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Chapter 6

Combating Cancer Through Public Health Practice in the United States: An In-Depth Look at the National Comprehensive Cancer Control Program

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Additional information is available at the end of the chapter

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Abstract

Cancer is the second leading cause of the death in the United States (U.S.). The National Comprehensive Cancer Control Program (NCCCP) is a national, public health practice program funded by the U.S. Centers for Disease Control and Prevention. The NCCCP has been planning and implementing interventions to reduce the burden of cancer since 1998. Interventions are implemented across three areas primary prevention, early detection, and survivorship using health systems and environmental changes to promote sustainable cancer control. The aim of this chapter is to provide a summary of the NCCCP, and highlight specific examples of interventions and successes to aid cancer planning in other countries. Cancer plan analyses show that all NCCCP participant cancer plans address reducing tobacco use for cancer prevention and 98% contain activities to increase colorectal cancer screening. The vast majority implement activities to improve the quality of life following a cancer diagnosis (94%). Relatively fewer cancer plans contain activities to reduce radon exposure (42%), promote human papilloma virus vaccination (62%), and incorporate the use of genomics in cancer control (56%). The examples of NCCCP activities demonstrate success in controlling cancer and other non-communicable diseases through public health practice.

Keywords: comprehensive cancer control, cancer plan, primary prevention, cancer screening, cancer survivorship

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1. Introduction

1.1. Cancer and public health in the United States

Cancer is a major public health concern in the United States (U.S.); it is currently the second leading cause of death among U.S. men and women after heart disease [1]. Cancer has long been a commonly diagnosed disease in the U.S. with over a million new cases diagnosed each year [2]. While age-adjusted rates of cancer have for the most part decreased in recent years, the actual number of cases diagnosed has increased and is projected to continue to increase in future years, mostly due to the aging of the U.S. population [2, 3]. Projections also suggest that cancer will soon surpass heart disease to become the overall leading cause of death in the U.S. [1]. The U.S. Centers for Disease Control and Prevention (CDC), the nation's health protection agency, administers several national programs to reduce the burden of cancer [4]. In 1992, the National Program of Cancer Registries (NPCR) was established to systematically collect information on all cancers diagnosed in the United States (NPCR registries cover 96% of the U.S. population). NPCR, in collaboration with other agencies, releases the official federal cancer statistics on an annual basis [2, 5]. In 1990, the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) was established to provide breast and cervical cancer screening and diagnostic services to low-income, under- and uninsured women who would otherwise have no access to these services [6]. From 1991 to 2012, the NBCCEDP has served more than 4.5 million women, and more than 65,000 breast and cervical cancer diagnoses occurred through the program during this time [6].

Because cancer is a group of diseases with various risk factors and outcomes, it was determined that a more broad-based and coordinated public health approach that incorporated risk reduction, early detection and post-diagnosis care may be necessary to address cancer in the U.S. As such, in 1998, CDC established the National Comprehensive Cancer Control Program (NCCCP), which provides funding to state and local health departments throughout the United States for the formation of a coalition of public health practitioners, clinicians, academicians, and other key stakeholders residing in or administering to that population [7]. This coalition uses their first-hand knowledge of the key factors and issues that their population faces with regard to cancer to develop a formal, written cancer plan which guides the cancer control activities within the area [7]. Cancer plans are updated at specified time intervals and are available along with a search tool for public use on CDC's website [8].

In addition to an increasing U.S. cancer burden, cancer is an emerging public health challenge in developing countries because of the aging and expansion of the population and increased prevalence of cancer risk factors such as smoking, obesity, and physical inactivity [9]. While global public health efforts in developing countries have traditionally centered on the prevention and treatment of communicable diseases, the global burden of disease has been changing, with approximately 70% of worldwide deaths in 2015 due to non-communicable diseases [10]. Cancer accounted for 22% of all non-communicable deaths globally in 2015, and over 75% of these deaths occurred in low and middle-income countries [10]. While the burden of cancer is substantial in all countries, high-income countries are increasingly addressing cancer rates through improvements in risk factor prevention, screening and early detection, and

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treatment. Conversely, cancer rates in many low and middle-income countries are increasing due to increases in preventable risk behaviors such as smoking, obesity, and physical inactivity [11]. The global movement for cancer control is gaining momentum. Since 2011, the World Health Organization (WHO) has called for improved agenda setting for cancer control among all member states (including low-income countries), to offset the large economic burden caused by cancer in all countries [12]. WHO cancer control strategies include planning, reduction of non-behavioral factors such as environmental and infectious risks in all countries, as well as progress in cancer treatment and effective health systems in more affluent countries [12]. **Figure 1** lists additional cancer control strategies for all countries by income level, suggested by the U.S. Institute of Medicine, the Global Task Force on Expanded Access to Cancer Care and Control in Developing Countries, and the Union for International Cancer Control [13]. The NCCCP is a long-standing example of a successful national cancer control program that incorporates these strategies. The NCCCP brings together an extremely diverse set of U.S. state, tribal, and territorial participants under one national umbrella program. As such, it serves as a rich resource for the global incorporation of cancer control measures across myriad populations with different structures and challenges. This aim of this book chapter is to provide a summary of the NCCCP, and highlight specific examples of interventions implemented and successes achieved. Our intention is to provide a snapshot of activities that have been implemented at given times over the 20-year history of the program, in order to aid other countries in their cancer control activities. The examples discussed below may also aid

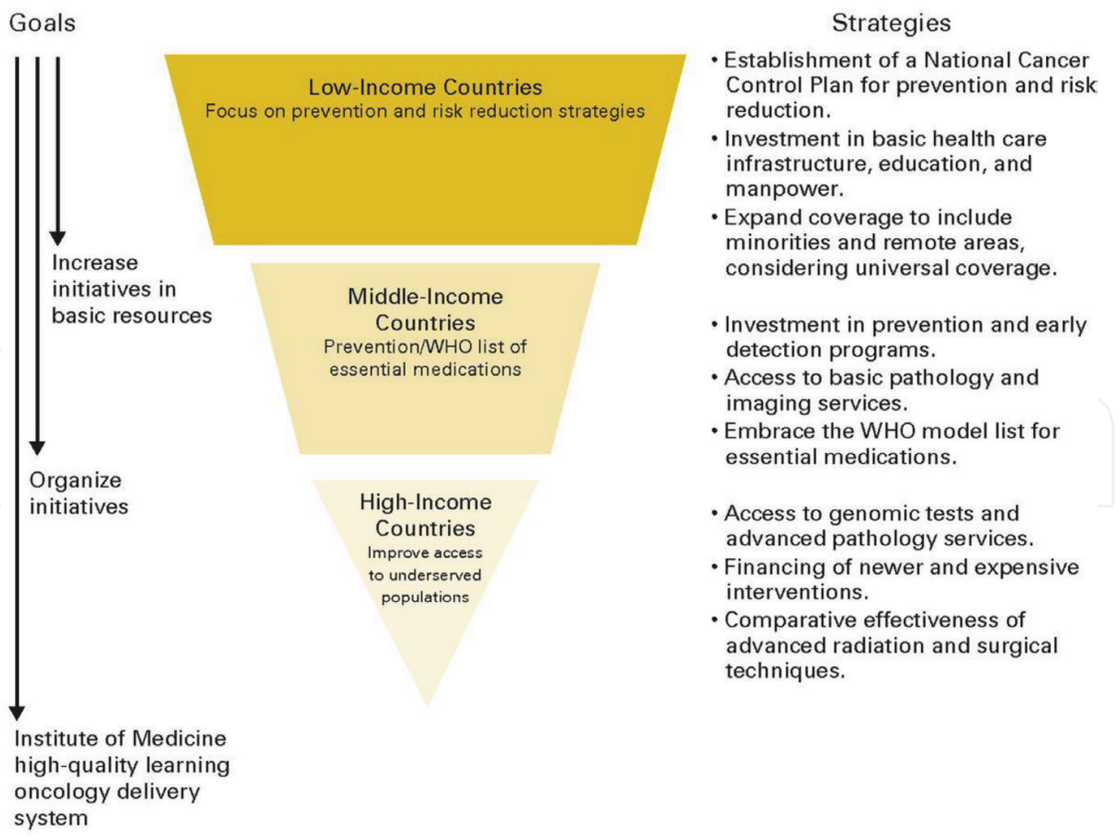


Figure 1. Global strategies for controlling cancer by income level of country. Reprinted with permission from authors and the American Society of Clinical Oncology [13].

those doing non-communicable disease planning, as many risk factors for cancer are shared with other non-communicable diseases [12].

1.2. Sources and methodology

PubMed (https://www.ncbi.nlm.nih.gov/pubmed/) was searched for the key words "comprehensive cancer control" in order to retrieve published articles pertaining to the NCCCP. Articles were limited to those published from U.S. authors and those published since 1998, the year the NCCCP was established. Article abstracts were scanned in order to determine whether the content was related to the NCCCP specifically, or to other general or broad efforts not pertaining to this CDC-funded program. All articles found to be NCCCP-specific were read for content and those that contained analyses of cancer plans or activities implemented as part of cancer planning were chosen for inclusion as an example of activities in this book chapter (see Section 3 below). In addition, CDC's main cancer website https://www.cdc.gov/cancer/ was searched for NCCCP-related content, and all content that contained activities implemented as part of cancer planning was also included in the examples section. Articles or website material retrieved that pertained solely to NCCCP development and/or evaluation were generally excluded from the examples section, but were used in some cases to describe the NCCCP (see Section 2 below). The examples provided in Section 3 do not represent a comprehensive environmental scan or systematic review of all initiatives undertaken by NCCCP participants, as only published literature found on PubMed or CDC's NCCCP website were used as sources. Many NCCCP participants have their own websites with further information that may be useful for cancer and non-communicable disease planners. NCCCP participant information is available on the CDC website [8].

2. The National Comprehensive Cancer Control Program

In 1998, the NCCCP was established and provided funding to five U.S. states and one tribal health board–Colorado, Massachusetts, Michigan, North Carolina, Texas, and the Northwest Portland Area Indian Health Board [NPAIHB]. These areas already had existing cancer plans and were in different stages of implementation [14]. The new CDC funding allowed for expansion into certain areas such as survivorship, pediatric cancers, genomics, and blood cancers [15]. It also established an avenue for providing coordinated, technical assistance from the national perspective and exchange of ideas and practices among the participants. The program quickly grew over the next few years to include 63 participants in 2005 (all 50 U.S. states, the District of Columbia, Puerto Rico, six American Indian/Alaska Native (AI/AN) tribes and tribal organizations, and six U.S. Associated Pacific Islands Jurisdictions [USAPIJ]) [14]. CDC funding specifically allowed for NCCCP participants to establish or maintain diverse cancer coalitions made up of key cancer stakeholders in each participant's area, for the coalition to determine their area's individual priorities for cancer prevention and control in a formal cancer plan, and to establish an ongoing infrastructure to implement priorities contained within the cancer plan [10]. As of 2005, more than half of the 63 NCCCP participants were receiving funding solely to build capacity and infrastructure, while the more advanced participants

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were receiving funding to implement specific cancer control activities [14]. Also in 2005, CDC began offering additional funding on a competitive basis to NCCCP participants to implement specific activities related to ovarian, prostate, skin, colorectal cancer. As of 2018, the NCCCP has 66 funded participants: all 50 states, the District of Columbia, Puerto Rico, eight AI/AN tribes or tribal organizations, and six USAPIJ. There is a great deal of diversity among each of these funded entities in terms of cancer burden, racial and ethnic structure, levels of income inequality and poverty, and access to cancer care and services. All these factors influence the level of funding each participant receives from CDC.

Evaluation efforts at the national level in the early years of the program, including the development and fielding of a performance measurement system and cancer plan assessment tool, provided valuable information regarding technical assistance needs and improvements that could be made across all participants [16–18]. Results from surveys in 2009 and 2010 showed that a majority of programs had successfully implemented at least one community- or organization-level change strategy; however, not all programs were using only evidence-based interventions, and there were few participants linking their activities to cancer impact [19]. Recognizing that participants needed assistance in these areas, as well as in communicating their efforts, CDC developed an overarching set of strategic priorities to guide the cancer public health practice of all NCCCP participants, regardless of their unique nature and cancer burden [20]. These priorities (**Table 1**) provide a roadmap for participants to follow, while still allowing for flexibility at the participant level for development of specific strategies that work in their area. At the national level, the priorities allow for provision of standardized technical assistance and tools, a more objective and consistent way to assess participant performance, and a more uniform and systematic way to disseminate information and successes regarding programmatic activities. The priorities span the cancer continuum (primary prevention, early detection, and survivorship), and place special emphasis on addressing health disparities and inequities in each of these continuum areas [20]. The priorities also define the methodology participants are encouraged to use to address these areas, specifically the implementation of systems and environmental change approaches, and emphasize participant-level evaluation as critical part of programmatic success [20]. The priorities were released in 2010 and were readily incorporated into planning by NCCCP participants. Soon after the release of the priorities, informal assessments showed programs tended to focus on implementation activities in one priority area (for example, some participants were implementing only primary

1. Place emphasis on the primary prevention of cancer during planning and implementation to reduce risk and environmental exposures.
2. Promote the early detection of cancers for which population-based screening is recommended.
3. Address the public health needs of cancer survivors.
4. Reduce cancer disparities by planning and implementing interventions in line with priorities 1-3, but tailored for specific underserved and/or in-need populations.
5. Use systems and environmental change approaches resulting in sustainable cancer control.
6. Measure all outcomes and impact through formal evaluation.

Table 1. The National Comprehensive Cancer Control Program Priorities.

prevention strategies listed). As of 2018, all 66 NCCCP participants have demonstrated the capability to implement activities in all priority areas. Current funding agreements require that all NCCCP participants at least three interventions in each of the cancer continuum areas and at least one strategy in these areas has to be aimed at reducing cancer disparities [21]. Additionally, participants use a specific library of interventions and data indicators, compiled by CDC, as a tool to plan and implement their interventions [21].

3. Examples of National Comprehensive Cancer Control Program implementation activities and success

3.1. Evidence for initiatives and interventions

As of 2017, all NCCCP participants were required to use 60% of their funding for implementation of interventions (with the other 40% being applied to personnel and staffing costs) [21]. All NCCCP participants, regardless of their unique cancer burden, are required to implement evidence-based initiatives and interventions (EBIs) to prevent and control cancer in their population [20]. Several U.S. organizations provide resources for these interventions. The United States Preventive Services Task Force (USPSTF), an independent, volunteer panel of national experts in disease prevention and evidence-based medicine [22], synthesizes all data in a given area (e.g., cervical cancer screening), and provides evidence-based recommendations about clinical preventive services that NCCCP participants follow. CDC's Guide to Community Preventive Services (The Community Guide), the National Cancer Institute's (NCI) Research-tested Intervention Programs (RTIPs) and Using What Works: Adapting Evidence-Based Programs to Fit Your Needs, and the Cancer Control P.L.A.N.E.T. (Plan, Link, Act, Network with Evidence-based tools, co-sponsored by CDC, NCI and others [23]), all provide EBI resources and tools for NCCCP participants [20]. A 2012 survey showed that 75% of NCCCP directors from states, tribes and/or USAPIJs reported using EBIs to address cancer plan objectives [24]. Most directors had used web sites for The Community Guide (95%) and Cancer Control P.L.A.N.E.T. (75%) [24]. Brief descriptions and specific examples of the types of activities are described below, categorized by each cancer continuum-related NCCCP priority area. These implementation examples are from a variety of NCCCP participants in different settings and with different resources. More detailed information on these implementation activities can be found in the cited reference or by contacting the individual NCCCP participant [8].

3.1.1. Emphasizing the primary prevention of cancer

Primary prevention for cancer includes reducing exposure to cancer-promoting environmental influences, reduction of genetic and behavioral risk factors, and vaccination against viruses that can cause cancer [25]. Many cancer risk factors and viruses also cause other diseases, and therefore emphasizing primary prevention in NCCCP plans has a broader impact on improving health [4]. Many of the strategies and interventions in these areas are specifically recommended to reduce the global burden of cancer [9, 12].

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Implementation of activities that address behavioral risk factors is a key approach most NCCCP plans address the primary prevention of cancer. Lung cancer is the leading cause of death in the U.S. [2], and tobacco use is responsible for about 90% of lung cancer diagnoses [27]. A 2013 assessment of NCCCP cancer plans showed that all plans incorporated at least one evidence-based tobacco control strategy [26]. On average, plans included five Community Guide recommendations related to tobacco, with activities focused on supporting smoking bans and restrictions (87%), mass media campaigns combined with other interventions (81%), provider reminders and provider education (19%), and promoting reduction of client costs for cessation therapies (49%) [26]. The Arkansas Cancer Coalition (ARCC) educated local legislators and the public about the benefits of raising taxes on tobacco products, including specific information regarding the expanded health programs that tobacco tax revenue could offset in Arkansas (estimated to be nearly $180 million for Arkansas) [27]. The Cherokee Nation Comprehensive Cancer Control Program implemented the *Tobacco Tour*, which educated young members of their tribe about the dangers of tobacco use, using culturally appropriate story-telling methods [28]. The education program also included a presentation from a six-time cancer survivor and former smokeless tobacco user, who shared intimate details about his experience with tobacco-associated cancer which strongly resonated with the students [28]. Over a four-year period, the *Tobacco Tour* reached more than 4400 children and adolescents in the Cherokee Nation's 14-county Tribal Jurisdictional Service Area in Oklahoma [28].

Radon is the second leading cause of lung cancer, and the leading cause of lung cancer among non-smokers [29]. Many NCCCP participants are increasingly incorporating activities to reduce exposure to radon, a radioactive gas ubiquitously present in the lower levels of U.S. homes and buildings [29]. A 2010 review of cancer plans identified radon-related activities in 27 (42%) plans [29]. An updated review in 2017, showed that the number of NCCCP participants addressing radon had increased; nearly two-thirds of all NCCCP cancer plans contained radon-related strategies [30]. Specific examples of radon activities implemented included increasing education, promoting radon testing and remediation of houses, partnering with other national agencies that address radon, and promoting adherence to existing local statewide radon policies [29, 30]. Iowa has the highest average radon concentrations in the U.S.; the Iowa Cancer Consortium led a collaboration to increase levels of awareness, testing, and (if necessary) mitigation, and to introduce a comprehensive radon control policy in Iowa by engaging partners and stakeholders across the states. Following their multi-pronged intervention, the number of radon tests increased by 20%, and the number of mitigations completed by certified mitigators increased by 108% [31].

It was recently reported that approximately 631,000 persons per year in the United States receive a diagnosis of a cancer associated with overweight and obesity, representing 40% of all cancers diagnosed [32]. There are several evidence-based nutrition and physical activity strategies for reducing cancer risk due to obesity. A 2016 review of NCCCP cancer plans showed that nutrition and physical activity content was consistently included in all cancer plans, with 89% contained specific goals or strategies in these areas [33]. The most common strategies were related to education (71%), followed by school wellness (61%), worksite-wellness, (47%), and community physical activity (39%) [33]. Examples of strategies in plans included promoting the building of safe sidewalks and bike paths between community schools and residential

areas, promoting increased time requirement for physical activity during physical education classes in school, increasing healthy food access (farmer's markets, community gardens, etc.), and encouraging children to decrease time spent with video games and TV and to substitute physical activity [33]. Indiana's Cancer Consortium implemented a "*Complete Streets"* initiative aimed at making city streets accessible and attractive to pedestrians and cyclists as well as automobile traffic. They provided coordinated education to the public and decision makers about the importance of planned environments, and partnered with the state transportation department, street design and engineering, pedestrian, and bicycle interest groups to facilitate its implementation. The intervention increased opportunities for Indiana residents to be physically active and reduce their cancer risk [34]. The Iowa Comprehensive Cancer Control Program designed a local initiative to reduce cancers that are disproportionately higher among African-Americans in Iowa [34]. The "*Body and Soul"* program was adapted from RTIPs [35], and tailored for the Iowa population, to increase awareness of healthier choices in nutrition and exercise [34]. In the first year, Iowa worked with 2 churches to support health awareness among its members [34]. More than 1,300 African-American residents across Iowa participated in the program in one year alone, and it is currently estimated that the program has now reached approximately 9700 African-American Iowans [34].

Intense, intermittent exposure to ultraviolet (UV) light from the sun is strongly linked with melanoma, which is one of the deadliest forms of skin cancer in the U.S. [2, 36]. New Mexico, Florida, and Arizona used systems and environmental change strategies and the establishment of partnerships (adapted for their individual needs) within schools and educational community to control sun exposure among school children [36]. New Mexico provided two or more presentations per year in schools delivering specific messages to avoid the sun between 10 am and 4 pm, wear sun-protective clothing when exposed to sunlight, and use sunscreen with a sun-protection factor of 15 or higher [36]. More than 3600 students demonstrated positive behavior changes following educational presentations, including playing in the shade, wearing a hat, using sunscreen, and wearing sunglasses. [36]. Additionally, many teachers, who serve as important role models for school children, reported positive changes in their own behavior related to sun safety [36]. New Mexico also implemented 55 systems and environmental changes including modifying recess times to avoid peak UV exposure, allowing students to wear hats outside, and providing shade structures or planting trees [36]. It is estimated that a total of 56,000 school-age children, school staff and community members have been reached through these efforts in New Mexico [27]. South Dakota worked with two worksites who hired seasonal workers to work outdoors to limit UV exposure in the workplace [34]. These worksites adopted local policies to provide employees with sunscreen and lip balm, and employees were also encouraged to wear wide-brimmed hats, long sleeve shirts, lightweight full-length pants, and sunglasses, as well as work in shaded areas and avoiding peak sun hours when possible [34]. Workers (n = 450) reported an increase in their knowledge of sun safety and using some form of protective behavior; wearing wide-brimmed hats and sunglasses, and spending more time in shady areas when possible were the most commonly reported sun protection behaviors [34]. The largest positive behavioral changes were observed among white men younger than 24 or aged 45–54 [34].

Vaccination against certain viruses can prevent cancer [25]. Cervical cancer and hepatocellular (liver) cancer are strongly linked to infection with human papilloma virus (HPV) and hepatitis

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B virus (HBV), respectively [25]. Routine vaccination against HPV at age 11 or 12 years of age has been recommended in the United States since 2006 for females and since 2011 for males [37]. NCCCP participants have played a key role in increasing uptake of the HPV vaccine. A 2017 cancer plan review showed that 62% of plans incorporated at least one activity since 2013 to address low HPV vaccination coverage in their areas [38]. Most plans (86%) reported community education activities, while 65% reported activities associated with provider education [38]. Systems-based strategies such as client reminders or provider assessment and feedback were reported in about of quarter of plans [38]. The North Dakota Comprehensive Cancer Control Program (ND CCCP) partnered with local public health units to facilitate an in-school vaccination program [34]. Public health units in four North Dakota rural counties launched school clinics in 20 middle and high schools to provide HPV vaccinations to students during school hours [34]. Each of the counties involved met or exceeded a 10% increase in vaccination rates, with one county reporting an increase of 18% [34]. The South Dakota Comprehensive Cancer Control Program (SDCCCP) had similar success partnering with a major integrated healthcare system within the state to increase the state's HPV vaccination rates [34]. Over a one year period starting in 2015, SDCCCP partnered with the health system to send out client reminders and provider feedback in seven primary care clinics [34]. More than 41,500 reminders were sent out and more than 3000 doses of HPV vaccine were administered as a result [34]. Community-based activities including panel discussions with cancer survivors and providers and showings of the "Someone You Love: The HPV Epidemic" documentary [39] were also implemented to raise awareness. At the end of the one-year implementation time, the seven participating clinics reported a 14 percentage point increase in HPV doses given to those who had not previously been vaccinated [34].

HBV vaccination is currently recommended for all infants, unvaccinated children aged <19 years, persons with diabetes aged 19–59 years, and all those who are at high risk for HBV infection [40]. A 2012 review of 66 cancer plans for liver cancer and HBV content revealed that 35% addressed liver cancer prevention through HBV-related strategies [41]. Specific strategies reported were to implement a culturally-appropriate campaign for high-risk Asian and Pacific Islander communities to increase their awareness about hepatitis B and preventive measures, and to liaise with the local sexually transmitted infections program to share data and incorporate cancer awareness in its activities [41]. Cherokee Nation and Idaho have actively engaged in promoting HBV vaccination by distributing over 2000 patient education resources, holding community meetings about risks associated with liver cancer, and developing and delivering provider education sessions on HBV vaccination.

Genomics is becoming an increasingly important field in the U.S., particularly with regard to its usefulness in precision medicine [42]. CDC has held several workshops and meetings to promote incorporation of genomic and genetic testing awareness and uptake into public health practice [43, 44]. Particular focus areas have been increasing awareness of and surveillance for cancer-promoting genetic mutations such as BRCA1/BRCA2 and those associated with Lynch syndrome that predispose individuals to breast, ovarian, colorectal, uterine, and other cancers [44]. A 2005 review noted that 56% of state plans analyzed had begun to implement genomics components described in their plan [45]. Most states emphasized educating health care providers and the public about the role of genomics in cancer control, and many considered awareness of family history to be an important aspect of cancer planning [45].

Approximately 67% of states with family history components in their plans had begun to implement initiatives in this area [45]. Alaska, Michigan, New Jersey, Puerto Rico, Tennessee, Texas, West Virginia, and Wisconsin held a series of structured, educational workshops, using resource materials from CDC's *Inside Knowledge* gynecologic cancer awareness campaign [46] to teach women about ovarian cancer risk factors and symptoms [47]. Educational sessions were implemented over a one year period and were tailored to the particular population. Following the workshops, almost 80% of women correctly identified genetic mutations as a risk factor for ovarian cancer, and the number of women reporting being confident in speaking to their doctor about genetic testing increased 30% [47].

3.1.2. Promoting early detection of cancer

Early detection for cancer involves screening for early malignancies or premalignancies and often treatment or removal of these lesions before they can spread to other parts of the body [25]. This area of addressing cancer is perhaps the most recognized by U.S. cancer specialists and the general public [25]. Early detection requires a solid clinical infrastructure to perform screenings and assess clinical and pathologic results of testing, so it can be more difficult to achieve in low-resource areas. CDC provides mammography and Pap smear screening services through its NBCCEDP [6], and the majority of providers in NBCCEDP-funded jurisdictions reported adequate technological resources for screening women [38]. As a community-driven implementation program, the NCCCP assists with promoting early detection by increasing knowledge and awareness of cancers that can be screened for, and implementing health systems changes to deliver screening among those who are eligible. NCCCP practitioners are required to partner and collaborate in a formal leadership team with NBCCEDP practitioners at the state and local levels as a requirement of CDC funding [21]. This helps ensure streamlining of screening activities between the programs.

Population-based early detection or screening is currently recommended by USPSTF for only a few types of cancer: mammography for breast cancer, pap smear for cervical cancer, colonoscopy (and other tests) for colorectal cancer, and the use of low-dose computed tomography for lung cancer screening [22]. Cancer plan reviews have shown that the vast majority contain cervical cancer content with 80.4% containing educational activities with a focus on individual behavior change [48]. Clinician behavior change was included in 41.2% of plans, and 11.7% identifying specific systems or environmental changes to bring about this change in clinicians [48]. This work does extend to NCCCP-funded areas of relatively low resources, such as the USAPIJs. In Yap USAPIJ, comprehensive cancer control practitioners held educational workshops to increase knowledge of cervical cancer screening and showed an approximate 25% increase in knowledge of Pap smear screening recommendations among the 326 women attending the workshops [44]. And a cross-sectional survey of 72 health care providers from five of the six USAPIJ funded by the NCCCP showed that most providers reported cervical cancer prevention as a priority in their clinical practices (90.3%) and used Pap smear screening (86.1%) [49].

Nearly all NCCCP cancer plans (98%) discuss interventions related to colorectal cancer screening [50]. Many (44%) included interventions to promote colorectal cancer screening in the workplace [51]. The Montana Cancer Control Program (MCCP) partnered with several

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insurance agencies in their state to promote colorectal cancer screening through several educational articles sent out in routine communications by the insurers, and postcards sent individuals reminding them that their insurance coverage allowed them to get screened [27]. About 92,000 Montanans were reach through these efforts [27]. Similar interventions by the Idaho Comprehensive Cancer Alliance resulted in an 8% increase over a 4 year period in persons reporting they received a colonoscopy [34].

Population-based lung cancer screening for long-term, heavy smokers is a relatively recent USPSTF recommendation compared to the other early detection recommendations discussed above [22]. As such, many NCCCP participants are beginning to collect baseline data in order to determine the interventions and types of interventions needed to increase adherence to this recommendation. Recently, the Maine Comprehensive Cancer Control Program conducted a survey to find out how many health facilities offered screening and the barriers to adopting screening [34]. While 1,131 lung cancer screenings were provided in results reported from their 2015 survey, most (84.4%) were performed in the two most populated counties included in the survey [34]. Barriers to screening identified included limited staffing, lack of patient and provider education, screening costs, and data reporting requirements of the Centers for Medicare & Medicaid Services (CMS) [34]. Armed with these data, Maine is preparing interventions to increase lung cancer screening across their state. They are developing appropriate interventions to lessen these barriers, and have adopted the lung cancer screening module of CDC's Behavioral Risk Factor Surveillance System (BRFSS) in 2017 to measure the results of their efforts [34].

3.1.3. Addressing the public health needs of cancer survivors

Survival from commonly diagnosed cancers (such as breast and colorectal cancers) has increased steadily in most developed countries, and considerable increases in prostate cancer survival have occurred in many countries in South America, Asia, and Europe [52]. People living with cancer have several unique needs that can be addressed through public health practice [53]. Cancer survivors often face long-term adverse physical, psychosocial, and financial effects from their cancer diagnosis and treatment [53, 54], and have elevated risks for developing subsequent, new cancers as well as other chronic diseases compared to those who have never had cancer [54]. The number of cancer survivors in the U.S. has steadily increased over the last 3 decades [54]. A 2016 study indicated there were over 19 million current U.S. cancer survivors [55]. Many of the evidence-based interventions for primary prevention and early detection equally apply to survivors. NCCCP participants have adapted these interventions for their survivor populations, given the increased health risks present in this group compared to those who have not had cancer. Additional survivor-specific activities are also often implemented. A 2013 assessment of NCCCP cancer plans showed that 94% contained cancer survivorship content [56]. The most commonly incorporated survivorship activities were providing communication, education, and training (91%), followed by developing programs, policies, and infrastructure (90%), ensuring access to quality care and services (77%), and supporting surveillance and applied research (75%) [56]. Common examples of implementation in these areas included incorporation of CDC's cancer survivorship BRFSS module to characterize health behaviors (such as tobacco use and cancer screening among cancer survivors), development of fact sheets explaining individual cancer diagnoses, collaboration with community resources

such as the YMCA's Cancer Survivor Program [57] which encourages exercise among survivors, and the fielding of needs assessments to determine where to allocate resources to ensure access to quality care and services [56]. Specific examples of activities in New Mexico, South Carolina, Vermont, Washington state, and the Fond Du Lac Band of Lake Superior Chippewa tribe are: (1) promotion of doctor and patient use of survivor care plans to better understand care prescribed and received; (2) use of patient navigation programs to help survivors gain access to clinical services; (3) use of psychosocial distress screening among cancer survivors to identify and treat concurrent illnesses stemming from their cancer diagnosis; and (4) facilitation of communication among cancer survivors through peer support groups and workshops to help survivors feel less marginalized and better equipped to handle their diagnosis [58]. Recognizing that a cancer diagnosis affects not only the individual, but also those in close proximity to the survivor, NCCCP participants also provide support to families and caregivers as part of addressing the survivors' needs. In 2007, the Alaska Native Tribal Health Consortium (ANTHC) began a grief camp for Alaska Native children who lost a family member due to cancer. The ANTHC developed and implemented Camp Coho, a one-day camp that provided culturally appropriate messages of grief support to children, including using art therapy, healing circles, and assigning children a peer to provide one-on-one support. Post camp surveys indicated that 75% of children no longer felt alone in their cancer loss after attending the camp [27]. The Wyoming Comprehensive Cancer Control Consortium (WCCCC) created a similar camp experience to bring children who themselves were diagnosed with cancer and their parents and sibling caregivers together [34]. Camp Courage Wyoming was established as a yearly camp in 2012, to allow families to build a statewide, long-lasting survivorship support network [34]. During the weekend long camp, cancer counseling and support group services are available, and families can attend educational workshops taught by physicians specializing in childhood cancers [34]. Attendees reported that the opportunity to talk with others about the challenges associated with having a child diagnosed with cancer has been very valuable [34]. Building on the knowledge gained from participant survivor activities, and in an effort to accelerate survivorship activities across all NCCCP participants, CDC began providing additional funding on a competitive basis to a small number of participants in 2015 to enhance surveillance of survivors and their behaviors, implement community-clinical linkages that would promote receipt of quality care for cancer, and increase provider education about survivorship needs and assist providers with completing and distributing survivor care plans [59].

3.2. Guidance of the National Comprehensive Cancer Control Program

The NCCCP is guided at the U.S. federal government level by CDC's Division of Cancer Prevention and Control (DCPC) [60]. Formal collaborations across CDC ensure complementary programmatic efforts [61]. For example, a consortium of national networks to enhance the quality and performance of the NCCCP in specific populations who traditionally experience health disparities is jointly supported by DCPC and CDC's Office on Smoking and Health. CDC also maintains a formal partnership with several national organizations listed in **Table 2** [62], who provide specific resources to assist NCCCP with interventions. These comprehensive cancer control national partners have helped build and sustain coalition capacity through a variety of technical assistance activities [62]. For example, the American Cancer Society drafted and published

• American Cancer Society	• Intercultural Cancer Council
• American Cancer Society Cancer Action Network	• LIVESTRONG
• American College of Surgeons Commission on Cancer	• Leukemia and Lymphoma Society
• Association of State and Territorial Health Officials	• National Association of Chronic Disease Directors
• Cancer Support Community	• National Association of County and City Health Officials
• **Centers for Disease Control and Prevention**	• North American Association of Central Cancer Registries
• The George Washington University Cancer Center	• National Cancer Institute
• Health Resources Services Administration	• Susan G. Komen for the Cure
	• Truth Initiative
	• YMCA of the USA

Table 2. Comprehensive Cancer Control National Partnership Members.

a series of guidelines for cancer survivor care, including colorectal cancer care [63], and George Washington Cancer Institute develops and disseminates social media messages about cancer EBIs for NCCCP participants to distribute during particular cancer awareness months.

4. Conclusion

Cancer is an ongoing public health concern in developed countries and an emerging concern in developing countries [9, 12]. Many countries are beginning to recognize the importance of comprehensive cancer control and are beginning to design national cancer control programs to improve cancer survival and quality of life through evidence-based strategies [64, 65]. Early efforts have reported several challenges including the lack of access to care, contamination of the environment, and cancer fatalistic attitudes among individuals in China, lack of informed healthcare staff, and sociocultural barriers in India, and inadequate assessment of cancer burden, negative societal attitudes towards cancer prevention, and lack of partnerships and engagement in Russia [66]. Many countries (both developed and developing) have cited the need for better assessments of cancer burden, determination of risk and protective factors, early detection and screening, interventions in vaccination, tobacco cessation efforts and palliative care, coordination and measurement of impact [67, 68]. The U.S. NCCCP provides a successful model, addressing all these factors in a coordinated, impactful, and collaborative approach for these countries to learn from and adapt. The varied examples of successful implementation activities presented above provide a platform to assist other countries with cancer planning. As countries begin to design and implement their national cancer control programs, they may wish to adapt a similar design to the NCCCP, that is, a community-based implementation program, with guidance and assistance from national levels. This particular design has been most effective for the U.S. in addressing multiple populations with widely diverging attitudes and infrastructure, and has contributed to the NCCCP's success over the last 20 years. All countries involved in national cancer planning could learn from the

NCCCP in their efforts to control cancer across diverse populations. Bringing key stakeholders together with first-hand knowledge of the cancer-related challenges in a given population is an essential first step. Allowing stakeholders themselves to write and implement a specific plan, based on their knowledge and all available data from the population, led to successful interventions in the NCCCP. Focusing on the implementation of similar cancer prevention and risk reduction strategies may be a good first option for many countries [13].

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Conflict of interest

The authors have no conflicts of interest.

Disclaimer

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