50% of the people living with HBV and HCV. It is not surprising that in parts of the European continent, screening has not yet been well-implemented, and the majority of residents are not aware about their probable infections. This gap in public knowledge is much larger in other continents such as Africa and leads to the propagation of infection [144]. Additionally, in China, where the prevalence of HCV is high, many people are not aware of their infection [179]. The European action plan included five strategic directions and priority actions, and all highlighted the use of novel digital technologies [180].

The implementation of social media campaigns on Facebook and the communication of messages about HBV vaccination as a liver cancer prophylactic tool has been successful in elevating the knowledge of health providers and residences in Idaho, US [181]. Additionally, the application of social media to pinpoint existing hurdles that confront the elimination program has been fruitful. In some trials, these digital marketing tools have been able to supplement the knowledge of the general population about liver cancer and its screening. Despite the successful use of digital marketing tools to increase public knowledge, these campaigns did not improve their screening behavior [182]. Health-related messages on social media are mostly considered by young adults who originate from different regions [183]. For instance, social-media-based interventions promoted HBV screening among Korean residents in the US [131]. Social networking and mobile apps played an outstanding role in response to two massive Hepatitis A outbreaks in Europe and Canada. Of note, social media assisted health authorities in tracing the infected cases and implement a vaccination campaign to immunize susceptible individuals [184,185]. Further, social media has been used to inform people who inject drugs (PWID), heterosexual young people and MSM about viral hepatitis and to achieve a reduction in viral infection [186–188]. Furthermore, these platforms have also been used to update the knowledge of family physicians [189]. A survey reported a number of YouTube videos about HCV, which have attracted considerable viewers. However, these videos do not cover all aspects of HCV [190]. Data retrieved from social media about marginal communities can be very useful. For example, a survey in the US showed that awareness about hepatitis C virus is very low in a significant number of Hispanic and NH Asian young adults, who had never heard about HCV [191]. Authors of this study emphasized a social media campaign to educate targeted population about HCV screening. In Australia, low knowledge about viral hepatitis and its sequels in non-Australian-borne citizens is a serious issue [192]. Certainly, providing cultural- or ethnical-tailored health services through social media communications can be efficient. Subsequently, raising awareness about viral hepatitis improved screen and vaccination in the target population [193].

According to the WHO, vaccine hesitancy is one of the top threats for human life [194]. Social media is a frequently used platform to spread antivaccination messages and, therefore, is associated with the increase in vaccine hesitancy [195]. The effect of antivaccination messages on social media seems lower for pediatric HBV and HAV vaccinations compared to other vaccines such as for MMR and Rota virus. [195]. An analysis of tweets on the vaccine debate posted between 2006 and 2015 demonstrated that national vaccination programs affected messages on Twitter. It was deduced that vaccination programs can be improved by the application of social media campaigns. Twitter posts that included links to scientific websites were in accordance with the "*cross-platform use*" strategy [166,176,196].

3.3. Social Media and Data Mining in Viral Hepatitis Elimination

The implementation of healthcare programs requires access to and the meticulous analysis of relevant data. Technology giants such as Google and Apple have been deeply involved in collecting data related to smart digital devices. Mining and analyzing accurate information of digital communications provides valuable information regarding the preferences and daily behavior of people. For instance, the data generated through Google searches, Twitter and Wikipedia have been used for influenza surveillance. Through Bayesian Change Point Analysis, web-based search data from Influenza like illness (ILI) was compared with Centers for Disease Control and Prevention (CDC) ILI data. Interestingly, data from web searches were correlated with CDC data, which are routinely reported by health care providers in real time [197]. Similarly, social media data have been used to estimate viral hepatitis burden as well [198]. By means of social media analytic software, Symplur Signals (Symplur LLC), Twitter activity related to three chronic liver diseases (CLDs) including nonalcoholic fatty liver disease (NAFLD)/nonalcoholic steatohepatitis (NASH), hepatitis B and hepatitis C were analyzed between 2013 and 2019. This analysis showed a fluctuation in Twitter activity and tweeter impression during this period. However, given the trend of increasing Twitter activity for HBV, surpassing HCV by 2023 and 2024 is predicted [199]. Accordingly, through social media communication, the health status of people living with hepatitis could be traced and monitored in different geographical regions [200].

The use of smartphone apps and social media for viral hepatitis elimination results in the generation of big data. Analyzing these data with different platforms of artificial intelligence such as machine learning could support health authorities [195]. These analyses help policy makers implement surveillance through monitoring the migration of viral hepatitis reservoirs. The displacement of individuals [201] from high to low endemic regions [202] can be a major health concern for decision makers [160]. For instance, health care policies in line with a viral hepatitis elimination program are primarily based on country-specific demographic data, which can be challenged by the movement of people from various endemic regions [160,203].

3.4. Merging Strategies

A campaign is an effective method to communicate to a targeted population for a specific goal and at a specific time [204,205]. This strategy can be implemented in different geographical regions at local, national and international levels. Campaigns are cost-effective in distributing information and marketing to audiences [206]. Creating campaigns can also be used as an effective tool in conveying visions, missions, policies, marketing, public relations and health awareness or health education [207].

Effective health communications have an influence on the behavior of the targeted community. For experts in the health sector, communication is a vital step in a health program to offer prophylactic measures and improve the quality of life. Among different communication strategies, health- or disease-targeted campaigns are most popular. In fact, health campaigns can educate the targeted audience and improve health by changing their behavior. A campaign to promote breast feeding using breast milk (which is healthier for mother and child) is an example of such a health campaign [205]. Furthermore, promoting sports, combating obesity, stopping smoking and alcohol consumption, cancer screening, the use of vaccines and promoting sugar-free and diet drinks, low-fat milk, natural juices and lower caffeine consumption are other examples of public campaigns that successfully influenced their audience. [208–210].

In addition to other international health programs targeted at healthy lifestyle modifications, such as AIDS and sexually transmitted diseases, the viral hepatitis elimination program is suitable to be communicated through campaigns [211]. So far, campaigns for raising awareness about liver cancer, liver cancer screening and vaccination against hepatitis B and A have been implemented. However, there are some tips and critical points that could contribute to the success of health campaigns in this field [184,185,212].

Still, traditional media such as TV, radio and newspapers assist the health sector in creating and spreading health campaigns. They have proven to be successful in adjusting public perception and receiving considerable positive responses. Mass media (radio and TV) exposure has displayed a positive impact on childhood stunting in African countries [213]. Furthermore, vegetable and fruit consumption has received much attention after a campaign on media in the US and led to a positive change in behaviors [214]. The role of newspapers in a campaign for HPV vaccination in Japan [215] or the positive role of media to promote meningococcal vaccination in a recent outbreak in the Netherlands [216] corroborates the usefulness of traditional media. However, adding digital marketing, particularly social media, to this communication toolbox has massively reinforced health campaigns. It has been shown that the use of social media and the launch of public health promotion campaigns have great potential for the target audience [217]. Compared to other methods, launching campaigns on different platforms of social media amplifies bi-directional communication and efficiently leads to changes in the user's behavior [124,218,219].

Elements such as availability, level of exposure to social media in targeted geographical region, appointing effective communication channels, presenting appropriate slogans or messages or visualized contents such as pictures or videos, also having a regular schedule, the determination of a target community and considering the educational level, age and gender of audiences [220–223] play critical role in a fruitful viral hepatitis campaign. In addition, one of the most important elements in campaigns is the choice of an appropriate message (warning, fear, excitement and pleasure) in line with the campaign goals. For example, messages containing fear are considered successful examples in antismoking campaigns. [224–226].

It has been shown that the use of innovative methods can increase the coverage of the message to the audience [227]. For example, in successful health campaigns, along with the use of images or videos, creative methods in storytelling and excitement have been emphasized [82,228,229]. Elements that contribute to the easy understanding of the message, such as infographics, had a positive impact on campaigns during the COVID-19 pandemic [223]. Furthermore, recruiting influencers, celebrities and seeders to the health campaign on social media is efficient and supports health campaigns [230,231]. Lessons learned from using influencers in campaigns that promoted flu vaccination demonstrated mass positive interaction [95,232] and could be applicable to other vaccination campaigns [82,233]. Influencers should be recruited from the health sectors. For example, in the case of a campaign for the elimination of viral hepatitis, inviting experts involved in prevention, screening and treatment is suitable for communicating the main message of campaigns [234,235]. Involving trained influencers such as family physicians, whose advice is listened to by the public, is always effective in the health sector. In a social network, they have a special position to recommend their patients to undertake viral hepatitis screening [236]. Providing a systematic and sustainable incorporation of messages about viral hepatitis by expert influencers fosters these campaigns. Educated influencers can present relevant messages and can easily convince their followers on social media through the messages they post [237]. Sufficient knowledge about relevant keywords and terms related to hepatitis screening, treatment, prevention and vaccination are principal necessities. Additionally, being familiar with key terms involved in viral hepatitis, such as antibodies, antigens or molecular biology terms such as PCR, Q-PCR and NGS and the usage of fibro scan or biopsy should be mastered by attracted influencers. This has been demonstrated previously, when hiring content knowledgeable influencers had a positive impact. These types of campaigns can reach large audiences, promote communications [24,238] and will finally decrease the burden of hepatitis in the short, middle and long term.

Finally, continuity and evaluation in dynamic communication are important for the promotion and development of a campaign [227]. A successful health campaign is updated by the received feedback [239–241]. In an evaluation system, the degree of change in the attitudes and behaviors of audiences who are exposed to the health campaign should be formulated and considered according to environmental and social factors [242,243]. The data obtained from the campaigns (psychological characteristics, demographics, along with the analysis of audience behavior on social media) should be used as effective tools in evaluating the campaign and determining future decisions [95,230].

In conclusion, digital technologies have revolutionized many disciplines and provided new opportunities for running healthcare programs, including viral hepatitis elimination. In this review, we tried to provide relevant evidence that the application of digital marketing tools such as mobile apps or creating campaigns on social media armed/engaged with influencers highly supports this program. The application of different strategies in using these tools will positively elevate public perception and some targeted populations. Subsequently, steps towards prophylactic screening and receiving appropriate treatment will be taken by the audience. Interactive communications between professional influencers and the community will neutralize the flood of vaccine hesitancy fueled by antivaccine movements. The success of these digital health strategies is closely insured by data monitoring, data mining and a continues evaluation system. Already, the application of social media has successfully been implemented in worldwide programs to control the spread of COVID-19. However, using digital marketing to promote the highly efficient vaccine for HBV and effective antiviral treatment for HCV is closer to the goal of viral hepatitis elimination than that of SARS-CoV-2. This should encourage health authorities to use digital platforms to decrease the worldwide burden of viral hepatitis and promote the viral hepatitis elimination program.

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References

1. Ghezzi, A.; Dramitinos, M. Towards a Future Internet infrastructure: Analyzing the multidimensional impacts of assured quality Internet interconnection. *Telemat. Inform.* **2016**, *33*, 613–630. [CrossRef]
2. Serval, T. Transformation digitale: Quand les problématiques industrielles refont surface. *J. L'école Paris Manag.* **2018**, *4*, 15–22. [CrossRef]
3. Kannan, P. Digital marketing: A framework, review and research agenda. *Int. J. Res. Mark.* **2017**, *34*, 22–45. [CrossRef]

4. Brandt, D.; Henning, K. Information and communication technologies: Perspectives and their impact on society. *AI Soc.* **2002**, *16*, 210–223. [CrossRef]
5. Heinze, A.; Fletcher, G.; Rashid, T.; Cruz, A. *Digital and Social Media Marketing: A Results-Driven Approach*; Routledge: London, UK, 2020.
6. Holloway, I.W.; Dunlap, S.; Del Pino, H.E.; Hermanstyne, K.; Pulsipher, C.; Landovitz, R.J. Online social networking, sexual risk and protective behaviors: Considerations for clinicians and researchers. *Curr. Addict. Rep.* **2014**, *1*, 220–228. [CrossRef]
7. Madden, M.; Lenhart, A.; Cortesi, S.; Gasser, U.; Duggan, M.; Smith, A.; Beaton, M. Teens, social media, and privacy. *Pew Res. Cent.* **2013**, *21*, 2–86.
8. Barreto, A.M. Do users look at banner ads on Facebook? *J. Res. Interact. Mark.* **2013**, *7*, 119–139. [CrossRef]
9. Duffett, R.G. Influence of social media marketing communications on young consumers' attitudes. *Young Consum.* **2017**, *18*, 19–39. [CrossRef]
10. Chu, S.-C.; Kim, Y. Determinants of consumer engagement in electronic word-of-mouth (eWOM) in social networking sites. *Int. J. Advert.* **2011**, *30*, 47–75. [CrossRef]
11. Floreddu, P.B.; Cabiddu, F. Social media communication strategies. *J. Serv. Mark.* **2016**, *30*, 490–503. [CrossRef]
12. Gvili, Y.; Levy, S. Consumer engagement with eWOM on social media: The role of social capital. *Online Inf. Rev.* **2018**, *42*, 482–505. [CrossRef]
13. Jernigan, D.H.; Rushman, A.E. Measuring youth exposure to alcohol marketing on social networking sites: Challenges and prospects. *J. Public Health Policy* **2014**, *35*, 91–104. [CrossRef] [PubMed]
14. Glazyrin, Y.E.; Veprintsev, D.V.; Ler, I.A.; Rossovskaya, M.L.; Varygina, S.A.; Glizer, S.L.; Zamay, T.N.; Petrova, M.M.; Minic, Z.; Berezovski, M.V. Proteomics-Based Machine Learning Approach as an Alternative to Conventional Biomarkers for Differential Diagnosis of Chronic Kidney Diseases. *Int. J. Mol. Sci.* **2020**, *21*, 4802. [CrossRef] [PubMed]
15. Fang, C.; An, J.; Bruno, A.; Cai, X.; Fan, J.; Fujimoto, J.; Golfieri, R.; Hao, X.; Jiang, H.; Jiao, L.R. Consensus recommendations of three-dimensional visualization for diagnosis and management of liver diseases. *Hepatol. Int.* **2020**, *14*, 437–453. [CrossRef] [PubMed]
16. Utunen, H.; Attias, M.; George, R.; Ndiaye, N.; Piroux, C.; Farzi, M.R.; Sy, A.; Gamhewage, G. Global Access to OpenWHO's Online Learning Resources for COVID-19. *Stud. Health Technol. Inform.* **2020**, *272*, 304–305.
17. Moorhead, S.A.; Hazlett, D.E.; Harrison, L.; Carroll, J.K.; Irwin, A.; Hoving, C. A new dimension of health care: Systematic review of the uses, benefits, and limitations of social media for health communication. *J. Med. Internet Res.* **2013**, *15*, e85. [CrossRef]
18. Tang, L.; Bie, B.; Park, S.-E.; Zhi, D. Social media and outbreaks of emerging infectious diseases: A systematic review of literature. *Am. J. Infect. Control.* **2018**, *46*, 962–972. [CrossRef]
19. Truth, A.U. No health without a workforce. In *World Health Organisation (WHO) Report*; WHO: Geneva, Switzerland, 2013; pp. 1–104.
20. Dhingra, D.; Dabas, A. Global Strategy on Digital Health. *Indian Pediatrics* **2020**, *57*, 356–358. [CrossRef]
21. Improta, G.; De Luca, V.; Illario, M.; Triassi, M. Digital innovation in healthcare: A device with a method for monitoring, managing and preventing the risk of chronic polypathological patients. *Transl. Med. UniSa* **2020**, *21*, 61.
22. Simpson, S.; Reid, C. Telepsychology in A ustralia: 2020 vision. *Aust. J. Rural. Health* **2014**, *22*, 306–309. [CrossRef]
23. Fox, S. Online Health Search 2006. Pew Internet and American Life Project. 29 October 2006. Available online: http://www.pewinternet.org/pdfs/PIP_Online_Health_2006.pdf (accessed on 29 October 2006).
24. Nielsen, R.C.; Luengo-Oroz, M.; Mello, M.B.; Paz, J.; Pantin, C.; Erkkola, T. Social media monitoring of discrimination and HIV testing in Brazil, 2014–2015. *AIDS Behav.* **2017**, *21*, 114–120. [CrossRef] [PubMed]
25. Polgreen, P.M.; Chen, Y.; Pennock, D.M.; Nelson, F.D.; Weinstein, R.A. Using internet searches for influenza surveillance. *Clin. Infect. Dis.* **2008**, *47*, 1443–1448. [CrossRef] [PubMed]
26. Ginsberg, J.; Mohebbi, M.H.; Patel, R.S.; Brammer, L.; Smolinski, M.S.; Brilliant, L. Detecting influenza epidemics using search engine query data. *Nature* **2009**, *457*, 1012–1014. [CrossRef] [PubMed]
27. Chan, E.H.; Sahai, V.; Conrad, C.; Brownstein, J.S. Using web search query data to monitor dengue epidemics: A new model for neglected tropical disease surveillance. *PLoS Negl. Trop. Dis.* **2011**, *5*, e1206. [CrossRef]
28. Chan, E.; Sahai, V.; Conrad, C.; Brownstein, J. Web search query data to monitor dengue epidemics: A new model for dengue surveillance. In Proceedings of the International Society for Disease Surveillance 10th Annual Conference 2011 Building the Future of Public Health Surveillance, Atlanta, GA, USA; 2011.
29. Smith, C.; Sokhey, L.; Tijamo, C.F.E.; McLaren, M.; Free, C.; Watkins, J.; Amra, O.; Masuda, C.; Oreglia, E. Development of an intervention to support reproductive health of garment factory workers in Cambodia: A qualitative study. *BMJ Open* **2021**, *11*, e049254. [CrossRef]
30. Yousef, H.; Al-Sheyab, N.; Al Nsour, M.; Khader, Y.; Al Kattan, M.; Bardus, M.; Alyahya, M.; Taha, H.; Amiri, M. Perceptions Toward the Use of Digital Technology for Enhancing Family Planning Services: Focus Group Discussion with Beneficiaries and Key Informative Interview with Midwives. *J. Med. Internet Res.* **2021**, *23*, e25947. [CrossRef]
31. Hempler, N.F.; Joensen, L.E.; Willaing, I. Relationship between social network, social support and health behaviour in people with type 1 and type 2 diabetes: Cross-sectional studies. *BMC Public Health* **2016**, *16*, 198. [CrossRef]
32. Ashrafi, S.; Taylor, D.; Tang, T.S. Moving beyond 'don't ask, don't tell': Mental health needs of adults with type 1 diabetes in rural and remote regions of British Columbia. *Diabet. Med.* **2021**, *38*, e14534. [CrossRef]

33. Li, C.; Ademiluyi, A.; Ge, Y.; Park, A. Using Social Media to Understand Web-Based Social Factors Concerning Obesity: Systematic Review. *JMIR Public Health Surveill.* **2022**, *8*, e25552. [CrossRef]
34. Yan, Q.; Jensen, K.J.; Thomas, R.; Field, A.R.; Jiang, Z.; Goei, C.; Davies, M.G. Digital Footprint of Academic Vascular Surgeons in the Southern United States on Physician Rating Websites: Cross-sectional Evaluation Study. *JMIR Cardio* **2021**, *5*, e22975. [CrossRef]
35. Fung, I.C.-H.; Tse, Z.T.H.; Cheung, C.-N.; Miu, A.S.; Fu, K.-W. Ebola and the social media. *Lancet* **2014**, *384*, 2207. [CrossRef]
36. Young, S.D.; Rivers, C.; Lewis, B. Methods of using real-time social media technologies for detection and remote monitoring of HIV outcomes. *Prev. Med.* **2014**, *63*, 112–115. [CrossRef] [PubMed]
37. Stoové, M.A.; Pedrana, A.E. Making the most of a brave new world: Opportunities and considerations for using Twitter as a public health monitoring tool. *Prev. Med.* **2014**, *63*, 109–111. [CrossRef] [PubMed]
38. van der Worp, H.; Brandenbarg, D.; Boek, P.A.; Braams, J.H.; Brink, L.J.; Keupers, J.; Blanker, M.H. Identifying women's preferences for treatment of urinary tract infection: A discrete choice experiment. *BMJ Open* **2021**, *11*, e049916. [CrossRef] [PubMed]
39. Muflih, S.M.; Al-Azzam, S.; Karasneh, R.A.; Conway, B.R.; Aldeyab, M.A. Public Health Literacy, Knowledge, and Awareness Regarding Antibiotic Use and Antimicrobial Resistance during the COVID-19 Pandemic: A Cross-Sectional Study. *Antibiotics* **2021**, *10*, 1107. [CrossRef]
40. Stevens, R.; Gilliard-Matthews, S.; Dunaev, J.; Todhunter-Reid, A.; Brawner, B.; Stewart, J. Social media use and sexual risk reduction behavior among minority youth: Seeking safe sex information. *Nurs. Res.* **2017**, *66*, 368. [CrossRef]
41. Phillips, G.; Magnus, M.; Kuo, I.; Rawls, A.; Peterson, J.; Jia, Y.; Opoku, J.; Greenberg, A.E. Use of geosocial networking (GSN) mobile phone applications to find men for sex by men who have sex with men (MSM) in Washington, DC. *AIDS Behav.* **2014**, *18*, 1630–1637. [CrossRef]
42. Rendina, H.J.; Jimenez, R.H.; Grov, C.; Ventuneac, A.; Parsons, J.T. Patterns of lifetime and recent HIV testing among men who have sex with men in New York City who use Grindr. *AIDS Behav.* **2014**, *18*, 41–49. [CrossRef]
43. Holloway, I.W.; Rice, E.; Gibbs, J.; Winetrobe, H.; Dunlap, S.; Rhoades, H. Acceptability of smartphone application-based HIV prevention among young men who have sex with men. *AIDS Behav.* **2014**, *18*, 285–296. [CrossRef]
44. Acharya, K.P.; Subedi, D. Use of Social Media as a Tool to Reduce Antibiotic Usage: A Neglected Approach to Combat Antimicrobial Resistance in Low and Middle Income Countries. *Front. Public Health* **2020**, *8*, 671. [CrossRef]
45. Mazińska, B.; Strużycka, I.; Hryniewicz, W. Surveys of public knowledge and attitudes with regard to antibiotics in Poland: Did the European Antibiotic Awareness Day campaigns change attitudes? *PLoS ONE* **2017**, *12*, e0172146. [CrossRef] [PubMed]
46. Lam, T.; Lam, K.; Ho, P.; Yung, W. Knowledge, attitude, and behaviour toward antibiotics among Hong Kong people: Local-born versus immigrants. *Hong Kong Med. J.* **2015**, *21*, S41–S47. [PubMed]
47. Or, P.-L.; Ching, T.-Y. The effectiveness of raising Hong Kong parents' awareness of antimicrobial resistance through an education program with peer support on social media: A randomized, controlled pilot study. *BMC Public Health* **2022**, *22*, 315. [CrossRef] [PubMed]
48. Alumran, A.; Hou, X.-Y.; Hurst, C. Assessing the overuse of antibiotics in children in Saudi Arabia: Validation of the parental perception on antibiotics scale (PAPA scale). *Health Qual. Life Outcomes* **2013**, *11*, 39. [CrossRef]
49. Hutinel, M.; Larsson, D.J.; Flach, C.-F. Antibiotic resistance genes of emerging concern in municipal and hospital wastewater from a major Swedish city. *Sci. Total Environ.* **2022**, *812*, 151433. [CrossRef]
50. Ellis, J.; Vassilev, I.; Kennedy, A.; Moore, M.; Rogers, A. Help seeking for antibiotics; is the influence of a personal social network relevant? *BMC Fam. Pract.* **2019**, *20*, 63. [CrossRef]
51. Djerf-Pierre, M.; Lindgren, M. Making sense of "superbugs" on YouTube: A storytelling approach. *Public Underst. Sci.* **2021**, *30*, 535–551. [CrossRef]
52. Pisano, J.; Pettit, N.; Bartlett, A.; Bhagat, P.; Han, Z.; Liao, C.; Landon, E. Social media as a tool for antimicrobial stewardship. *Am. J. Infect. Control.* **2016**, *44*, 1231–1236. [CrossRef]
53. Hale, A.R.; Young, V.L.; Grand, A.; McNulty, C.A.M. Can gaming increase antibiotic awareness in children? A mixed-methods approach. *JMIR Serious Games* **2017**, *5*, e6420. [CrossRef]
54. Patel, M.K.; Dumolard, L.; Nedelec, Y.; Sodha, S.V.; Steulet, C.; Gacic-Dobo, M.; Kretsinger, K.; McFarland, J.; Rota, P.A.; Goodson, J.L. Progress toward regional measles elimination—worldwide, 2000–2018. *Morb. Mortal. Wkly. Rep.* **2019**, *68*, 1105. [CrossRef]
55. Wawrzuta, D.; Jaworski, M.; Gotlib, J.; Panczyk, M. Characteristics of antivaccine messages on social media: Systematic review. *J. Med. Internet Res.* **2021**, *23*, e24564. [CrossRef] [PubMed]
56. Schmidt, A.L.; Zollo, F.; Scala, A.; Betsch, C.; Quattrociocchi, W. Polarization of the vaccination debate on Facebook. *Vaccine* **2018**, *36*, 3606–3612. [CrossRef] [PubMed]
57. Bozzola, E.; Spina, G.; Tozzi, A.E.; Villani, A. Global measles epidemic risk: Current perspectives on the growing need for implementing digital communication strategies. *Risk Manag. Healthc. Policy* **2020**, *13*, 2819. [CrossRef] [PubMed]
58. Gunaratne, K.; Coomes, E.A.; Haghbayan, H. Temporal trends in anti-vaccine discourse on Twitter. *Vaccine* **2019**, *37*, 4867–4871. [CrossRef] [PubMed]
59. Broniatowski, D.A.; Hilyard, K.M.; Dredze, M. Effective vaccine communication during the disneyland measles outbreak. *Vaccine* **2016**, *34*, 3225–3228. [CrossRef] [PubMed]

60. Kang, G.J.; Culp, R.K.; Abbas, K.M. Facilitators and barriers of parental attitudes and beliefs toward school-located influenza vaccination in the United States: Systematic review. *Vaccine* **2017**, *35*, 1987–1995. [CrossRef] [PubMed]
61. Bodson, J.; Wilson, A.; Warner, E.L.; Kepka, D. Religion and HPV vaccine-related awareness, knowledge, and receipt among insured women aged 18-26 in Utah. *PLoS ONE* **2017**, *12*, e0183725. [CrossRef]
62. Massey, P.M.; Kearney, M.D.; Hauer, M.K.; Selvan, P.; Koku, E.; Leader, A.E. Dimensions of misinformation about the HPV vaccine on Instagram: Content and network analysis of social media characteristics. *J. Med. Internet Res.* **2020**, *22*, e21451. [CrossRef]
63. Zhong, B.; Liu, Q. Medical Insights from Posts About Irritable Bowel Syndrome by Adolescent Patients and Their Parents: Topic Modeling and Social Network Analysis. *J. Med. Internet Res.* **2021**, *23*, e26867. [CrossRef]
64. Lammert, C.; Comerford, M.; Love, J.; Bailey, J.R. Investigation gone viral: Application of the social mediasphere in research. *Gastroenterology* **2015**, *149*, 839–843. [CrossRef]
65. Sheppard, M.K. mHealth Apps: Disruptive Innovation, Regulation, and Trust—A Need for Balance. *Med. Law Rev.* **2020**, *28*, 549–572. [CrossRef] [PubMed]
66. Lewis, R.A.; Lunney, M.; Chong, C.; Tonelli, M. Identifying Mobile Applications Aimed at Self-Management in People with Chronic Kidney Disease. *Can. J. Kidney Health Dis.* **2019**, *6*, 2054358119834283. [CrossRef] [PubMed]
67. Falkenhain, K.; Locke, S.R.; Lowe, D.A.; Lee, T.; Singer, J.; Weiss, E.J.; Little, J.P. Use of an mHealth Ketogenic Diet App Intervention and User Behaviors Associated with Weight Loss in Adults with Overweight or Obesity: Secondary Analysis of a Randomized Clinical Trial. *JMIR mHealth uHealth* **2022**, *10*, e33940. [CrossRef] [PubMed]
68. Turesson, C.; Liedberg, G.; Björk, M. Development of a Digital Support Application with Evidence-Based Content for Sustainable Return to Work for Persons with Chronic Pain and Their Employers: User-Centered Agile Design Approach. *JMIR Hum. Factors* **2022**, *9*, e33571. [CrossRef]
69. Rochat, J.; Ehrler, F.; Siebert, J.N.; Ricci, A.; Ruiz, V.G.; Lovis, C. Usability Testing of a Patient-Centered Mobile Health App for Supporting and Guiding the Pediatric Emergency Department Patient Journey: Mixed Methods Study. *JMIR Pediatrics Parent.* **2022**, *5*, e25540. [CrossRef]
70. Denecke, K.; Schmid, N.; Nüssli, S. Implementation of Cognitive Behavioral Therapy in e–Mental Health Apps: Literature Review. *J. Med. Internet Res.* **2022**, *24*, e27791. [CrossRef]
71. Anastasiadou, D.; Lupiañez-Villanueva, F.; Faulí, C.; Cunillera, J.A.; Serrano-Troncoso, E. Cost-effectiveness of the mobile application TCApp combined with face-to-face CBT treatment compared to face-to-face CBT treatment alone for patients with an eating disorder: Study protocol of a multi-centre randomised controlled trial. *BMC Psychiatry* **2018**, *18*, 118. [CrossRef]
72. Oladeru, O.T.; Eber, G.; McClelland, S., III. Should patients who are incarcerated on death row receive palliative cancer care? *Lancet Oncol.* **2020**, *21*, 337–338. [CrossRef]
73. Lwin, M.O.; Lu, J.; Sheldenkar, A.; Schulz, P.J.; Shin, W.; Gupta, R.; Yang, Y. Global sentiments surrounding the COVID-19 pandemic on Twitter: Analysis of Twitter trends. *JMIR Public Health Surveill.* **2020**, *6*, e19447. [CrossRef]
74. Seltzer, E.K.; Jean, N.; Kramer-Golinkoff, E.; Asch, D.A.; Merchant, R. The content of social media's shared images about Ebola: A retrospective study. *Public Health* **2015**, *129*, 1273–1277. [CrossRef]
75. Gui, X.; Wang, Y.; Kou, Y.; Reynolds, T.L.; Chen, Y.; Mei, Q.; Zheng, K. Understanding the patterns of health information dissemination on social media during the Zika outbreak. *AMIA Annu. Symp. Proc.* **2017**, *2017*, 820–829. [PubMed]
76. Gu, H.; Chen, B.; Zhu, H.; Jiang, T.; Wang, X.; Chen, L.; Jiang, Z.; Zheng, D.; Jiang, J. Importance of Internet surveillance in public health emergency control and prevention: Evidence from a digital epidemiologic study during avian influenza A H7N9 outbreaks. *J. Med. Internet Res.* **2014**, *16*, e2911. [CrossRef] [PubMed]
77. Lwin, M.O.; Jayasundar, K.; Sheldenkar, A.; Wijayamuni, R.; Wimalaratne, P.; Ernst, K.C.; Foo, S. Lessons from the implementation of Mo-Buzz, a mobile pandemic surveillance system for dengue. *JMIR Public Health Surveill.* **2017**, *3*, e7376. [CrossRef] [PubMed]
78. Fung, I.C.-H.; Fu, K.-W.; Ying, Y.; Schaible, B.; Hao, Y.; Chan, C.-H.; Tse, Z.T.-H. Chinese social media reaction to the MERS-CoV and avian influenza A (H7N9) outbreaks. *Infect. Dis. Poverty* **2013**, *2*, 31. [CrossRef] [PubMed]
79. Ginossar, T.; Cruickshank, I.J.; Zheleva, E.; Sulskis, J.; Berger-Wolf, T. Cross-platform spread: Vaccine-related content, sources, and conspiracy theories in YouTube videos shared in early Twitter COVID-19 conversations. *Hum. Vaccines Immunother.* **2022**, *18*, 1–13. [CrossRef]
80. Thijssen, M.; Devos, T.; Ejtahed, H.-S.; Amini-Bavil-Olyaee, S.; Pourfathollah, A.A.; Pourkarim, M.R. Convalescent plasma against COVID-19: A broad-spectrum therapeutic approach for emerging infectious diseases. *Microorganisms* **2020**, *8*, 1733.
81. Halim, D.A.; Kurniawan, A.; Agung, F.H.; Angelina, S.; Jodhinata, C.; Winata, S.; Wijovi, F.; Agatha, C.M. Understanding of Young People About COVID-19 During Early Outbreak in Indonesia. *Asia-Pac. J. Public Health* **2020**, *32*, 363–365. [CrossRef]
82. Yousuf, H.; Corbin, J.; Sweep, G.; Hofstra, M.; Scherder, E.; Van Gorp, E.; Zwetsloot, P.P.; Zhao, J.; Van Rossum, B.; Jiang, T. Association of a public health campaign about coronavirus disease 2019 promoted by news media and a social influencer with self-reported personal hygiene and physical distancing in the Netherlands. *JAMA Netw. Open* **2020**, *3*, e2014323. [CrossRef]
83. Stechemesser, A.; Wenz, L.; Levermann, A. Corona crisis fuels racially profiled hate in social media networks. *EClinicalMedicine* **2020**, *23*, 100372. [CrossRef]
84. Yadav, S.K.; Yadav, N. Continuity of cancer care in the era of COVID-19 pandemic: Role of social media in low-and middle-income countries. *World J. Clin. Cases* **2021**, *9*, 291. [CrossRef]

85. Li, H.; Zheng, S.; Da Li, D.J.; Liu, F.; Guo, W.; Zhao, Z.; Zhou, Y.; Liu, J.; Zhao, R. The Establishment and Practice of Pharmacy Care Service Based on Internet Social Media: Telemedicine in Response to the COVID-19 Pandemic. *Front. Pharmacol.* **2021**, *12*, 707442. [CrossRef] [PubMed]
86. Pulido, C.M.; Ruiz-Eugenio, L.; Redondo-Sama, G.; Villarejo-Carballido, B. A New Application of Social Impact in Social Media for Overcoming Fake News in Health. *Int. J. Environ. Res. Public Health* **2020**, *17*, 2430. [CrossRef] [PubMed]
87. Constantinou, M.; Kagialis, A.; Karekla, M. COVID-19 scientific facts vs. Conspiracy theories: Is science failing to pass its message? *Int. J. Environ. Res. Public Health* **2021**, *18*, 6343. [CrossRef] [PubMed]
88. Shahsavari, S.; Holur, P.; Wang, T.; Tangherlini, T.R.; Roychowdhury, V. Conspiracy in the time of corona: Automatic detection of emerging COVID-19 conspiracy theories in social media and the news. *J. Comput. Soc. Sci.* **2020**, *3*, 279–317. [CrossRef]
89. Siegler, A.J.; Luisi, N.; Hall, E.W.; Bradley, H.; Sanchez, T.; Lopman, B.A.; Sullivan, P.S. Trajectory of COVID-19 Vaccine Hesitancy Over Time and Association of Initial Vaccine Hesitancy with Subsequent Vaccination. *JAMA Netw. Open* **2021**, *4*, e2126882. [CrossRef]
90. Clark, S.E.; Bledsoe, M.C.; Harrison, C.J. The role of social media in promoting vaccine hesitancy. *Curr. Opin. Pediatrics* **2022**, *34*, 156–162. [CrossRef]
91. Blane, J.T.; Bellutta, D.; Carley, K.M. Social-Cyber Maneuvers During the COVID-19 Vaccine Initial Rollout: Content Analysis of Tweets. *J. Med. Internet Res.* **2022**, *24*, e34040. [CrossRef]
92. Keelan, J.; Pavri-Garcia, V.; Tomlinson, G.; Wilson, K. YouTube as a source of information on immunization: A content analysis. *Jama* **2007**, *298*, 2482–2484. [CrossRef]
93. Bonnevie, E.; Goldbarg, J.; Gallegos-Jeffrey, A.K.; Rosenberg, S.D.; Wartella, E.; Smyser, J. Content themes and influential voices within vaccine opposition on Twitter, 2019. *Am. J. Public Health* **2020**, *110*, S326–S330. [CrossRef]
94. Hoffman, B.L.; Felter, E.M.; Chu, K.-H.; Shensa, A.; Hermann, C.; Wolynn, T.; Williams, D.; Primack, B.A. It's not all about autism: The emerging landscape of anti-vaccination sentiment on Facebook. *Vaccine* **2019**, *37*, 2216–2223. [CrossRef]
95. Bonnevie, E.; Smith, S.M.; Kummeth, C.; Goldbarg, J.; Smyser, J. Social media influencers can be used to deliver positive information about the flu vaccine: Findings from a multi-year study. *Health Educ. Res.* **2021**, *36*, 286–294. [CrossRef] [PubMed]
96. Kalichman, S.C.; Eaton, L.A.; Earnshaw, V.A.; Brousseau, N. Faster than warp speed: Early attention to COVD-19 by anti-vaccine groups on Facebook. *J. Public Health* **2022**, *44*, e96–e105. [CrossRef] [PubMed]
97. Hou, Z.; Tong, Y.; Du, F.; Lu, L.; Zhao, S.; Yu, K.; Piatek, S.J.; Larson, H.J.; Lin, L. Assessing COVID-19 vaccine hesitancy, confidence, and public engagement: A global social listening study. *J. Med. Internet Res.* **2021**, *23*, e27632. [CrossRef] [PubMed]
98. Jamison, A.M.; Broniatowski, D.A.; Dredze, M.; Sangraula, A.; Smith, M.C.; Quinn, S.C. Not just conspiracy theories: Vaccine opponents and proponents add to the COVID-19 'infodemic'on Twitter. *Harv. Kennedy Sch. Misinform. Rev.* **2020**, *1*. [CrossRef]
99. Donzelli, G.; Palomba, G.; Federigi, I.; Aquino, F.; Cioni, L.; Verani, M.; Carducci, A.; Lopalco, P. Misinformation on vaccination: A quantitative analysis of YouTube videos. *Hum. Vaccines Immunother.* **2018**, *14*, 1654–1659. [CrossRef] [PubMed]
100. Espinosa, L.; Wijermans, A.; Orchard, F.; Höhle, M.; Czernichow, T.; Coletti, P.; Hermans, L.; Faes, C.; Kissling, E.; Mollet, T. Epitweetr: Early warning of public health threats using Twitter data. *SSRN* **2021**, *397*, 3811673. [CrossRef]
101. Leonard, N.R.; Casarjian, B.; Fletcher, R.R.; Prata, C.; Sherpa, D.; Kelemen, A.; Rajan, S.; Salaam, R.; Cleland, C.M.; Gwadz, M.V. Theoretically-based emotion regulation strategies using a mobile app and wearable sensor among homeless adolescent mothers: Acceptability and feasibility study. *JMIR Pediatrics Parent.* **2018**, *1*, e9037. [CrossRef]
102. Ming, L.C.; Untong, N.; Aliudin, N.A.; Osili, N.; Kifli, N.; Tan, C.S.; Goh, K.W.; Ng, P.W.; Al-Worafi, Y.M.; Lee, K.S. Mobile health apps on COVID-19 launched in the early days of the pandemic: Content analysis and review. *JMIR mHealth uHealth* **2020**, *8*, e19796. [CrossRef]
103. Lattie, E.G.; Cohen, K.A.; Hersch, E.; Williams, K.D.; Kruzan, K.P.; MacIver, C.; Hermes, J.; Maddi, K.; Kwasny, M.; Mohr, D.C. Uptake and effectiveness of a self-guided mobile app platform for college student mental health. *Internet Interv.* **2022**, *27*, 100493. [CrossRef]
104. Davalbhakta, S.; Advani, S.; Kumar, S.; Agarwal, V.; Bhoyar, S.; Fedirko, E.; Misra, D.; Goel, A.; Gupta, L.; Agarwal, V. A systematic review of the smartphone applications available for coronavirus disease 2019 (COVID19) and their assessment using the mobile app rating scale (MARS). *medRxiv* **2020**. [CrossRef]
105. Huang, Z.; Guo, H.; Lim, H.Y.-F.; Chow, A. Determinants of the acceptance and adoption of a digital contact tracing tool during the COVID-19 pandemic in Singapore. *Epidemiol. Infect.* **2022**, *150*, e54. [CrossRef] [PubMed]
106. Tsvyatkova, D.; Buckley, J.; Beecham, S.; Chochlov, M.; O'Keeffe, I.R.; Razzaq, A.; Rekanar, K.; Richardson, I.; Welsh, T.; Storni, C. Digital Contact Tracing Apps for COVID-19: Development of a Citizen-Centered Evaluation Framework. *JMIR mHealth uHealth* **2022**, *10*, e30691. [CrossRef] [PubMed]
107. Majeed, M.T.; Khan, F.N. Do information and communication technologies (ICTs) contribute to health outcomes? An empirical analysis. *Qual. Quant.* **2019**, *53*, 183–206. [CrossRef]
108. Becker, E.R.; Shegog, R.; Savas, L.S.; Frost, E.L.; Coan, S.P.; Healy, C.M.; Spinner, S.W.; Vernon, S.W. Parents' Experience with a Mobile Health Intervention to Influence Human Papillomavirus Vaccination Decision Making: Mixed Methods Study. *JMIR Pediatrics Parent.* **2022**, *5*, e30340. [CrossRef]
109. Muñoz-Ramírez, S.; Escribano-López, B.; Rodrigo-Casares, V.; Vergara-Hernández, C.; Gil-Mary, D.; Sorribes-Monrabal, I.; Garcés-Sánchez, M.; Muñoz-Del-Barrio, M.-J.; Albors-Fernández, A.-M.; Úbeda-Sansano, M.-I. Feasibility of a hybrid clinical trial for respiratory virus detection in toddlers during the influenza season. *BMC Med. Res. Methodol.* **2021**, *21*, 273. [CrossRef]

110. Antonelli, M.; Penfold, R.S.; Merino, J.; Sudre, C.H.; Molteni, E.; Berry, S.; Canas, L.S.; Graham, M.S.; Klaser, K.; Modat, M. Risk factors and disease profile of post-vaccination SARS-CoV-2 infection in UK users of the COVID Symptom Study app: A prospective, community-based, nested, case-control study. *Lancet Infect. Dis.* **2022**, *22*, 43–55. [CrossRef]
111. Fahy, N.; Williams, G.A. *Use of Digital Health Tools in Europe: Before, during and after COVID-19*; European Observatory on Health Systems and Policies: Copenhagen, Denmark, 2021.
112. Arias-Oliva, M.; Pelegrín-Borondo, J.; Almahameed, A.A.; Andrés-Sánchez, J.d. Ethical Attitudes toward COVID-19 Passports: Evidences from Spain. *Int. J. Environ. Res. Public Health* **2021**, *18*, 13098. [CrossRef]
113. Morley, J.; Cowls, J.; Taddeo, M.; Floridi, L. *Ethical Guidelines for COVID-19 Tracing Apps*; Nature Publishing Group: Berlin, Germany, 2020.
114. Bengio, Y.; Ippolito, D.; Janda, R.; Jarvie, M.; Prud'homme, B.; Rousseau, J.-F.; Sharma, A.; Yu, Y.W. Inherent privacy limitations of decentralized contact tracing apps. *J. Am. Med. Inform. Assoc.* **2020**, *28*, 193–195. [CrossRef]
115. Vandamme, A.-M.; Nguyen, T. Belgium–concerns about coronavirus contact-tracing apps. *Nature* **2020**, *581*, 384–385. [CrossRef]
116. Godinho, M.A.; Martins, H.; Al-Shorbaji, N.; Quintana, Y.; Liaw, S.-T. "Digital Health Diplomacy" in Global Digital Health? A call for critique and discourse. *J. Am. Med. Inform. Assoc.* **2021**, *29*, 1019–1024. [CrossRef]
117. Zeng, K.; Bernardo, S.N.; Havins, W.E. The use of digital tools to mitigate the COVID-19 pandemic: Comparative retrospective study of six countries. *JMIR Public Health Surveill.* **2020**, *6*, e24598. [CrossRef] [PubMed]
118. Grande, D.; Mitra, N.; Marti, X.L.; Merchant, R.; Asch, D.; Dolan, A.; Sharma, M.; Cannuscio, C. Consumer views on using digital data for COVID-19 control in the United States. *JAMA Netw. Open* **2021**, *4*, e2110918. [CrossRef] [PubMed]
119. Khan, M.L.; Malik, A.; Ruhi, U.; Al-Busaidi, A. Conflicting attitudes: Analyzing social media data to understand the early discourse on COVID-19 passports. *Technol. Soc.* **2022**, *68*, 101830. [CrossRef] [PubMed]
120. Ye, G.; Hudders, L.; De Jans, S.; De Veirman, M. The value of influencer marketing for business: A bibliometric analysis and managerial implications. *J. Advert.* **2021**, *50*, 160–178. [CrossRef]
121. Childers, C.C.; Lemon, L.L.; Hoy, M.G. #Sponsored# Ad: Agency perspective on influencer marketing campaigns. *J. Curr. Issues Res. Advert.* **2019**, *40*, 258–274.
122. Glucksman, M. The rise of social media influencer marketing on lifestyle branding: A case study of Lucie Fink. *Elon J. Undergrad. Res. Commun.* **2017**, *8*, 77–87.
123. Lou, C.; Yuan, S. Influencer marketing: How message value and credibility affect consumer trust of branded content on social media. *J. Interact. Advert.* **2019**, *19*, 58–73. [CrossRef]
124. Gough, A.; Hunter, R.F.; Ajao, O.; Jurek, A.; McKeown, G.; Hong, J.; Barrett, E.; Ferguson, M.; McElwee, G.; McCarthy, M. Tweet for behavior change: Using social media for the dissemination of public health messages. *JMIR Public Health Surveill.* **2017**, *3*, e6313. [CrossRef]
125. Byrne, E.; Kearney, J.; MacEvilly, C. The role of influencer marketing and social influencers in public health. *Proc. Nutr. Soc.* **2017**, *76*, E103. [CrossRef]
126. Navarro, M.A.; O'Brien, E.K.; Ganz, O.; Hoffman, L. Influencer prevalence and role on cigar brand Instagram pages. *Tob. Control.* **2021**, *30*, e33–e36. [CrossRef]
127. La Fauci, V.; Mondello, S.; Squeri, R.; Alessi, V.; Genovese, C.; Laudani, N.; Cattaruzza, M. Family, lifestyles and new and old type of smoking in young adults: Insights from an italian multiple-center study. *Ann Ig* **2021**, *33*, 131–140. [PubMed]
128. Ortiz, R.R.; Smith, A.; Coyne-Beasley, T. A systematic literature review to examine the potential for social media to impact HPV vaccine uptake and awareness, knowledge, and attitudes about HPV and HPV vaccination. *Hum. Vaccines Immunother.* **2019**, *15*, 1465–1475. [CrossRef] [PubMed]
129. Chen, F.; Stevens, R. Applying lessons from behavioral economics to increase flu vaccination rates. *Health Promot. Int.* **2017**, *32*, 1067–1073. [CrossRef] [PubMed]
130. Priebe Rocha, L.; Soares, C.; McGregor, A.; Chen, S.; Kaplan, A.; Rose, R.R.; Galvão, H.; Siqueira, C.E.; Allen, J.D. Understanding health priorities, behaviors, and service utilization among Brazilian immigrant women: Implications for designing community-based interventions. *J. Racial Ethn. Health Disparities* **2022**, *9*, 135–145. [CrossRef]
131. Hong, Y.A.; Yee, S.; Bagchi, P.; Juon, H.-S.; Kim, S.C.; Le, D. Social media-based intervention to promote HBV screening and liver cancer prevention among Korean Americans: Results of a pilot study. *Digit. Health* **2022**, *8*, 20552076221076257. [CrossRef]
132. Massaro, M.; Tamburro, P.; La Torre, M.; Dal Mas, F.; Thomas, R.; Cobianchi, L.; Barach, P. Non-pharmaceutical interventions and the infodemic on Twitter: Lessons learned from Italy during the COVID-19 Pandemic. *J. Med. Syst.* **2021**, *45*, 50. [CrossRef]
133. Arora, S.; Bø, B.; Tjoflåt, I.; Eslen-Ziya, H. Immigrants in Norway: Resilience, challenges and vulnerabilities in times of COVID-19. *J. Migr. Health* **2022**, *5*, 100089. [CrossRef]
134. Xu, L.; Tang, F.; Chen, Y.; Dong, X. Acculturation and depressive symptoms among older Chinese immigrants in the United States: The roles of positive and negative social interactions. *Aging Ment. Health* **2022**, *26*, 1–8. [CrossRef]
135. Zhou, X.; Yap, P.; Tanner, M.; Bergquist, R.; Utzinger, J.; Zhou, X.-N. Surveillance and response systems for elimination of tropical diseases: Summary of a thematic series in infectious diseases of poverty. *Infect. Dis. Poverty* **2016**, *5*, 9–15. [CrossRef]
136. Henderson, D.A. The eradication of smallpox–an overview of the past, present, and future. *Vaccine* **2011**, *29*, D7–D9. [CrossRef]
137. Hasso-Agopsowicz, M.; Crowcroft, N.; Biellik, R.; Gregory, C.J.; Menozzi-Arnaud, M.; Amorij, J.-P.; Gilbert, P.-A.; Earle, K.; Frivold, C.; Jarrahian, C. Accelerating the Development of Measles and Rubella Microarray Patches to Eliminate Measles and Rubella: Recent Progress, Remaining Challenges. *Front. Public Health* **2022**, *10*, 809675. [CrossRef] [PubMed]

138. De La Santé, O.M.; World Health Organization. Malaria vaccine: WHO position paper–March 2022–Rapport mensuel des cas de dracunculose, janvier 2022. *Wkly. Epidemiol. Rec. Relev. Épidémiol. Hebd.* **2022**, *97*, 60–78.
139. Vorsters, A.; Bosch, F.X.; Poljak, M.; Stanley, M.; Garland, S.M.; HPV Prevention and Control Board and the International Papillomavirus Society. HPV prevention and control–The way forward (1490 words, 1500 limit). *Prev. Med.* **2022**, *156*, 106960. [CrossRef] [PubMed]
140. Malik, G.F.; Zakaria, N.; Majeed, M.I.; Ismail, F.W. Viral Hepatitis-The Road Traveled and the Journey Remaining. *Hepatic Med. Evid. Res.* **2022**, *14*, 13.
141. Pourkarim, M.R.; Amini-Bavil-Olyaee, S.; Kurbanov, F.; Van Ranst, M.; Tacke, F. Molecular identification of hepatitis B virus genotypes/subgenotypes: Revised classification hurdles and updated resolutions. *World J. Gastroenterol. WJG* **2014**, *20*, 7152. [CrossRef] [PubMed]
142. Rezaee-Zavareh, M.S.; Hesamizadeh, K.; Behnava, B.; Alavian, S.M.; Gholami-Fesharaki, M.; Sharafi, H. Combination of ledipasvir and sofosbuvir for treatment of hepatitis C virus genotype 1 infection: Systematic review and meta-analysis. *Ann. Hepatol.* **2017**, *16*, 188–197. [CrossRef] [PubMed]
143. Sharafi, H.; Alavian, S.M. The rising threat of hepatocellular carcinoma in the Middle East and North Africa region: Results from Global Burden of Disease Study 2017. *Clin. Liver Dis.* **2019**, *14*, 219. [CrossRef]
144. Sonderup, M.W.; Spearman, C.W. Global Disparities in Hepatitis B Elimination—A Focus on Africa. *Viruses* **2022**, *14*, 82. [CrossRef]
145. Pourkarim, M.R.; Thijssen, M.; Alavian, S.M.; Van Ranst, M. Natural disasters pose a challenge for hepatitis elimination in Iran. *Lancet Gastroenterol. Hepatol.* **2019**, *4*, 581–582. [CrossRef]
146. Zangiabadian, M.; Zamani, A.; Nasiri, M.J.; Behzadi, E.; Fooladi, A.A.I. Diagnostic Accuracy and Validity of Serological and Molecular Tests for Hepatitis B and C. *Curr. Pharm. Biotechnol.* **2022**, *23*, 803–817. [CrossRef]
147. Cuypers, L.; Thijssen, M.; Shakibzadeh, A.; Sabahi, F.; Ravanshad, M.; Pourkarim, M.R. Next-generation sequencing for the clinical management of hepatitis C virus infections: Does one test fits all purposes? *Crit. Rev. Clin. Lab. Sci.* **2019**, *56*, 420–434. [CrossRef] [PubMed]
148. Cuypers, L.; Thijssen, M.; Shakibzadeh, A.; Deboutte, W.; Sarvari, J.; Sabahi, F.; Ravanshad, M.; Pourkarim, M.R. Signature of natural resistance in NS3 protease revealed by deep sequencing of HCV strains circulating in Iran. *Infect. Genet. Evol.* **2019**, *75*, 103966. [CrossRef] [PubMed]
149. Pourkarim, M.R.; Vergote, V.; Amini-Bavil-Olyaee, S.; Sharifi, Z.; Sijmons, S.; Lemey, P.; Maes, P.; Alavian, S.M.; Van Ranst, M. Molecular characterization of hepatitis B virus (HBV) strains circulating in the northern coast of the Persian Gulf and its comparison with worldwide distribution of HBV subgenotype D1. *J. Med. Virol.* **2014**, *86*, 745–757. [CrossRef] [PubMed]
150. Fakhr, A.E.; Pourkarim, M.R.; Maes, P.; Atta, A.H.; Marei, A.; Azab, M.; Van Ranst, M. Hepatitis C virus NS5B sequence-based genotyping analysis of patients from the Sharkia Governorate, Egypt. *Hepat. Mon.* **2013**, *13*, e12706.
151. Trovão, N.S.; Thijssen, M.; Vrancken, B.; Pineda-Peña, A.-C.; Mina, T.; Amini-Bavil-Olyaee, S.; Lemey, P.; Baele, G.; Pourkarim, M.R. Reconstruction of the Origin and Dispersal of the Worldwide Dominant Hepatitis B Virus Subgenotype D1. *Virus Evol.* **2022**, *8*, veac028. [CrossRef]
152. Mina, T.; Amini-Bavil-Olyaee, S.; Shirvani-Dastgerdi, E.; Trovao, N.S.; Van Ranst, M.; Pourkarim, M.R. 15year fulminant hepatitis B follow-up in Belgium: Viral evolution and signature of demographic change. *Infect. Genet. Evol. J. Mol. Epidemiol. Evol. Genet. Infect. Dis.* **2017**, *49*, 221–225. [CrossRef]
153. Mina, T.; Amini Bavil Olyaee, S.; Tacke, F.; Maes, P.; Van Ranst, M.; Pourkarim, M.R. Genomic Diversity of Hepatitis B Virus Infection Associated with Fulminant Hepatitis B Development. *Hepat. Mon.* **2015**, *15*, e29477. [CrossRef]
154. Amini-Bavil-Olyaee, S.; Pourkarim, M.; Schaefer, S.; Mahboudi, F.; Van Ranst, M.; Adeli, A.; Trautwein, C.; Tacke, F. Single-step real-time PCR to quantify hepatitis B virus and distinguish genotype D from non-D genotypes. *J. Viral Hepat.* **2011**, *18*, 300–304. [CrossRef]
155. Zhang, M.; Li, G.; Shang, J.; Pan, C.; Zhang, M.; Yin, Z.; Xie, Q.; Peng, Y.; Mao, Q.; Xiao, X. Rapidly decreased HBV RNA predicts responses of pegylated interferons in HBeAg-positive patients: A longitudinal cohort study. *Hepatol. Int.* **2020**, *14*, 212–224. [CrossRef]
156. Pourkarim, M.R.; Ranst, M.V. Guidelines for the detection of a common source of hepatitis B virus infections. *Hepat. Mon.* **2011**, *11*, 783–785.
157. Amini-Bavil-Olyaee, S.; Maes, P.; Van Ranst, M.; Pourkarim, M.R. Providing strong evidence of nosocomial outbreak of hepatitis B virus infection. *J. Hosp. Infect.* **2012**, *80*, 269–270. [CrossRef] [PubMed]
158. World Health Organization. *Global Health Sector Strategy on Viral Hepatitis 2016–2021. Towards Ending Viral Hepatitis*; World Health Organization: Geneva, Switzerland, 2016.
159. World Health Organization. *Combating hepatitis B and C to reach elimination by 2030. 2016*; World Health Organization: Geneva, Switzerland, 2020.
160. Thijssen, M.; Lemey, P.; Amini-Bavil-Olyaee, S.; Dellicour, S.; Alavian, S.M.; Tacke, F.; Verslype, C.; Nevens, F.; Pourkarim, M.R. Mass migration to Europe: An opportunity for elimination of hepatitis B virus? *Lancet Gastroenterol. Hepatol.* **2019**, *4*, 315–323. [CrossRef]
161. Pourkarim, M.R.; Razavi, H.; Lemey, P.; Van Ranst, M. Iran's hepatitis elimination programme is under threat. *Lancet* **2018**, *392*, 1009. [CrossRef]

162. Collaborators, P.O.; Razavi, H.; Blach, S.; Razavi-Shearer, D.; Abaalkhail, F.; Abbas, Z.; Abdallah, A.; Abrao Ferreira, P.; Abu Raddad, L.J.; Adda, D. The case for simplifying and using absolute targets for viral hepatitis elimination goals. *J. Viral Hepat.* **2021**, *28*, 12–19. [CrossRef] [PubMed]
163. Haering, C.; McMahon, B.; Harris, A.; Weis, N.; Lundberg Ederth, J.; Axelsson, M.; Olafsson, S.; Osiowy, C.; Tomas, K.; Bollerup, S. Hepatitis B virus elimination status and strategies in circumpolar countries, 2020. *Int. J. Circumpolar Health* **2021**, *80*, 1986975. [CrossRef] [PubMed]
164. De Villiers, M.J.; Nayagam, S.; Hallett, T.B. The impact of the timely birth dose vaccine on the global elimination of hepatitis B. *Nat. Commun.* **2021**, *12*, 6223. [CrossRef]
165. Artenie, A.; Luhmann, N.; Lim, A.G.; Fraser, H.; Ward, Z.; Stone, J.; MacGregor, L.; Walker, J.G.; Trickey, A.; Marquez, L.K. Methods and indicators to validate country reductions in incidence of hepatitis C virus infection to elimination levels set by WHO. *Lancet Gastroenterol. Hepatol.* **2022**, *7*, 353–366. [CrossRef]
166. Lazarus, J.V.; Wiktor, S.; Colombo, M.; Thursz, M. Micro-elimination–A path to global elimination of hepatitis C. *J. Hepatol.* **2017**, *67*, 665–666. [CrossRef]
167. Ólafsson, S.; Tyrfingsson, T.; Rúnarsdóttir, V.; Bergmann, O.; Hansdóttir, I.; Björnsson, E.S.; Johannsson, B.; Sigurdardottir, B.; Fridriksdottir, R.; Löve, A. Treatment as Prevention for Hepatitis C (TraP Hep C)–a nationwide elimination programme in Iceland using direct-acting antiviral agents. *J. Intern. Med.* **2018**, *283*, 500–507. [CrossRef]
168. Whitelaw, S.; Mamas, M.A.; Topol, E.; Van Spall, H.G. Applications of digital technology in COVID-19 pandemic planning and response. *Lancet Digit. Health* **2020**, *2*, e435–e440. [CrossRef]
169. Thijssen, M.; Van Ranst, M.; Pourkarim, M.R. *Elimination of Viral Hepatitis and an Update on Blood Safety Technology*; Kowsar: Heerlen, The Netherlands, 2018; Volume 18.
170. Harjai, K.J.; Agarwal, S.; Bauch, T.; Bernardi, M.; Casale, A.S.; Green, S.; Harostock, M.; Ierovante, N.; Mascarenhas, V.; Matsumura, M. Coronary and structural heart disease interventions during COVID-19 pandemic: A road map for clinicians and health care delivery systems. *Cardiovasc. Revascularization Med.* **2020**, *21*, 939–945. [CrossRef] [PubMed]
171. Zhang, H.; Shaw, R. Identifying research trends and gaps in the context of COVID-19. *Int. J. Environ. Res. Public Health* **2020**, *17*, 3370. [CrossRef] [PubMed]
172. Chuaypen, N.; Khlaiphuengsin, A.; Prasoppokakorn, T.; Susantitaphong, P.; Prasithsirikul, W.; Avihingsanon, A.; Tangkijvanich, P.; Praditpornsilpa, K. Prevalence and genotype distribution of hepatitis C virus within hemodialysis units in Thailand: Role of HCV core antigen in the assessment of viremia. *BMC Infect. Dis.* **2022**, *22*, 79. [CrossRef] [PubMed]
173. Ehelepola, N.; Wijewardana, B. An episode of transmission of COVID-19 from a vaccinated healthcare worker to co-workers. *Infect. Dis.* **2021**, *54*, 297–302. [CrossRef]
174. Ai, J.; Zhang, H.; Zhang, Y.; Lin, K.; Zhang, Y.; Wu, J.; Wan, Y.; Huang, Y.; Song, J.; Fu, Z. Omicron variant showed lower neutralizing sensitivity than other SARS-CoV-2 variants to immune sera elicited by vaccines after boost. *Emerg. Microbes Infect.* **2021**, *11*, 337–343. [CrossRef] [PubMed]
175. Chemaitelly, H.; Tang, P.; Hasan, M.R.; AlMukdad, S.; Yassine, H.M.; Benslimane, F.M.; Al Khatib, H.A.; Coyle, P.; Ayoub, H.H.; Al Kanaani, Z. Waning of BNT162b2 vaccine protection against SARS-CoV-2 infection in Qatar. *N. Engl. J. Med.* **2021**, *385*, e83. [CrossRef]
176. Lazarus, J.V.; Safreed-Harmon, K.; Thursz, M.R.; Dillon, J.F.; El-Sayed, M.H.; Elsharkawy, A.M.; Hatzakis, A.; Jadoul, M.; Prestileo, T.; Razavi, H. The micro-elimination approach to eliminating hepatitis C: Strategic and operational considerations. *Semin. Liver Dis.* **2018**, *38*, 181–192.
177. Schwartz, P.; Sedillo, J.L.; Sapp, J.L. Hepatitis a Vaccine Promotion Using Facebook Ads to Reach At-Risk Groups. *Am. J. Health Promot.* **2021**, *35*, 08901171211044594. [CrossRef]
178. Bentouhami, M.; Chakib, A.; El Fane, M. Hepatitis B knowledge, attitudes and practices among Moroccan college students. *Rev. D'épidémiologie St. Publique* **2019**, *67*, 397–402. [CrossRef]
179. Wong, W.C.; Yang, N.S.; Li, J.; Li, H.; Wan, E.Y.; Fitzpatrick, T.; Xiong, Y.; Seto, W.-K.; Chan, P.; Liu, R. Crowdsourcing to promote hepatitis C testing and linkage-to-care in China: A randomized controlled trial protocol. *BMC Public Health* **2020**, *20*, 1048. [CrossRef]
180. World Health Organization. *Action Plan for the Health Sector Response to Viral Hepatitis in the WHO European Region*; World Health Organization: Geneva, Switzerland, 2017.
181. Momin, B.; Nielsen, D.; Schaff, S.; Mezzo, J.L.; Cariou, C. Promising Interventions to Prevent Liver Cancer in Idaho. *Health Promot. Pract.* **2021**, *22*, 15248399211057154. [CrossRef] [PubMed]
182. Qin, L.; Zhang, X.; Wu, A.; Miser, J.S.; Liu, Y.-L.; Hsu, J.C.; Shia, B.-C.; Ye, L. Association between Social Media Use and Cancer Screening Awareness and Behavior for People without a Cancer Diagnosis: Matched Cohort Study. *J. Med. Internet Res.* **2021**, *23*, e26395. [CrossRef] [PubMed]
183. Alber, J.M.; Cohen, C.; Nguyen, G.T.; Ghazvini, S.F.; Tolentino, B.T. Exploring communication strategies for promoting hepatitis B prevention among young Asian American adults. *J. Health Commun.* **2018**, *23*, 977–983. [CrossRef] [PubMed]
184. Nicolay, N.; Bourhis-Zaimi, L.; Lesourd, A.; Martel, M.; Roque-Afonso, A.-M.; Erouart, S.; Etienne, M.; Ndeikoundam Ngangro, N. A description of a hepatitis A outbreak in men who have sex with men and public health measures implemented in Seine-Maritime department, Normandy, France, 2017. *BMC Public Health* **2020**, *20*, 1441. [CrossRef] [PubMed]

185. Sachdeva, H.; Benusic, M.; Ota, S.; Stuart, R.; Maclachlan, J.; Dubey, V.; Andonov, A. Open Science/Open Data: Community outbreak of hepatitis A disproportionately affecting men who have sex with men in Toronto, Canada, January 2017–November 2018. *Can. Commun. Dis. Rep.* **2019**, *45*, 262. [CrossRef]
186. Roy, A.; King, C.; Gilson, R.; Richardson, D.; Burns, F.; Rodger, A.; Clark, L.; Miners, A.; Pollard, A.; Desai, S. Healthcare provider and service user perspectives on STI risk reduction interventions for young people and MSM in the UK. *Sex. Transm. Infect.* **2020**, *96*, 26–32. [CrossRef]
187. Cavazos-Rehg, P.; Grucza, R.; Krauss, M.J.; Smarsh, A.; Anako, N.; Kasson, E.; Kaiser, N.; Sansone, S.; Winograd, R.; Bierut, L.J. Utilizing social media to explore overdose and HIV/HCV risk behaviors among current opioid misusers. *Drug Alcohol Depend.* **2019**, *205*, 107690. [CrossRef]
188. Baker, L.S.; Smith, W.; Gulley, T.; Tomann, M.M. Community perceptions of comprehensive harm reduction programs and stigma towards people who inject drugs in rural Virginia. *J. Community Health* **2020**, *45*, 239–244. [CrossRef]
189. Seehusen, D.A.; Bowman, M.A.; Neale, A.V. New tools and approaches for family physicians. *Am. Board Fam. Med.* **2015**, *28*, 689–692. [CrossRef]
190. Ortiz-Martínez, Y.; Castellanos-Mateus, S.; Rojas-Moreno, H.; Suárez-Molina, J. YouTube videos as a source of Hepatitis C-related information: A cross-sectional study. *Travel Med. Infect. Dis.* **2020**, *37*, 101708. [CrossRef]
191. Islam, J.Y.; Spees, L.; Camacho-Rivera, M.; Vidot, D.C.; Yarosh, R.; Wheldon, C.W. Disparities in awareness of hepatitis C virus among US adults: An analysis of the 2019 Health Information National Trends Survey. *Sex. Transm. Dis.* **2021**, *48*, 981–985. [CrossRef] [PubMed]
192. Robotin, M.C.; Wallace, J.; Gallego, G.; George, J. Hepatitis B and Liver Cancer: Community Awareness, Knowledge and Beliefs of Middle Eastern Migrants in Sydney, Australia. *Int. J. Environ. Res. Public Health* **2021**, *18*, 8534. [CrossRef] [PubMed]
193. Plant, A.; Snow, E.G.; Montoya, J.A.; Young, S.; Javanbakht, M.; Klausner, J.D. Test4HepC: Promoting hepatitis C testing to baby boomers using social media. *Health Promot. Pract.* **2020**, *21*, 780–790. [CrossRef] [PubMed]
194. Wilson, S.L.; Wiysonge, C. Social media and vaccine hesitancy. *BMJ Glob. Health* **2020**, *5*, e004206. [CrossRef]
195. Bar-Lev, S.; Reichman, S.; Barnett-Itzhaki, Z. Prediction of vaccine hesitancy based on social media traffic among Israeli parents using machine learning strategies. *Isr. J. Health Policy Res.* **2021**, *10*, 49. [CrossRef]
196. Becker, B.F.; Larson, H.J.; Bonhoeffer, J.; Van Mulligen, E.M.; Kors, J.A.; Sturkenboom, M.C. Evaluation of a multinational, multilingual vaccine debate on Twitter. *Vaccine* **2016**, *34*, 6166–6171. [CrossRef]
197. Sharpe, J.D.; Hopkins, R.S.; Cook, R.L.; Striley, C.W. Evaluating Google, Twitter, and Wikipedia as tools for influenza surveillance using Bayesian change point analysis: A comparative analysis. *JMIR Public Health Surveill.* **2016**, *2*, e5901. [CrossRef]
198. Qiu, R.; Hadzikadic, M.; Yu, S.; Yao, L. Estimating disease burden using Internet data. *Health Inform. J.* **2019**, *25*, 1863–1877. [CrossRef]
199. Da, B.L.; Surana, P.; Schueler, S.A.; Jalaly, N.Y.; Kamal, N.; Taneja, S.; Vittal, A.; Gilman, C.L.; Heller, T.; Koh, C. Twitter As a Noninvasive Bio-Marker for Trends in Liver Disease. *Hepatol. Commun.* **2019**, *3*, 1271–1280. [CrossRef]
200. Sommaggio, P.; Marchiori, S. Health data ethics in the time of covid-19: A legal perspective. *Humanid. Tecnol.* **2020**, *25*, 95–101.
201. Rashti, R.; Sharafi, H.; Alavian, S.M.; Moradi, Y.; Mohamadi Bolbanabad, A.; Moradi, G. Systematic Review and Meta-Analysis of Global Prevalence of HBsAg and HIV and HCV Antibodies among People Who Inject Drugs and Female Sex Workers. *Pathogens* **2020**, *9*, 432. [CrossRef]
202. Thijssen, M.; Trovão, N.S.; Mina, T.; Maes, P.; Pourkarim, M.R. Novel hepatitis B virus subgenotype A8 and quasi-subgenotype D12 in African–Belgian chronic carriers. *Int. J. Infect. Dis.* **2020**, *93*, 98–101. [CrossRef] [PubMed]
203. Cooke, G.S.; Andrieux-Meyer, I.; Applegate, T.L.; Atun, R.; Burry, J.R.; Cheinquer, H.; Dusheiko, G.; Feld, J.J.; Gore, C.; Griswold, M.G. Accelerating the elimination of viral hepatitis: A Lancet Gastroenterology & Hepatology Commission. *Lancet Gastroenterol. Hepatol.* **2019**, *4*, 135–184. [PubMed]
204. Rogers, E.M.; Storey, J.D. *Communication Campaigns*; Sage: London, UK, 1987.
205. Snyder, L.B. Health communication campaigns and their impact on behavior. *J. Nutr. Educ. Behav.* **2007**, *39*, S32–S40. [CrossRef] [PubMed]
206. Kraak, V.I.; Consavage Stanley, K.; Harrigan, P.B.; Zhou, M. How have media campaigns been used to promote and discourage healthy and unhealthy beverages in the United States? A systematic scoping review to inform future research to reduce sugary beverage health risks. *Obes. Rev.* **2022**, *23*, e13425. [CrossRef]
207. Kraak, V.I.; Consavage Stanley, K. A Systematic Scoping Review of Media Campaigns to Develop a Typology to Evaluate Their Collective Impact on Promoting Healthy Hydration Behaviors and Reducing Sugary Beverage Health Risks. *Int. J. Environ. Res. Public Health* **2021**, *18*, 1040. [CrossRef]
208. Perler, B. Thrombolytic therapies: The current state of affairs. *J. Endovasc. Ther.* **2005**, *12*, 224–232. [CrossRef]
209. Bonnevie, E.; Morales, O.; Rosenberg, S.D.; Goldbarg, J.; Silver, M.; Wartella, E.; Smyser, J. Evaluation of a campaign to reduce consumption of sugar-sweetened beverages in New Jersey. *Prev. Med.* **2020**, *136*, 106062. [CrossRef]
210. Farley, T.A.; Halper, H.S.; Carlin, A.M.; Emmerson, K.M.; Foster, K.N.; Fertig, A.R. Mass media campaign to reduce consumption of sugar-sweetened beverages in a rural area of the United States. *Am. J. Public Health* **2017**, *107*, 989–995. [CrossRef]
211. Alemany-Pagès, M.; Azul, A.M.; Ramalho-Santos, J. The use of comics to promote health awareness: A template using nonalcoholic fatty liver disease. *Eur. J. Clin. Investig.* **2022**, *52*, e13642. [CrossRef]

212. Wogu, J.O.; Chukwu, C.O.; Orekyeh, E.S.S.; Anorue, L.I.; Nwokedi, O.; Chukwu, L.C. Communicating health risk in Southeast Nigeria: The case of media campaign against viral hepatitis and its implication for health communication. *Medicine* **2019**, *98*, e15847. [CrossRef] [PubMed]
213. Moffat, R.; Sayer, A.; DeCook, K.; Cornia, A.; Linehan, M.; Torres, S.; Mulokozi, G.; Crookston, B.; Hall, C.; West, J. A National Communications Campaign to decrease childhood stunting in Tanzania: An analysis of the factors associated with exposure. *BMC Public Health* **2022**, *22*, 531. [CrossRef] [PubMed]
214. Lee, C.-J.; Pena-y-Lillo, M. A communication inequalities approach to disparities in fruit and vegetable consumption: Findings from a national survey with US adults. *Patient Educ. Couns.* **2022**, *105*, 375–382. [CrossRef] [PubMed]
215. Tsuda, K.; Yamamoto, K.; Leppold, C.; Tanimoto, T.; Kusumi, E.; Komatsu, T.; Kami, M. Trends of media coverage on human papillomavirus vaccination in Japanese newspapers. *Clin. Infect. Dis.* **2016**, *63*, ciw647.
216. de Vries, M.; Claassen, L.; Te Wierik, M.J.; Timmermans, D.R.; Timmermans, A. Dynamics in public perceptions and media coverage during an ongoing outbreak of meningococcal W disease in the Netherlands. *BMC Public Health* **2022**, *22*, 9. [CrossRef]
217. Neiger, B.L.; Thackeray, R.; Van Wagenen, S.A.; Hanson, C.L.; West, J.H.; Barnes, M.D.; Fagen, M.C. Use of social media in health promotion: Purposes, key performance indicators, and evaluation metrics. *Health Promot. Pract.* **2012**, *13*, 159–164. [CrossRef]
218. Silva, T.M.; Estrela, M.; Roque, V.; Gomes, E.R.; Figueiras, A.; Roque, F.; Herdeiro, M.T. Perceptions, knowledge and attitudes about COVID-19 vaccine hesitancy in older Portuguese adults. *Age Ageing* **2022**, *51*, afac013. [CrossRef]
219. Ford, K.; Bellis, M.A.; Hill, R.; Hughes, K. An evaluation of a short film promoting kindness in Wales during COVID-19 restrictions# TimeToBeKind. *BMC Public Health* **2022**, *22*, 583.
220. Colston, D.C.; Xie, Y.; Thrasher, J.F.; Patrick, M.E.; Titus, A.R.; Emery, S.; McLeod, M.C.; Elliott, M.R.; Fleischer, N.L. Examining Truth and State-Sponsored Media Campaigns as a Means of Decreasing Youth Smoking and Related Disparities in the United States. *Nicotine Tob. Res.* **2022**, *24*, 469–477. [CrossRef]
221. Vallone, D.; Cantrell, J.; Bennett, M.; Smith, A.; Rath, J.M.; Xiao, H.; Greenberg, M.; Hair, E.C. Evidence of the impact of the truth FinishIt campaign. *Nicotine Tob. Res.* **2018**, *20*, 543–551. [CrossRef]
222. Kandra, K.; McCullough, A.; Summerlin-Long, S.; Agans, R.; Ranney, L.; Goldstein, A. The evaluation of North Carolina's state-sponsored youth tobacco prevention media campaign. *Health Educ. Res.* **2013**, *28*, 1–14. [CrossRef] [PubMed]
223. Lee, S.H.; Pandya, R.K.; Hussain, J.S.; Lau, R.J.; Chambers, E.A.B.; Geng, A.; Jin, B.X.; Zhou, O.; Wu, T.; Barr, L. Perceptions of using infographics for scientific communication on social media for COVID-19 topics: A survey study. *J. Vis. Commun. Med.* **2022**, *45*, 105–133. [CrossRef] [PubMed]
224. Niederdeppe, J.; Kellogg, M.; Skurka, C.; Avery, R.J. Market-level exposure to state antismoking media campaigns and public support for tobacco control policy in the United States, 2001–2002. *Tob. Control.* **2018**, *27*, 177–184. [CrossRef] [PubMed]
225. Halkjelsvik, T. Do disgusting and fearful anti-smoking advertisements increase or decrease support for tobacco control policies? *Int. J. Drug Policy* **2014**, *25*, 744–747. [CrossRef] [PubMed]
226. Durkin, S.J.; Brennan, E.; Wakefield, M.A. *Optimising Tobacco Control Campaigns within a Changing Media Landscape and among Priority Populations*; BMJ Publishing Group Ltd.: London, UK, 2022.
227. Hamill, S.; Turk, T.; Murukutla, N.; Ghamrawy, M.; Mullin, S. I 'like'MPOWER: Using Facebook, online ads and new media to mobilise tobacco control communities in low-income and middle-income countries. *Tob. Control.* **2015**, *24*, 306–312. [CrossRef]
228. Sims, M.; Langley, T.; Lewis, S.; Richardson, S.; Szatkowski, L.; McNeill, A.; Gilmore, A.B. Effectiveness of tobacco control television advertisements with different types of emotional content on tobacco use in England, 2004–2010. *Tob. Control.* **2016**, *25*, 21–26. [CrossRef]
229. Murphy-Hoefer, R.; Davis, K.C.; Beistle, D.; King, B.A.; Duke, J.; Rodes, R.; Graffunder, C. Peer Reviewed: Impact of the Tips From Former Smokers Campaign on Population-Level Smoking Cessation, 2012–2015. *Prev. Chronic Dis.* **2018**, *15*, E71. [CrossRef]
230. Stefanone, M.; Anker, A.E.; Evans, M.; Feeley, T.H. Click to "like" organ donation: The use of online media to promote organ donor registration. *Prog. Transplant.* **2012**, *22*, 168–174. [CrossRef]
231. Carter, O.B.; Donovan, R.; Jalleh, G. Using viral e-mails to distribute tobacco control advertisements: An experimental investigation. *J. Health Commun.* **2011**, *16*, 698–707. [CrossRef]
232. Quinn, S.C.; Hilyard, K.M.; Jamison, A.M.; An, J.; Hancock, G.R.; Musa, D.; Freimuth, V.S. The influence of social norms on flu vaccination among African American and White adults. *Health Educ. Res.* **2017**, *32*, 473–486. [CrossRef]
233. Al-Marshoudi, S.; Al-Balushi, H.; Al-Wahaibi, A.; Al-Khalili, S.; Al-Maani, A.; Al-Farsi, N.; Al-Jahwari, A.; Al-Habsi, Z.; Al-Shaibi, M.; Al-Msharfi, M. Knowledge, Attitudes, and Practices (KAP) toward the COVID-19 vaccine in Oman: A pre-campaign cross-sectional study. *Vaccines* **2021**, *9*, 602. [CrossRef] [PubMed]
234. Dunlop, S.; Cotter, T.; Perez, D.; Wakefield, M. Televised antismoking advertising: Effects of level and duration of exposure. *Am. J. Public Health* **2013**, *103*, e66–e73. [CrossRef] [PubMed]
235. Biener, L.; Wakefield, M.; Shiner, C.M.; Siegel, M. How broadcast volume and emotional content affect youth recall of anti-tobacco advertising. *Am. J. Prev. Med.* **2008**, *35*, 14–19. [CrossRef] [PubMed]
236. Okada, M.; Oeda, S.; Katsuki, N.; Iwane, S.; Kawaguchi, Y.; Kawamoto, S.; Tomine, Y.; Fukuyoshi, J.; Maeyama, K.; Tanaka, H. Recommendations from primary care physicians, family, friends and work colleagues influence patients' decisions related to hepatitis screening, medical examinations and antiviral treatment. *Exp. Ther. Med.* **2020**, *19*, 2973–2982. [CrossRef]
237. Signorelli, C.; Odone, A. Four Italian experiences on vaccination policies: Results and lessons. *Ann Ig* **2019**, *31*, 36–44.

238. Jones, J.; Salazar, L.F. A review of HIV prevention studies that use social networking sites: Implications for recruitment, health promotion campaigns, and efficacy trials. *AIDS Behav.* **2016**, *20*, 2772–2781. [CrossRef]
239. Brinn, M.P.; Carson, K.V.; Esterman, A.J.; Chang, A.B.; Smith, B.J. Cochrane review: Mass media interventions for preventing smoking in young people. *Evid. Based Child Health A Cochrane Rev. J.* **2012**, *7*, 86–144. [CrossRef]
240. Allen, J.A.; Duke, J.C.; Davis, K.C.; Kim, A.E.; Nonnemaker, J.M.; Farrelly, M.C. Using mass media campaigns to reduce youth tobacco use: A review. *Am. J. Health Promot.* **2015**, *30*, e71–e82. [CrossRef]
241. Bala, M.M.; Strzeszynski, L.; Topor-Madry, R. Mass media interventions for smoking cessation in adults. *Cochrane Database Syst. Rev.* **2017**, *11*, CD004704. [CrossRef]
242. Mosdøl, A.; Lidal, I.B.; Straumann, G.H.; Vist, G.E. Targeted mass media interventions promoting healthy behaviours to reduce risk of non-communicable diseases in adult, ethnic minorities. *Cochrane Database Syst. Rev.* **2017**, *2*, CD011683. [CrossRef]
243. Wakefield, M.A.; Loken, B.; Hornik, R.C. Use of mass media campaigns to change health behaviour. *Lancet* **2010**, *376*, 1261–1271. [CrossRef]