Relationship between Democracy and Health Policies: A Study of 40 Countries and its Effect on Cancer Policies

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Abstract

Background: Many empirical studies report a positive association between democracy and health outcomes. However, no empirical study has explored the relationship between democracy and health policies. This study aimed to explore the relationship between democracy and the quality and comprehensiveness of National Cancer Control Plans (NCCPs) to make an argument in support of democracy.

Methods: Panel data for 40 countries was created. Data was extracted and aligned for the year when the NCCP was last updated to capture the proximal effect of the independent and control variables on the NCCP score (Yw). NCCP scores were calculated via desk research, segmented into eleven dimensions. This was followed by expert weighting and geometric aggregation across the dimensions and analysis using R software.

Results: Along the spectrum of democratic regimes from closed autocracy (CA) to liberal democracy (LD), the mean NCCP scores rose from 0.042 (0.015) for CA to 0.054 (0.012) for countries with LD. The model for Yw obtained with the bidirectional stepwise modeling technique had an adjusted R2 value of 0.424, with an overall p-value of <0.001.

Conclusion: A higher degree of democracy in a country appears to be associated with a transparent and inclusive process that produces NCCPs of better quality and comprehensiveness.

Keywords: Democracy; Health Policy; National Cancer Control Plans

Introduction

Democratic backsliding refers to the erosion of democratic institutions, processes, and norms. The implications of this decline extend well beyond the political sphere, threatening the potential loss of advancements achieved over decades of democratic governance, including in areas such as National Cancer Control Programs (NCCP).

Democracy has brought peace, development, and economic growth, which has resulted in several downstream benefits [1,2] including more efficient health systems and better population health [3,4]. However, health outcomes are influenced by several factors, such as health financing and infrastructure. Further, health outcomes can be impacted by external shocks, such as armed conflict and natural disasters, air pollution levels, living conditions, and other social determinants of health. Some of these, especially the external shocks, are not under the proximal control of any government. (Figure 1)

In contrast, health policies are linked to governance and serve as crucial political determinants of health, and herein lies the importance of understanding this link. Research indicates that health policies are more effectively formulated and implemented in democratic contexts. This relationship warrants further exploration, as effective governance is essential for policymaking [5,6], and health policies are vital tools for achieving sustained and long-term improvements that can withstand the negative effects of external shocks [3,7].
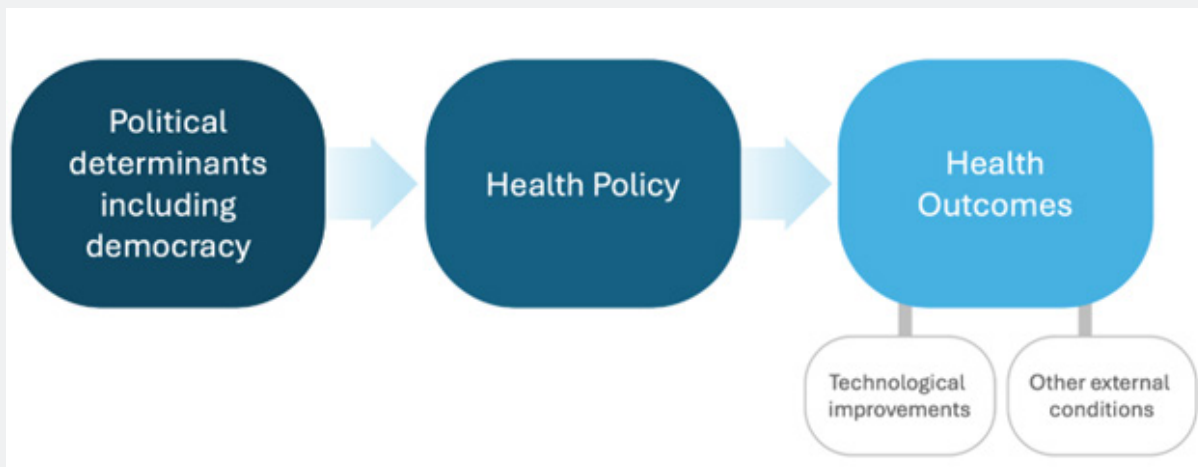
Figure 1: The relationship between political determinants, health policy, and health outcomes.

Health policies are significantly influenced by political dynamics, which can either constrain or enhance public health outcomes. As countries, states, and to a lesser extent, municipalities serve as sites for autonomous official initiatives, their institutional structures play a pivotal role in shaping the political processes that inform social policies, including health policies. These policies are vital for ensuring the delivery of quality and equitable healthcare, and democracy is fundamental to safeguarding the rights of individuals, including the right to health. A literature review indicates that left-leaning and egalitarian political ideologies, as well as advanced liberal democracies, have a positive impact on health outcomes [8].

For example, until the 1970s, Venezuela was considered a well-functioning democracy. Currently, the nation is under authoritarian rule and faces many challenges [9]. This transition has resulted in a fragile healthcare infrastructure [10] and an infant mortality rate (IMR) of 21 per 1,000 live births in 2022, significantly higher than the regional average of 14 per 1,000 live births in Latin America and the Caribbean [11]. The healthcare system has been adversely affected, and outbreaks of infectious diseases, linked to deteriorating public health services, are posing a threat to the nations and regional health [12]. The example of Venezuela is not an isolated one, several other countries, including Hungary, [13] Poland, [14] and Turkey, [15] among others, have witnessed a democratic backsliding characterized by curtailment of judicial independence, media freedom, and civil liberties in recent decades, with implications for policy-making and/or prioritization of investments in health infrastructure [5,16-22].

It is argued that through participative, deliberative, egalitarian, and rights-based approaches and attributes of democracy, normatively public policies, including health policies made under a democratic regime, would address equity, be comprehensive, and be of higher quality [23]. Further, a key mission of WHO's work in cancer control is to promote NCCPs that are harmonized with strategies for NCDs and other related health concerns. Our study aligns with this mission and is an attempt to study one of the antecedents of NCCPs [24]. Therefore, we aim to study the relationship between the levels of democracy and the quality and comprehensiveness of cancer policies. Since cancer is a leading cause of death worldwide and its burden continues to rise, [25-27] effective policy measures are crucial for improving cancer prevention, screening, treatment, and palliative care. Lastly, the quality of these policies can significantly influence cancer outcomes. With that rationale, this study seeks to test the hypothesis that higher levels of democracy support better quality and comprehensiveness of NCCPs

Materials and Methods

Overview

The relationship between democracy and public policies, including health policies, is not straightforward. It is affected by the influence of several other factors, which are included as controls in this analysis. Democracy is measured using the V-Dem score for the liberal democracy index [28] for the year when the NCCP was last updated. NCCP plans were given a score based on primary research using a pre-designed set of eighty-three items categorized under eleven dimensions which were expert-weighted, geometrically aggregated, and log-transformed.

Selection of countries

A purposive sampling technique was used to select 40 countries to ensure an even representation of the various democratic regime types (closed autocracy (CA), electoral autocracy (EA), electoral democracy (ED), and liberal democracy (LD) [29] (Table 1) across four world regions-Americas, Asia and Oceania, Africa and the Middle East, and Europe. We obtained a near-even representation of the World Bank income levels under each regime type, except liberal democracy (LD), where 9 out of 10 countries were high-income countries (HIC) [30]. This was unavoidable given the extant country mix under the LD regime (Appendix C)

Table 1: Regime Characteristics

Regime type	Description	
Closed autocracy (CA)	No multiparty elections for the chief executive	No free and fair, de factoo multiparty elections or minimal institutional prerequisites not fulfilled
Electoral autocracy (EA)	Elections for the chief executive with a minimal level of multiparty competition	
Electoral democracy (ED)	Liberal principles not satisfied	Free and fair and multiparty elections and minimal institutional prerequisites fulfilled
Liberal democracy (LD)	Liberal principles satisfied	

Data and measures

Independent variable: Democracy and Governance

VDem dataset provides numerous indicators of regime characteristics, such as multiparty elections, freedom of civil association, et cetera, for 201 countries from 1789 to 2023. This study focuses on the Liberal Democracy Index (D) as the primary independent variable. This index reflects the core principle of ensuring that rulers are responsive to citizens through extensive electoral competition. It considers how free and fair elections are, as well as the ability of political and civil society organizations to operate without restrictions. Additionally, it considers freedom of expression and the media's independence and capacity to present diverse perspectives on political issues between elections. For more detailed information, refer to the V-Dem 2024 data codebook and report [28].

Democracy is not a moment in time but a way of living and interacting among people and of people with their governments. Similarly, policy formulation or reform can take years and is not an instantaneous or short-term process. Moreover, the resources, expertise, and antecedents of policy choices are shaped over a longer period. To capture the effect of democracy as a factor influencing this long-term policy formulation process, the democratic experience of each country for 5, 10, and 15 years preceding the launch of the latest cancer plan update was calculated using the V-Dem Liberal democracy index (D). We calculated democratic experience by taking the sum of each country's Liberal democracy index score for the last 5, 10, and 15 years up to the year of plan formulation, giving us another set of independent variables labeled D5, D10, and D15, respectively. Political cycles in most countries are usually 4 to 5 years [31]. Hence, we used 5-year gaps to develop democratic stock indices. D, D5, D10, and D15 were the main independent variables for the regression models. The regime type (R) described above was used as a categorical variable for descriptive analysis of the data before running regression models. It was done using ANOVA and the Kruskal Wallis test, where the data were normal and not normal in distribution, respectively.

Dependent variable: National Cancer Policy score (NCCP score)

A NCCP was identified for each country from sources including but not limited to the International Cancer Control Partnership (ICCP) portal, [32] the WHO Non-communicable Diseases document repository, [33] the Ministry of Health (MoH), and other government websites. A score was assigned for each country's NCCP by conducting desk research on a pre-designed questionnaire (Appendix A). Each cancer plan was scored using this questionnaire containing 83 items categorized under eleven dimensions (Table 2), which were weighted with expert inputs and combined using geometric aggregation to measure the construct of quality and comprehensiveness of cancer policies. It gave us the primary dependent variable Y_w and its 11 dimensions (Y_1 to Y_{11}). [a]

These themes have been informed by the following concepts: Cancer care continuum, [34] WHO Health systems building blocks, [35] Key WHO resource documents like Strategizing national health in the 21st century, [36] and the conceptual framework of Health Equity. Weights were assigned to the dimensions using the Budget allocation (BAL) method [37-39] The NCCP score ranged from 0 to 0.087[b] where a higher score indicates a higher quality and comprehensiveness of the cancer policy.

While the NCCP score captured the product of the policy formulation process, primary data was collected on its process to check if it was inclusive and transparent allowing for participation from a range of stakeholders and accountability. A set of eight questions (Appendix A) was used to do this, which provided the secondary dependent variable called Process (P).

Table 2: The Dimensions of the NCCP Scoring Questionnaire

S. No.	Dimension	Description
1	Prevention	The plan focuses on strategies to identify and prevent risk factors for cancer
2	Screening and diagnosis	The plan focuses on improving the awareness, availability, and access to cancer screening and early diagnosis programs.
3	Treatment	The plan focuses on the development and use of clinical guidelines, availability of anti-cancer medications including innovative medicines, multi-disciplinary treatment, treatment of metastatic cancer, and quality treatment access in optimal time.
4	Palliative care	The plan mentions pain management and home-based or institution-based palliative care
5	Service delivery	The plan focuses on developing outpatient and ambulatory care - strong primary care-based systems or providing outreach, developing infrastructure and equipment for delivering effective cancer care.
6	Governance	The plan ensures there is an apex body or leadership for cancer plan implementation.
7	Health Workforce	The plan focuses on building/training the healthcare workforce to adequately address the population's needs and mentions the relevant statistics.
8	M&E (Monitoring & evaluation)	The plan mentions cancer targets, KPIs, and/or a detailed M&E plan and focuses on the development of a cancer registry and the availability of data.
9	Research	The plan focuses on research partnerships, developing a research strategy, and supporting innovation in cancer care
10	Financing	The plan acknowledges the funding gap (if any), addresses the sustainable flow of funds for cancer care, and recognizes the annual budget for cancer in the country.
11	Equity	The plan has strategies for improving cancer care access in vulnerable, marginalized, and rural populations. It identifies populations at high risk for cancer and addresses health equity.

Controls

As mentioned earlier, the translation of political intentions, technical capacity, and capability is a complex process and might involve several intermediary factors to arrive at the policy. A methodological choice was made to allow for post-treatment bias by including downstream factors of democracy, such as GDP per capita, as controls.

This was done to ensure that the direct effects of democracy on NCCP quality and comprehensiveness are captured. It is argued that the following variables can impact policy formulation and therefore can function as confounders and hence are included as controls in the regression models

• Health expenditure per capita (current US$) at the time of plan formulation [40]

• Health expenditure (% of GDP) at the time of plan formulation [41]

• Income level [30]

• Domestic autonomy measures if the state is autonomous from the control of other states in the conduct of domestic policy [28].

• World Governance Indicator - Voice and Accountability: it captures the perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and free media [42]

• World Governance Indicator (WGI) - Government effectiveness: it captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies [43].

• Gender Inequality Index (GII): It is a composite metric of gender inequality using three dimensions - reproductive health, empowerment, and the labor market. GII measures gender-based disadvantage in three dimensions reproductive health, empowerment (Parliamentary representation of females), and the labor market (Labor force participation for females) [44]

• Gender Development Index (GDI): It measures gender inequalities in achievement in three basic dimensions of human development - health, education, and command over economic resources [45].

Creating the panel data

The panel was created with data from included countries and all variables - independent, control, and dependent variables, listed above. Each data point for the independent and control variables was taken from its source for the year of the last update of the NCCP to capture their proximal effect on the NCCP. For

example, the value of the Liberal democracy index (D1) was taken for the year 2011 for Costa Rica, which is when its NCCP was last updated. This can reasonably ensure that the level of democracy (D) reflects the environment under which the plan formulation took place.

Analysis

Statistical analyses were done using R software (version 4.3.3) using packages-gtsummary, ggstatsplot, model summary, pwr, and performance [46]. The panel data used in the analysis are available upon request. A p-value of 0.05 or less indicated a significant difference. Lastly, post hoc power analysis was done using pwr package. The power. f². The test function was utilized, which calculates power for a regression model based on the effect size, denoted as F^2. The effect size F^2 is derived from the coefficient of determination (R^2) using the formula:

$$F^2 = \{R^2\}/\{1-R^2\}$$

Where R^2 represents the proportion of variance explained by the predictors in the model. By providing F^2, the total sample size, and the number of predictors, the power. f².test function computed the achieved power of the analysis.

Descriptive analysis

The included countries were classified by regime types, region, and income levels, and the mean values of independent and control variables were tabulated.

Bivariate analysis

Analysis of Variance (ANOVA) and Kruskal-Wallis tests were used for bivariate analysis between the independent, control, and dependent variables. In the bivariate analysis, variables were assessed in pairs to identify associations between them. The association of Y_w, its dimensions Y_1 to Y_{11}, and the process score (P) were seen with all the independent and control variables then they were analyzed simultaneously in regression models.

Regression

To remove the effect of confounding and arrive at the best-fit model for Yw and some dimension scores, regression was done using the bidirectional stepwise method. It was applied since there were many independent, plausible explanatory variables in our study. The goal was to come up with a parsimonious model and to find the most useful predictor variables. We started with no variables, also called the null model, and evaluated variables for addition or removal at each iterative step, one by one after evaluating them for GVIF (<10), p-value, highest increase in adjusted R-square, and highest reduction in Akaike Information Criterion (AIC). We added variables that improved model fit and removed those that did not. We continued this process until no more variables provided a significant improvement to the model or until all variables under consideration were evaluated. Final models arrived at using this procedure are reported in the results section and Table 7.

Results

Descriptive analysis

Upon cross-tabulating the region and income level (Table 3, Figure 2 and 3); independent and control variables (Table 4); and dependent variables (Table 5) with the regime types, patterns can be seen in the way these variables move across the spectrum of democracy from Closed autocracy (CA), Electoral autocracy (EA), Electoral democracy (ED), to Liberal democracy (LD). For example, health expenditure per capita, and % GDP spent on health show a clear increasing pattern from CA to LD. Health expenditure per capita, and % GDP spent on Health in CA were US Dollars 782.74 (689.210) and 5.66% (3.169), and for LD was US Dollars 4843.72 (3023.547) and 10.91% (2.306) respectively (Table 4). Changes in the control variables may mediate the effects of democracy (or lack thereof) on NCCP.
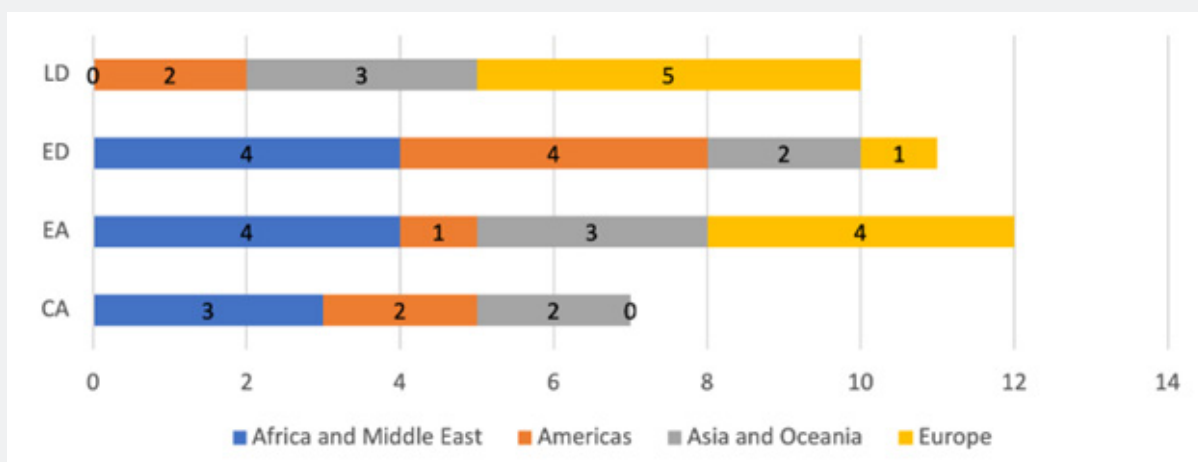

Figure 2: Stacked bar chart showing regime types by region of the included countries.
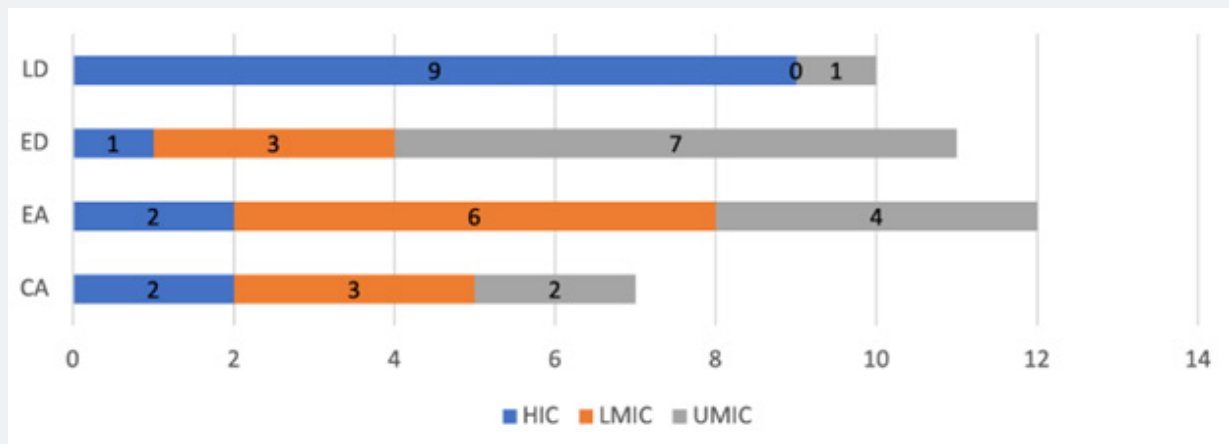
Figure 3: Stacked bar chart showing regime types by income level of the included countries.

Table 3: Classification of Regime Types by Region and the Income Level of the Included Countries.

	CA	EA	ED	LD	Total
Region					
Africa and the Middle East	3	4	4	0	11
Americas	2	1	4	2	9
Asia and Oceania	2	3	2	3	10
Europe	0	4	1	5	10
Income level					
HIC	2	2	1	9	14
LMIC	3	6	3	0	12
UMIC	2	4	7	1	14

Table 4: Mean Values of Independent and Control Variables by Regime Types.

	CA	EA	ED	LD	Total
Independent variables					
D	0.14±0.097	0.43±0.202	0.68±0.119	0.86±0.027	0.56±0.284
D5	0.73±0.590	2.2±1.122	3.41±0.527	4.3±0.136	2.8±1.430
D10	1.49±1.248	4.81±2.102	6.8±1.148	8.59±0.340	5.72±2.784
D15	2.3±1.958	7.3±3.011	10.2±1.830	12.9±0.481	8.6±4.157
Control variables					
Domestic autonomy	1.47±0.693	1.59±0.487	1.60±0.408	1.87±0.159	1.64±0.457
GDP per capita (Current USD)	20240.90±30542.447	6211.41±5160.088	7839.76±6681.940	42435.27±19548.940	18170.33±21829.099
Health expenditure per capita (Current USD)	782.74±689.210	342.94±337.124	662.00±774.472	4843.72±3023.547	1632.84±2433.027
% GDP spent on Health	5.66±3.169	5.10±1.539	7.24±2.623	10.91±2.306	7.24±3.244
Universal Health Coverage Index (2021)	72.86±9.668	67.42±16.273	67.82±13.717	85.60±2.503	73.03±14.023
WGI: Voice and Accountability	-1.41±0.264	-0.42±0.674	0.32±0.457	1.10±0.182	-0.01±0.975
WGI: Government effectiveness	-0.24±0.982	-0.27±0.453	-0.09±0.512	1.17±0.475	0.15±0.831

Gender Inequality Index (GII)	0.36±0.171	0.40±0.172	0.41±0.134	0.11±0.079	0.32±0.187
Gender Development Index (GDI)	0.95±0.053	0.92±0.089	0.97±0.042	0.98±0.016	0.95±0.061
Parliamentary Representation of Females	19.70±17.485	16.55±10.496	29.66±13.571	31.91±9.478	24.55±13.829
Labor Force Participation of Females	46.05±21.375	44.58±19.348	52.33±10.810	53.36±6.130	49.16±15.167

Table 5: Mean (Standard deviation) ˄ and Median (Interquartile Range (IQR)) # of Dependent Variables by Regime Types.

Variable	CA	EA	ED	LD	Total	p-value
Y_w˄	0.042± (0.015)	0.049± (0.010)	0.049± (0.011)	0.054± (0.012)	0.049± (0.012)	0.3
y^1 Prevention#	0.109 (0.065, 0.109)	0.109 (0.109, 0.109)	0.109 (0.098, 0.109)	0.109 (0.060, 0.109)	0.109 (0.103, 0.109)	0.8
y^2 Screening and diagnosis˄	0.045± (0.033)	0.068± (0.028)	0.047± (0.019)	0.074± (0.018)	0.060± (0.027)	0.031
y^3 Treatment˄	0.031± (0.024)	0.041± (0.022)	0.034± (0.022)	0.042± (0.026)	0.038± (0.023)	0.7
y^4 Palliative care#	0.030 (0.015, 0.038)	0.038 (0.030, 0.045)	0.030 (0.030, 0.045)	0.030 (0.019, 0.045)	0.030 (0.030, 0.045)	0.7
y^5 Service delivery˄	0.051± (0.022)	0.055± (0.018)	0.050± (0.023)	0.067± (0.008)	0.056± (0.019)	0.2
y^6 Governance#	0.029 (0.021, 0.042)	0.036 (0.029, 0.039)	0.046 (0.036, 0.048)	0.040 (0.026, 0.042)	0.038 (0.029, 0.046)	0.3
y^7 Health Workforce#	0.061 (0.046, 0.061)	0.061 (0.061, 0.069)	0.061 (0.046, 0.061)	0.061 (0.061, 0.061)	0.061 (0.061, 0.061)	0.6
Y^8 Monitoring and Evaluation#	0.049 (0.025, 0.049)	0.044 (0.037, 0.049)	0.049 (0.039, 0.059)	0.044 (0.022, 0.059)	0.049 (0.030, 0.052)	0.7
y^9 Research#	0.050 (0.037, 0.050)	0.044 (0.037, 0.050)	0.050 (0.037, 0.050)	0.062 (0.053, 0.062)	0.050 (0.037, 0.053)	0.012
y^{10} Financing˄	0.044± (0.030)	0.045± (0.031)	0.050± (0.024)	0.052± (0.027)	0.048± (0.027)	>0.9
y^{11} Equity#	0.064 (0.056, 0.080)	0.064 (0.054, 0.080)	0.072 (0.056, 0.080)	0.104 (0.078, 0.104)	0.072 (0.056, 0.096)	0.024
P Process˄	0.36± (0.18)	0.47± (0.28)	0.52± (0.22)	0.67± (0.13)	0.51± (0.23)	0.039

˄ Mean ± (SD); One-way ANOVA

Median (IQR); Kruskal-Walli's rank sum test

Bivariate analysis

There is also some association between regime types as a democracy variable and the dimension (Y_1 to Y_{11}), process (P), and overall NCCP scores (Y_w) using one-way ANOVA and Kruskal-Walli's rank sum tests. The dimension score for Screening and diagnosis, Research, and Equity showed significant differences between the regime types with a p-value of 0.031, 0.012, and 0.024, respectively; the Process score was also significantly different among the regime types (p-value 0.039) (Table 5). These relationships were substantiated when these variables were significantly associated with the other democracy variables. The mean weighted NCCP score (Y_w) was 0.042 (0.015) for countries under CA and 0.054 (0.012) for countries with LD.

The association of Yw, its dimensions Y_1 to Y_{11}, and the process score (P) were seen with all the independent and control variables, and several significant relationships were discovered (Table 6). Most notably, Yw was significantly associated with WGI Government effectiveness and Gender Inequality Index (GII) with a p-value of 0.023 and 0.02, respectively. Comparable results were obtained upon log and reciprocal transformation of Y_w. Since the Yw values were normally distributed and comparable results were obtained upon transformations, the need for this was ruled out and was not done in any further analysis.

• Screening and diagnosis score (Y_2) was significantly associated with D5, D10, and D15 (p-value 0.007, 0.032, 0.027), Domestic autonomy, % GDP spent on health, UHC score, WGI Government effectiveness, WGI Voice and accountability, Gender inequality index (p values 0.005, 0.011, 0.004, 0.028, 0.003, 0.002).

• Equity (Y_{11}) dimension was significantly associated with D, D10, D15, GDP per capita, Health expenditure per capita, % GDP spent on health, UHC score, WGI Voice and accountability, WGI Government effectiveness, Gender inequality index (p-value 0.026, 0.022, 0.02, <0.001, <0.001, 0.003, 0.006, 0.005, <0.001, <0.001); and

• Process (P) scores were significantly associated with D, D10, D15, Health expenditure per capita, WGI Voice and accountability, and WGI Government effectiveness (p-value 0.037, 0.046, 0.046, 0.043, 0.011, 0.023).

Table 6: Bivariate Relationships between Dependent and Independent and Control Variables.

	Y_w	Y_w log	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	P
Regime	0.3	0.2	0.4	0.031	0.7	0.5	0.2	0.4	0.7	0.6	0.02	>0.9	0.022	0.039
Region	0.018	0.016	0.054	0.012	0.021	0.3	0.3	0.2	0.2	0.023	0.7	0.031	0.12	0.3
Income Level	0.041	0.037	0.7	0.004	0.3	0.5	0.002	0.4	0.4	0.7	0.006	0.7	<0.001	0.2
D	0.2	0.2	0.5	0.073	0.8	0.7	0.2	0.6	>0.9	0.6	0.016	>0.9	0.026	0.037
D5	0.2	0.3	0.8	0.007	0.5	0.5	0.079	>0.9	0.2	0.6	0.5	0.4	0.2	0.2
D10	0.2	0.2	0.5	0.032	0.9	0.8	0.14	0.7	>0.9	0.8	0.024	0.7	0.022	0.046
D15	0.2	0.2	0.5	0.027	0.8	0.9	0.12	0.6	>0.9	>0.9	0.020	0.7	0.020	0.046
Domestic autonomy	0.2	0.13	0.4	0.005	>0.9	0.5	0.060	>0.9	0.061	>0.9	0.3	0.5	0.2	0.7
GDP per capita	0.062	0.067	0.8	0.10	0.2	0.5	0.026	0.5	0.2	0.3	0.002	0.3	<0.001	0.12
Health expenditure per capita	0.3	0.2	0.3	0.061	0.6	0.3	0.079	0.6	0.7	0.12	0.005	0.4	<0.001	0.043
% GDP spent on health	0.2	0.13	0.3	0.011	0.6	0.7	0.032	0.4	0.7	0.8	0.006	0.5	0.003	0.12
UHC score	0.093	0.074	>0.9	0.004	0.12	0.9	0.003	0.6	0.3	0.3	0.10	0.5	0.006	0.5
WGI Voice and accountability	0.11	0.11	0.6	0.028	0.7	0.8	0.10	0.4	0.8	>0.9	0.009	>0.9	0.005	0.011
WGI Government effectiveness	0.023	0.011	0.7	0.003	0.2	>0.9	0.002	0.14	0.14	0.12	0.001	0.3	<0.001	0.023
GII	0.020	0.017	0.6	0.002	0.14	0.6	0.002	0.3	0.2	0.5	0.006	0.9	<0.001	0.5
GDI	0.15	0.13	0.7	0.14	0.7	>0.9	0.020	0.4	0.023	0.9	0.2	0.3	0.074	0.6
Parliamentary representation (females)	>0.9	0.7	0.7	0.4	0.051	0.6	0.2	0.6	0.5	0.2	0.6	0.2	0.6	0.3
Labor force participation rate (females)	0.6	0.6	>0.9	0.4	0.7	0.8	0.15	>0.9	0.10	0.5	0.2	0.7	0.8	0.4

UHC: Universal Health Coverage; WGI: World Governance Indicators; GII: Gender Inequality Index; GDI: Gender Development Index

Regression

The final model for Y_w (model 7) had an Adjusted R^2 of 0.424, which means it could explain 42.4% of the variation in the NCCP score with a beta value of 0.01 (p-value of 0.073) and -0.04 (p-value <0.001) for liberal democracy score (D) and GII, respectively. This found a significant albeit small effect of liberal democracy scores (D) on NCCP score in the final model for Y_w where one unit change in D leads to 0.01-unit changes in the geometric NCCP score which is about a 10% increase of quality and comprehensiveness of NCCP, given that the maximum value of Y_w with geometric aggregation was 0.087. Estimates including beta coefficients, log-likelihood ratios, p-values, R-squared, and adjusted R-squared for all the models are reported in Table 7.

The equation of the model for Y_w (model 7) is given below -

Y_w = 0.067-0.018* Region Americas-0.018* Region Asia and Oceania-0.016* Region Europe+0.01* D-0.035* GII

Regression Diagnostics and Model Estimation

- Assessment of the model's assumptions was done using Tests for linearity, normality of residuals, homoscedasticity, and multicollinearity.

- Estimates included beta coefficients, 95% CI, log-likelihood, p-values, and adjusted R-squared.

- The robustness of the results was checked using Q-Q, posterior predictive check, linearity, and homogeneity of variance graphs. (Figure 4)

The model for Process was able to explain 40.7% (adjusted R^2 0.407) of variation in P scores with a p-value of <0.001. The beta value for D was 0.38. (Table 7) These results show that higher levels of democracy lead to higher levels of the quality and comprehensiveness of the NCCPs (Y_w) and the transparency and inclusiveness of their formulation (P). Power analysis showed sufficient power for all our models which is mentioned on table 7.

Table 7: OLS Models with Parameters

Independent variables	Model 1 (Prevention, Y_1)	Model 2 (Screening and diagnosis, Y_2)	Model 3 (Treatment, Y_3)	Model 4 (Financing, Y_{10})	Model 5 (Equity, Y_{11})	Model 6 (Process, P)	Model 7 (Y_w)
Regime							
CA	NA	NA	NA	NA	NA	NA	NA
EA	NA	NA	NA	NA	NA	NA	NA
ED	NA	NA	NA	NA	NA	NA	NA
LD	NA	NA	NA	NA	NA	NA	NA
Region							
Africa and the Middle East		-			-	-	-
Americas	-0.046313 ** [-0.075892, -0.016735]	-0.01 [-0.032, 0.011]	-0.035155 ** [-0.055918, -0.014392]	-0.018554+ [-0.038783, 0.001674]	-0.026* [-0.046, -0.006]	-0.37*** [-0.559, -0.191	-0.018*** [-0.027, -0.009]
Asia and Oceania	-0.010265 [-0.037321, 0.016790]	-0.016 [-0.036, 0.005]	-0.027084 ** [-0.045457, -0.008710]	-0.042067 *** [-0.063011, -0.021123]	-0.02* [-0.037, -0.005]	-0.08 [-0.248, 0.077]	-0.018*** [-0.027, -0.009]
Europe	-0.018284 [-0.047154, 0.010586]	0.005 [-0.021, 0.031]	-0.016250 [-0.038602, 0.006102]	-0.045255 *** [-0.067368, -0.023143]	-0.02* [-0.041, -0.003]	-0.17+ [-0.356, 0.009]	-0.016** [-0.027, -0.005]
Income level							
HIC	NA	NA	NA	NA	-	NA	NA
UMIC	NA	NA	NA	NA	-0.02** [-0.042, -0.007]	NA	NA
LMIC	NA	NA	NA	NA	-0.03** [-0.05, -0.01]	NA	NA
D	NA	0.003 [-0.026, 0.033]	0.006085 [-0.018852, 0.031022]	NA	0.01 [-0.014, 0.04]	0.38** [0.102, 0.664]	0.01+ [0.001, 0.022]
D5	NA	0.001 [-0.0002, 0.002]	NA	NA	NA	-0.011* [-0.021, -0.0001]	NA
D10	NA	NA	NA	NA	NA	NA	NA
D15	NA	NA	NA	NA	NA	NA	NA
Domestic autonomy	NA	0.01 [-0.004, 0.033]	NA	NA	NA	-0.14+ [-0.291, 0.007]	NA
Health expenditure per capita	NA	NA	NA	NA	NA	NA	NA
% GDP spent on health	NA	NA	NA	NA	0.001 [-0.001, 0.004]	0.03+ [-0.0004, 0.0538]	NA
WGI Voice and Accountability	NA	NA	NA	NA	NA	NA	NA

WGI Government Effectiveness	NA	NA	NA	0.016583 ** [0.006417, 0.026749]	NA	NA	NA
GII	NA	-0.03 [-0.083, 0.027]	NA	NA	NA	NA	-0.035** [-0.056, -0.013]
GDI	0.132099 [-0.054016, 0.318214]	NA	NA	NA	NA	NA	NA
Constant	-0.015787 [-0.189657, 0.158084]	0.04+ [-0.002, 0.090]	0.002208 [-0.035770, 0.040186]	0.071276 *** [0.057390, 0.085163]	0.09 *** [0.062, 0.118]	0.53*** [0.298, 0.758]	0.067*** [0.054, 0.080]
N	40	40	40	40	40	40	40
Log-likelihood	85.548	100.7	103.587	98.288	110.6	16.8	134.2
R^2	0.234	0.450	0.359	0.403	0.586	0.513	0.498
Adjusted R^2	0.147	0.330	0.264	0.334	0.495	0.407	0.424
Post hoc power	74.89%	98.09%	94.11%	98.45%	99.98%	99.67%	99.82%

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
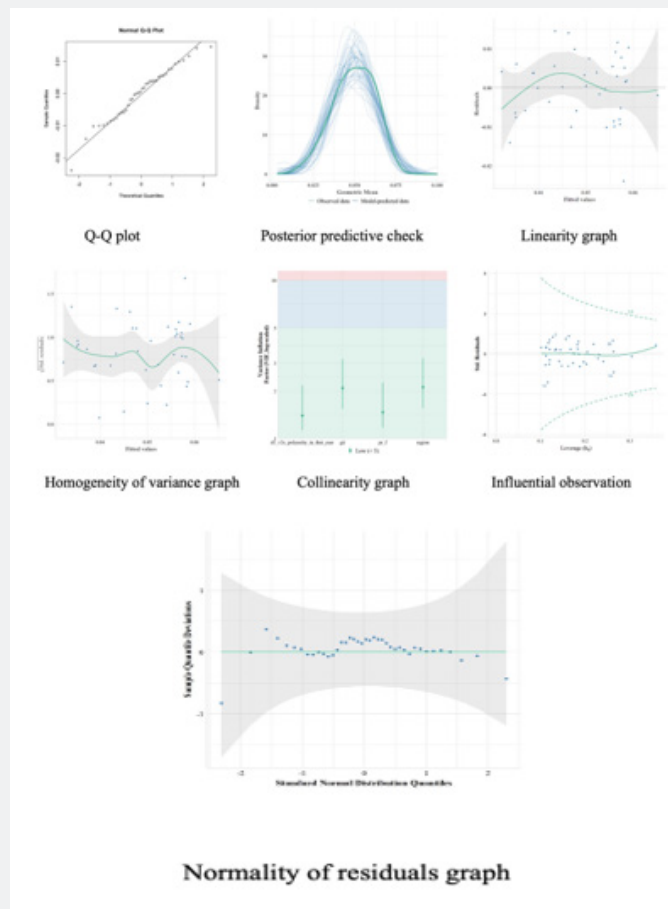
Figure 4: Graphs to check robustness of the final model.

Discussion

This paper hypothesizes that higher levels of democracy are associated with better quality and more comprehensive cancer policies, hence making a case for supporting democracy in pursuit of better healthcare. The findings of the analysis and their generalizability, considering the methodological choices and existing literature connecting democracy and health, are discussed in this section. It is organized as follows: rising cancer burden and democratic backsliding to set the context; political influences on health and the positive influence of democracy; limitations of the study, new knowledge, and recommendations of the study; and avenues of further research.

Rising cancer burden and the role of health policy

Cancer is a heterogeneous disease group that includes various types, such as breast, cervical, and colon cancers, affecting people from all socio-economic strata. Its global burden has been steadily increasing, causing significant suffering for patients and their families. [25-27] This growing challenge necessitates that governments implement policies that address the full cancer care continuum, are financed sustainably, and create conditions for equitable outcomes. Such policies could help reduce cancer's morbidity, mortality, and socio-economic impact.

The impact of national health policies is difficult to measure since the outcomes are not only the result of existing policies but of their implementation and a variety of other policies and actions in sectors beyond health (including education, environment, transport, etc.). Nonetheless, effective policies offer a framework and can contribute to the reduction of the cancer burden. Therefore, the quality and comprehensiveness of cancer policies were studied in relation to democracy.

Since early 1980, the World Health Organization (WHO) has been promoting well-conceived and well-managed national cancer control programmes as the best approach to translating evidence into practice [47]. In September 2011, at a High-Level Meeting of the United Nations General Assembly on the Prevention and Control of Non-communicable Diseases (NCDs), Member States committed themselves to integrating non-communicable diseases, including cancer, into the health planning process [48] Effective policy measures are crucial for improving cancer and the cancer care continuum. However, the quality of these policies can vary across countries, and democracy may play a key role in shaping the quality of cancer policies by affecting the deliberative, participatory, and inclusive aspects of governance and policymaking.

Democracy in danger

There have been multiple reports of democratic backsliding across the world for many years. It is the longest stretch of decline recorded since the 1970s. Reports by Freedom House [49] and International IDEA [50] highlight a worrying trend - nearly half of all countries have seen a weakening of democratic institutions. The 2024 V-Dem report also highlighted a decline in democracy globally. According to their report, the world has been experiencing a shift towards autocracy, with 71% of the world's population, or 5.7 billion people, currently living in autocracies. This marks a significant increase of 48% compared to a decade ago [51,52].

Since governance affects social policymaking, [53,54] how policy shaping will be approached will also be different based on the existing regime types. Health policy advocates need to be aware of this and the fact that democratic backsliding can have negative consequences for population health [5]. First, there is a normative argument that public health is committed to supporting human rights and balancing population health needs with respect for individual autonomy, both of which are incompatible with authoritarianism [55]. Second, there is an empirical argument that backsliding increases the probability of worse public health systems and the potential for poor population health outcomes [5].

Political influences on health

Institutional structures shape the political processes from which policies emerge [56]. A literature review reported that left-leaning and egalitarian politics positively impact health, as do advanced and liberal democracies [8].

When governments adopt a participatory and representative approach to policymaking, the resulting policies are more likely to address people's needs, be more effectively implemented, and promote equity. Under favorable external conditions, such policies can lead to positive health outcomes, with factors like economic development often shaped by democratic governance impacting the social determinants of health [57]. Conversely, political interference can disrupt the policy-making process and hinder effective implementation [6].

Given this background, the analysis found that higher levels of democracy lead to better quality and comprehensiveness of NCCPs. A one-unit change in democracy leads to a 10% increment in the NCCP score. It is worth noting that a 10% increase in the quality and comprehensiveness of NCCP is substantial, given that it is a policy with several other contributory factors and inputs. This suggests that higher levels of democracy do support better quality and comprehensiveness of NCCPs, and yet democracy is often ignored as a lever of policy change. If leveraged, advocacy for democracy can lead to several benefits already discussed, like better policies, economic development, and better health outcomes.

The formulation of NCCPs was more inclusive and transparent in countries with higher levels of democracy. This approach facilitated the involvement of various stakeholders and incorporated public input, ensuring that the voices of end users were considered in health-related matters. As a result, the policies were more responsive and people-centered, leading to more effective implementation and long-term, sustainable improvements. [23,58] Additionally, nearly all dimensions of the NCCP, including key aspects of the cancer care continuum such as prevention, treatment, and financing (Table 5) scored higher in liberal democracies (LD) compared to closed autocracies (CA), except for Y8 Monitoring and Evaluation. Notably, the scores for screening and diagnosis, research, and equity were significantly higher in countries with higher levels of democracy.

Better quality health policies alone are not a primary outcome of interest; rather, the concern is on improving population health. To that end, existing literature suggests that effective and equitable health policies have had a positive influence on population health and other co-benefits, such as poverty reduction by contributing to goals outside the health domain [59-61].

Since the results indicate that the quality and comprehensiveness of NCCPs were higher in countries with greater levels of democracy, it can be expected that democracy contributes to better cancer outcomes. This occurs not only through the enhancement of NCCPs, which provide a strong blueprint for action, but also through other pathways such as economic development and improved public service delivery. The WHO supports this view, stating that national health policies provide a framework for improving health outcomes and addressing national health priorities. A study by Thomas Fujiwara reinforces this, suggesting that public service delivery is the key channel through which democracy influences health outcomes, as observed in Brazil. [62] Similarly, Burgess et al. have found that electoral competition enhances social outcomes, including health, by reducing biases in public service delivery [63]. This is crucial because democracy is often associated with improved governance, such as better control of corruption, greater administrative efficiency, and stronger state capacity [64]. Therefore, the actual impact of democracy on health outcomes may be even greater than captured by this analysis.

The transferability of the findings to underserved populations warrants careful consideration. While purposive sampling allowed for the inclusion of countries across income levels and regions. Despite that it must be acknowledged that liberal democracies in the sample were predominantly high-income countries (9/10), potentially limiting generalizability to low-resource democratic settings.

Health policies play a critical role in balancing competing priorities and promoting targeted approaches to healthcare based on need, evidence, and feasibility. The results demonstrate that, in democratic settings, people benefit from policies that are of higher quality and developed through inclusive and transparent processes. These findings, along with existing literature, highlight the often-overlooked connection between political determinants of health such as democracy and the formulation of health policies.

In summary: (i) there is a significant correlation between levels of democracy and both NCCP and Process scores; (ii) there is evidence that these correlations persist even after controlling for other variables; and (iii) while the correlations appear to be causal, further empirical investigation is required to confirm this.

Limitations

It is acknowledged that this study has potential limitations.

1. Omitted Variables: There could be other variables that might influence NCCP scores but were not included as covariates despite attempts to account for all possible covariates and including them, based on the existing literature.

2. Ecological Fallacy: the analysis focuses on country-level data, and findings may not translate to individual-level relationships in terms of democratic, policy, and health system experiences. However, it is acceptable since the study aimed to explore country level effects of democracy on NCCPs.

3. In alignment with the aim of the study we focused on assessing the relationship between level of democracy and the quality and comprehensiveness of NCCPs. Hence, this study did not study the health outcomes as result of democracy or cancer policies.

4. Point estimates for correlation do not imply causation, and therefore, this study does not claim causal inferences.

5. Residual confounding in the final model cannot be eliminated despite attempts to control it using regression models

6. Limited sample size and possibility of bias due to non-random selection of countries. As explained in section 2.1 Selection of countries, purposive sampling was done to ensure even representation of countries from various regions and regime types. Sample size may be considered limited, but it included 20% of all countries.

7. Major occurrences in the global health policy landscape could influence national policies and these changes are agnostic to the levels of democracy at the country level. Regional diffusion of policies is also a possibility that can alter the NCCP scores without affecting the levels of democracy. This choice

was made in alignment with the scope of this study and hence recommendations for further research in this direction is made.

8. A consolidated index of democracy was used, rather than disaggregating parameters, to simplify the analysis. However, this approach may obscure potential relationships between specific aspects of democracy and health policies. This choice was made in alignment with the scope of this study, and hence recommendations for further research in this direction are made.

9. Principal Component Analysis (PCA) and Factor Analysis (FA) were not used for dimension reduction in creating the questionnaire for the NCCP score. This decision was made because the dimensions represented a continuum of care, each of which was essential to retain and had been validated by public health experts.

Recommendation

This study provides an empirical basis for defending democracy in pursuit of public health. Maintaining higher levels of democracy is expected to result in better quality and more comprehensive cancer policies that are formulated in an inclusive and participatory manner. Since policies are typically formulated for long timescales, it is reasonable to expect that these benefits will be sustained in the long term. Willison et al recommended some practices for public health institutions, including reinvigorating alliances and multilateral institutions, developing civil society organizations, and combating misinformation to support democracy. In turn, healthier people are more likely to vote and less likely to support authoritarianism [5,65,66].

Avenues of further research

• Correlation of NCCP scores with cancer outcome (mortality) and to explore which dimension of the cancer plan (screening, diagnosis, or treatment) is more strongly associated with positive health outcomes?

• Using disaggregated scores of democracies could help understand which aspects of democracy lead to better health policies.

• Since social policies can transform politics once enacted and implemented. It could be worthwhile to study this "policy feedback" over time [56].

• Study of the relationship between other national health policies (environmental or social welfare/security policies) and levels of democracy.

• Study to explore the effect of regional diffusion of policies and their interplay with levels of democracy. For example, a national health insurance or family planning policies which have the potential to spread or influence policies in the neighboring countries because of a similar geopolitical climate or shared challenges [67].

• Examination of how democratic processes can be leveraged to improve cancer policy development in resource-constrained settings and ensure equitable policy implementation for marginalized communities.

Conclusion

The findings of this study have implications for health policy making related to cancer and deepen understanding of the political determinants of health. Democratic systems, with their emphasis on public participation and responsiveness to citizen needs, are more likely to prioritize public health and implement effective cancer control policies that are evidence-based, comprehensive, and equity-focused. This study underscores the importance of defending and promoting democracy to create environments where comprehensive and effective cancer policies are made.

Beyond contributing to academic discourse, these findings offer insights for policymakers aiming to improve cancer care and guidance for advocates seeking effective strategies to shape health policies. However, navigating this advocacy is complex; strategies that spur positive change in liberal democracies might be perceived as regime challenges in closed autocracies. The challenge lies in identifying appropriate strategies tailored to the specific context, considering factors like regime type, resource availability, and the presence of networks and coalitions [68].

The global decline in democracy alerts us to the need for concerted efforts to safeguard and promote national cancer policies that prioritize equity. Organizations like the WHO play a pivotal role in advocating for policies prioritizing equity and public education on the connection between democracy and health outcomes. This paper serves as one such effort, arguing that democracies could potentially contribute to better cancer policies and improved health outcomes.

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Appendix A -Questionnaire

The questionnaire was divided into two sections

(1) Structure which had 82 items categorized in 11 dimensions.

(2) Process which had 8 items. (Table A1, A2, A3)

Table A1: List of Questions under 'Structure' and their Maximum Scores

S No.	Question	Score
	Section: Prevention (1) Maximum score 5	
1	Does the plan mention programs or efforts for any of the following • Awareness on the risk factors of cancer • reduce alcohol consumption • reduce tobacco consumption • HBV vaccination • HPV vaccination • Air pollution monitoring • Hepatitis C control • Any other carcinogen/risk factor (please specify)	5
	Section: Screening and Diagnosis (7) Maximum score 11	
2	Does the plan mention breast cancer screening? • Yes • No	1
3	Does the plan mention colorectal cancer screening? • Yes • No	1
4	Does the plan mention prostate cancer screening? • Yes • No	1
5	Does the plan mention screening for any other cancer? • Yes • No (mark yes and list the types of cancer for which it is available)	5
6	Does the plan mention cancer awareness promotion, screening drives or any other efforts aimed at facilitation of early diagnosis? • Yes • No	1
7	Does the plan mention a laboratory assessment plan or quality standard or a national laboratory/diagnostics plan in reference to cancer diagnosis? • Yes • No	1
8	Is there a mention of minimum or optimal time to diagnosis in the plan for a specified cancer or cancer in general? • Yes • No	1
	Section: Treatment (11) Maximum score 15	
9	Does the plan mention Precision oncology? • Yes • No	1
10	Does the plan mention use of innovative drugs for chemotherapy? • Yes • No	1
11	Does the plan mention development or use of cancer treatment guidelines? • Yes • No	1
12	Is there any reference to the WHO EML in the plan? • Yes • No	1

13	Does the plan mention a mechanism for procurement or supply chain or other ways of improving access to innovative cancer drugs? • Yes • No	1
14	Does the plan mention innovative and modern treatment options like nuclear medicine, robotic surgery etc.? • Yes • No	1
15	Does the plan mention strengthening/supporting/providing/making available Radiation oncology for cancer treatment? • Yes • No	1
16	Does the plan mention strengthening/supporting/providing/making available Surgical Oncology for cancer treatment? • Yes • No	1
17	Does the plan mention strengthening/supporting/providing/making available Chemotherapy for cancer treatment? • Yes • No	1
18	Does the plan mention metastatic cancer treatment? • Yes • No	1
19	Does the plan mention standard treatment guidelines (STGs) for any of the following diseases • Breast • Colorectal • Prostate • Lung • Liver • Others (please specify) • Yes • No (mark yes if it is available for at least one of the above and list the types of cancer for which it is available)	5
Section: Palliative and follow-up care (4) Maximum score 4		
20	Does the plan mention pain management? • Yes • No	1
21	Does the plan mention home-based; Institution based and/or community-based palliative services? • Yes • No	1
22	Does the plan mention rehabilitation of cancer patients' post-treatment? • Yes • No	1
23	Does the plan mention any reference to WHO Guidelines for the pharmacological and radiotherapeutic management of cancer pain in adults and adolescents? • Yes • No	1
Section: Service delivery (12) Maximum score 12		
24	Does the plan mention psychosocial or mental health care of the patients and/or caregivers? • Yes • No	1
25	Does the plan mention care for the patient along the cancer care continuum including at least the following four - Prevention, Diagnosis/early detection, Treatment and palliative care/end-of-life-care/managing metastatic disease. • Yes • No	1
26	Does the plan address health infrastructure development or mention minimum infrastructure requirements for effective cancer care? • Yes • No	1
27	Does the plan mention improving patient experience, patient friendly services or patient satisfaction with the service delivery or patient-centered care? • Yes • No	1

S No.	Question	Score
Section: Service delivery (12) Maximum score 12		
28	If yes, is there a reference to connecting the patient with awareness, improved clinical diagnosis and/or referral patterns, access to treatment and follow-up care? Mark as yes, if continuity of care is evident i.e., referral of screened positive patient and connection with access to care. • Yes • No	1
29	If yes, is there a reference to connecting the patient with awareness, improved clinical diagnosis and/or referral patterns, access to treatment and follow-up care? Mark as yes, if continuity of care is evident i.e., referral of screened positive patient and connection with access to care. • Yes • No	1
30	If yes, is there a reference to connecting the patient with awareness, improved clinical diagnosis and/or referral patterns, access to treatment and follow-up care? Mark as yes, if continuity of care is evident i.e., referral of screened positive patient and connection with access to care. • Yes • No	1
31	Does the plan mention cancer care network OR cancer care coordination framework OR Multi-Disciplinary Team (MDT) meetings? • Yes • No	1
32	Is there a mention of minimum or optimal time to treatment (starting from diagnosis) in the plan for a specified cancer or cancer in general? • Yes • No	1
33	Is there any mention of developing outpatient and ambulatory care such as building strong primary care-based systems or providing outreach services? • Yes • No	1
34	Does the plan mention about developing new infrastructure for cancer treatment/diagnosis/care in general? • Yes • No	1
35	Does the plan mention about upgrading or investing in latest equipment for cancer care? • Yes • No	1
Section: Governance (10) Maximum score 14		
36	Is there a mention to update the cancer plan at regular intervals; next update; or any mention of incorporating new elements in the plan as research and SH inputs are received/available? • Yes • No	1

37	Are Cancer goals specified? For example - 'Cancers are detected and treated at early stages, enabling more effective treatment and reducing morbidity and mortality.' • Yes • No	1
38	Plan objectives are SMART (Specific, Measurable, Attainable, Results-oriented, Time-phased)? • Yes • No	1
39	Does the plan make use of evidence to select/prioritize objectives and strategies? • Yes • No	1
40	Does it include current cancer statistics or a mention of the burden of cancer in the country? • Yes • No	1
41	Does it mention other programmes/plans and how strategies of NCCP will be integrated with those of the other plans? • NCD plan • Reproductive health plan • Health information Management system (HIMS) • Vaccination plan • Tobacco control plans • HIV control plan • Hepatitis Control plans • Any other (please specify)	5
42	Does the mentioned STGs state any alignment or connection to international guidelines, WHO or international bodies like European Society for Medical Oncology (ESMO) etc.? • Yes • No	1
43	Does the plan mention an apex body/leadership/role for cancer plan implementation specifically? • Yes • No	1
44	Is there a government funded HTA body that carries out health technology assessment? • Yes • No	1
45	Is the HTA process used for the reimbursement of cancer drugs in the country mentions the criteria in a transparent manner or allow for public review? • Yes • No	1
Section: Health Workforce (3) Maximum score 3		
46	Does the plan address health workforce for cancer? • Yes • No	1
47	Does the plan mention about building/training workforce for cancer including oncologists, surgeons, nurses, nuclear medicine specialists etc.? • Yes • No	1

48	Does the plan mention statistics related to cancer workforce on oncologists, surgeons, nurses, nuclear medicine specialists etc.? • Yes • No	1
Section: M&E (7) Maximum score 7		
49	Does the plan have a M&E section or an evaluation plan which is mentioned but is kept as a separate document? • Yes • No	1
50	Does the plan acknowledge any one of the following – • Global targets • Regional targets • National targets For example, does it talk about WHO goals for cancer? • Yes • No	1
51	Does the plan mention personnel dedicated to monitoring and evaluation? • Yes • No	1
52	Is there any mention of existence or the development of cancer registry? i.e., population based or hospital-based? • Yes • No	1
53	Is there a detailed M&E plan mentioned as part of the National cancer plan? • Yes • No	1
54	Are cancer targets and indicators stated? For example, 'Number of people accessing systemic anti-cancer therapies' • Yes • No	1
55	If no, is there a mention of development of clinical care or other indicators to monitor progress in the future? • Yes • No	1

S No.	Question	Score
Section: Research (5) Maximum score 5		
56	Does the plan address developing or improving data availability for cancer? For example, '...by improving cancer registries' • Yes • No	1
57	Does the plan mention improving/supporting research and innovation through funding, grants, or partnerships etc.? • Yes • No	1
58	Does the plan mention a cancer research strategy? • Yes • No	1
59	Does it mention research partnership with other organizations? • Yes • No	1

60	Does the plan mention support innovation for cancer drugs? • Yes • No	1
Section: Financing (14) Maximum score 17		
61	Is there a specified budgetary allocation made for prevention? • Yes • No	1
62	Is there a specified budgetary allocation made for screening and diagnosis? • Yes • No	1
63	Is there a specified budgetary allocation made for Treatment? • Yes • No	1
64	Is there a specified budgetary allocation made for Palliative, end-of-life or survivorship care? • Yes • No	1
65	Is there a specified budgetary allocation made to improve service delivery by developing infrastructure for treatment/diagnosis or investing in equipment or providing outreach services? • Yes • No	1
66	Is there a specified budgetary allocation made for Health workforce training/development for cancer? • Yes • No	1
67	Is there a specified budgetary allocation made for M&E? • Yes • No	1
68	Is there a specified budgetary allocation made for cancer research in the plan? • Yes • No	1
69	Does the plan acknowledge funding gap or sufficient availability of funds for cancer in the country? • Yes • No	1
70	Is there a strategy to address any financial deficit or lack of funds using one of the following • Sumptuary tax/taxes on tobacco etc. • Foreign aid/Development assistance for Health (DAH) • Any others • Yes • No	1
71	Does the plan mention the national health plan or the national health budget in the context of financing or allocation of funds for cancer care and/or research? • Yes • No	1
72	Is there a mention of a strategy or an effort to promote financial protection for patients against catastrophic expenditure or provision of affordable care? • Yes • No	1
73	Does the national health budget mention funding for cancer? • Yes • No	1

Section: Equity (10) Maximum score 14		
74	What are the cancers that are included in the plan? • Breast • Colorectal • Prostate • Lung • Liver • Others (please specify)	5
75	If yes, does it mention disease burden in diverse populations? • Yes • No	1
76	Does the plan have a section to address or mention equity or to eliminate inequity in cancer care? • Yes • No	1
77	Does the plan mention the use of telemedicine for cancer care. For example, for counselling, follow-up care etc. • Yes • No	1
78	Does the plan address or mention social determinants of Health? • Yes • No	1
79	Does the plan identify population at high risk for cancer or cancer mortality? • Yes • No	1
80	Does the plan mention any active effort or program to ensure equitable outcomes for cancer? • Yes • No	1
81	Does the plan mention cancer care access to vulnerable population groups? (Indigenous populations, LGBTQ+ and others) • Yes • No	1
82	Does the plan mention rare cancers? • Yes • No	1
83	Does the plan mention access to cancer care for rural populations? • Yes • No	1

[b] Geometric and not arithmetic aggregation was used to allow for non-compensation of dimension score upon aggregation; the highest dimension score of each dimension when geometrically aggregated will produce a score of 0.087.

[c] Scale (also called a questionnaire or an instrument) is defined as a set of items designed to measure a construct, also called latent variable or domain which cannot be measured directly but is composed of measurable domains. (Fabrigar & Ebel-Lam, 2017).

[d] Definition of NCCP given by Gorgojo et al (2019) was used - A national cancer control plan (NCCP) is a government document aiming to meet the strategic goals and support implementation of national cancer control activities in the country.

[e] As per World Health Organization (WHO) NCCP are defined as 'public health programmes designed to reduce cancer incidence and mortality and improve quality of life of cancer patients, through the systematic and equitable implementation of evidence- based strategies for the prevention, early detection, diagnosis, treatment and palliation, making the best use of available resources.

[f] According to the model, information about quality of care can be drawn from three categories: "structure," "process," and "outcomes."

Table A2: List of Dimensions under which the Items under 'Structure' are Classified

S. No.	Dimension	Number of questions	Maximum score
1	Prevention	1	5
2	Screening and diagnosis	7	11
3	Treatment	11	15
4	Palliative care	4	4
5	Service delivery	12	12
6	Governance	10	14
7	Health Workforce	3	3
8	M&E	7	7
9	Research	5	5
10	Financing	13	17
11	Equity	10	14
Total		83	103

Table A3: List of Questions under 'Process' and their Maximum Scores

S No.	Question	Score
1	Is there any information on the plan formulation process mentioned? For example, consultations organized, inputs taken, SHs engaged etc.	1
2	SHs consulted during the formulation of the NCCP? • Patient organizations • Public • Academic experts • International experts • Private Sector • Philanthropic organization • Others (please specify)	5
3	Is there any strategy for promotion and dissemination among key stakeholders?	1
4	Does the plan describe the process for prioritizing the strategies listed?	1
5	Is there a mention of any collaborations between the Government and the Private sector, NGOs, or the industry, for plan formulation or giving inputs to the plan?	1
6	Is there a mention of transparency in fund allocation and/or utilization for the activities mentioned in the plan?	1
7	Is there a mention of public consultation for the formulation/updating/implementation of the plan?	1
8	Was there a situational analysis using epidemiological and other parameters of cancer burden for the formulation of the plan?	1
Total score		12

Appendix B -Scale Development

We developed the scale[c] to score the National Cancer Control Plan (NCCP) [69] [d, e] of the countries included in our research using a combination of literature review and expert-informed iterative procedure which is described below.

The construct that we wanted to measure using our scale was the quality and comprehensiveness of NCCPs. To measure and score a complicated concept such as the quality of health policy we could not rely on proxy measures such as health outcomes since they are impacted by several other elements such as the health systems, social determinants of health etc. Hence, we needed to develop a set of specific questions or items to measure our construct-Quality and comprehensiveness of NCCP. All items or questions were included or excluded with this construct in mind and were grouped under 11 dimensions (Table B1).

As a starting point, we defined our construct - A NCCP can be called high quality and comprehensive when it is resource-appropriate, has outlined programmes to achieve its goals, recognizes innovative care and detailed the necessary funding and monitoring required to ensure successful and equitable implementation across the cancer care-continuum to address the disease burden in the country.

Scale development

Generation of items

After identifying the construct and its operational definition we identified key items that should be a part of a NCCP from the existing literature. Some additional aspects like the use of innovative medicine and newer technologies like telemedicine, and finally concepts like health equity were added. The question format was kept mostly dichotomous with a Yes or No answer to lend objectivity to the scoring.

Based on this initial list of items generated, we conducted a literature review to add more items deductively by studying existing scales, questionnaires, frameworks, or guidance documents from a variety of sources including the World Health Organization (WHO), International Atomic Energy Agency (IAEA), European Union (EU), Center for Disease Control (CDC), International Cancer Control Partnerships (ICCP), Association of European Cancer Leagues, Union for International Cancer Control (UICC) and others including academic articles [36,47,48,69-78]. For a complete list of tools and frameworks, please see (Table B2).

Donabedian's Structure, Process, and Outcome framework[f] of examining health services and evaluating the quality of health care [79] was adapted to develop a framework for policy evaluation with health outcomes being the result of the policy structure and process. (see figure B1) We argue that the process by which a NCCP was formulated is just as important as the structure of the plan. Hence, a set of items under the heading 'process' was added in the NCCP evaluation which looked at the inclusiveness and transparency of the plan formulation process.

We adapted the Donabedian's framework in the policy evaluation space as a framework where-

• The structure includes the contents of the policy documents, what they focus on and plan to address. For example, the Cancer care continuum, equity, monitoring and evaluation etc. Although their mere inclusion does not ensure effective implementation, it does establish accountability and creates systems for action, for example, the inclusion of an M&E section in the plan would mean that there are personnel and mechanisms in place to carry it out.

• The process includes 'How' the policy or the plan was arrived at. It is just as important as the structure since policies that are inclusive and are made in consultations with the end users, patients and healthcare providers tend to be grounded in lived experiences and have a higher acceptability [80,81]. Furthermore, A key strategy employed by democratic governments to enhance their legitimacy and reputation has been the adoption of measures aimed at fostering public participation in policymaking, thereby increasing procedural transparency while embedding decisions in sound scientific evidence [82,83]. The evidence-based nature of the NCCPs is also assessed under the process head.

• Outcomes include the health outcomes for the disease area that the plan or policy in question addresses. In this case where we are concerned with the evaluation of NCCPs the health outcomes of relevance will be cancer mortality and other parameters related to cancer, for example, survival rates, incidence rates etc. Outcomes were not included in the analysis of this study since our focus was on exploring the relationship between democracy and health policies.

Refinements

Refinements were made iteratively in discussion with health policy experts, researchers and end-users of the NCCP scale (see figure B2 for more details). A preliminary review of resources yielded 113 potential items for structure and 12 items for process. Following the removal of overlapping items to reduce redundancy, merging some items to achieve harmonization and with the addition of some items suggested by experts, we arrived at 83 items for structure and 8 items for process which were included in the questionnaire. Finally, experts advised the categorization of the finalized list of items under dimensions which built upon the pre-defined evidence-informed domains given by Oar et al 2019. For the final list of items and dimensions see Appendix A.

Validation

Since, the country selection was not done randomly and the main objective of this study was not to develop a scale, partly because several scales have been proposed by others most notably by Oar et al [75]. Therefore, exploratory and confirmatory factor analyses were not carried out and the item reduction and assignment of dimensions were done solely based on expert consultations and validation.

Pre-testing

The scale was tested on a set of 5 countries and researcher feedback was incorporated in adjusting the language and order of some

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[a] For a detailed description of the methods adopted to choose the items and design the questionnaire; finalize the items and its dimensions; and methodologies for weighting and aggregation please see Appendix B.

question items before beginning research on all forty countries included in the sample. Before commencing research, consensus was achieved between the authors and health policy experts involved in the refinement and validation of the scale that it is optimum in length, and the included items measure the construct of quality and comprehensiveness of NCCPs.

Weighting

Weights were assigned to the dimensions using Budget allocation (BAL) which is a participatory method including experts who are given a "budget" of N points (100 in our case), to be distributed over several sub-indicators or dimensions, "paying" more for those indicators whose importance they want to stress. This was done in three phases (1) selection of experts from a wide spectrum of knowledge, and experience including in the field of global health policy, patient advocacy, and governance. The panel of experts also included Healthcare providers and policymakers. (2) Budget allocation by experts; (3) calculation of weights [37,39,84].

The following process was followed -

• **Identify the Dimensions:** The first step was to identify the dimensions that made up the composite indicator-NCCP score. The scale items have been classified under these dimensions. Table B1 describes the dimensions of our scale.

• **Collect Expert Input:** We gathered a diverse panel of experts-Healthcare providers, policymakers, global health experts, academicians, patients and patient advocates. These experts were responsible for assigning weights to the dimensions. They were reached out via email with a brief overview of the study, description of the dimensions as per table B1, and the instruction for weighting using Budget Allocation method.

• **Budget Allocation Process [39]:** In the budget allocation process, each expert is given a hypothetical budget (100 points) that they can allocate across the different dimensions. The idea is that the more important a dimension is, the more of their budget an expert would allocate to it.

• **Normalize the Weights:** After all experts had allocated their budgets, we normalized the weights for each dimension. This was done by dividing the total points allocated to each dimension by all experts by the total points allocated across all dimensions (number of experts multiplied by 100). This gave us a weight between 0 and 1 for each dimension. (Table B3)

• **Calculate the Composite Indicator:** We multiply each dimension score by its weight and then geometrically aggregated these values to get the composite score for NCCP. We chose geometric aggregation over linear aggregation because when different dimensions are equally legitimate and important, then a non-compensatory logic is better suited (geometric mean). This is usually the case when very different dimensions are involved in the composite, like in our case for example, equity, financing and continuum of care are included.

Table B1: NCCP index dimensions and their description.

S. No.	Dimension	Description	Number of questions	Total score
1	Prevention	The plan focuses on strategies to identify and prevent risk factors for cancer	1	5
2	Screening and diagnosis	The plan focuses on improving the awareness, availability, and access to cancer screening and early diagnosis programs.	7	11
3	Treatment	The plan focuses on the development and use of clinical guidelines, availability of anti-cancer medications including innovative medicines, multi-disciplinary treatment, treatment of meta-static cancer, and quality treatment access in optimal time.	11	15
4	Palliative care	The plan mentions pain management and home-based or institution-based palliative care	4	4
5	Service de-livery	The plan focuses on developing outpatient and ambulatory care - strong primary care-based systems or providing outreach, developing infrastructure and equipment for delivering effective cancer care.	12	12
6	Governance	The plan ensures there is an apex body or leadership for cancer plan implementation.	10	14
7	Health Work-force	The plan focuses on building/training the healthcare workforce to adequately address the pop-ulation's needs and mentions the relevant statistics.	3	3
8	M&E	The plan mentions cancer targets, KPIs, and/or a detailed M&E plan and focuses on the devel-opment of a cancer registry and the availability of data.	7	7
9	Research	The plan focuses on research partnerships, developing a research strategy, and supporting innovation.	5	5

10	Financing	The plan acknowledges the funding gap (if any), addresses the sustainable flow of funds for cancer care, and recognizes the annual budget for cancer in the country.	13	17
11	Equity	The plan has strategies for improving cancer care access in vulnerable, marginalized, and rural populations. It identifies populations at high risk for cancer and addresses health equity.	10	14

Table B2: Tools and Framework that informed the Structure of the NCCP assessment framework.

S No.	Name	Agency/Organization	URL
1	European Guide for quality national control programs (Tit Albreht), 2015	National Institute of Public Health, Slovenia, European Union, European Partnership against cancer	https://www.cancercontrol.eu/archived/up-loads/images/European_Guide_for_Quality_National_Cancer_Control_Programmes_web.pdf
2	Cancer plans self-assessment tool (2012)	CDC	https://www.iccp-portal.org/system/files/resources/CancerSelfAssessTool.pdf
3	National Cancer Control Plan Development and Implementation Assessment Tool (2017)	ICCP	https://www.iccp-portal.org/sites/default/files/resources/ICCP%20Cancer%20Plan%20Dev%20and%20Impl%20Assessment%20Tool%20Jan%202016.pdf
4	Strategizing national health in the 21st century: a handbook (2016)	WHO	https://www.who.int/publications/i/item/9789241549745
5	WHO-IAEA NCCP core-self assessment tool (2011)	WHO IAEA	https://www.who.int/publications/i/item/national-cancer-control-programmes-core-capacity-self-assessment-tool
6	Planning a National Cancer Control Programme chapter from the WHO NCCP: Policy and Managerial Guidelines (2002)	WHO	https://iris.who.int/bitstream/handle/10665/42494/9241545577.pdf?sequence=1
7	Cancer Control: Knowledge into Action WHO Guide for Effective Programmes series	WHO	https://pubmed.ncbi.nlm.nih.gov/24716263/
8	Comprehensive Cancer Control Branch Program Evaluation Toolkit	WHO	https://www.cdc.gov/cancer/ncccp/prog_eval_toolkit.htm
9	Assessing national capacity for the prevention and control of noncommunicable diseases: report of the 2021 global survey	WHO	https://www.who.int/publications/i/item/9789240071698

Table B3: Weighting of the index dimensions by experts

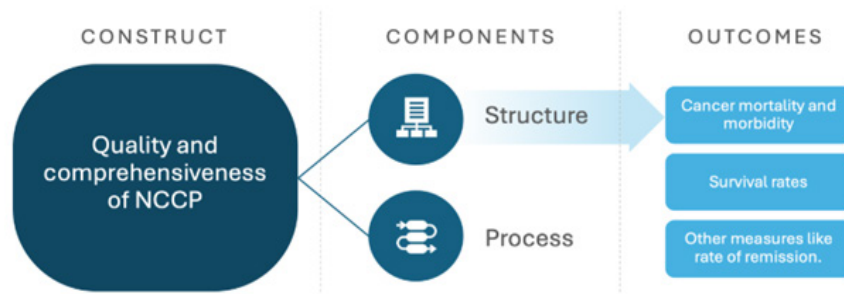|	Dimensions										
Name of the Expert	1	2	3	4	5	6	7	8	9	10	11
Expert1	x1										
Expert2	x2										
Expert nth	xn										
Total weight assigned	x										
Total weight/ budget available	n*100	n*100	n*100	n*100	n*100	n*100	n*100	n*100	n*100	n*100	n*100
Weight of the dimension	x/n*100										

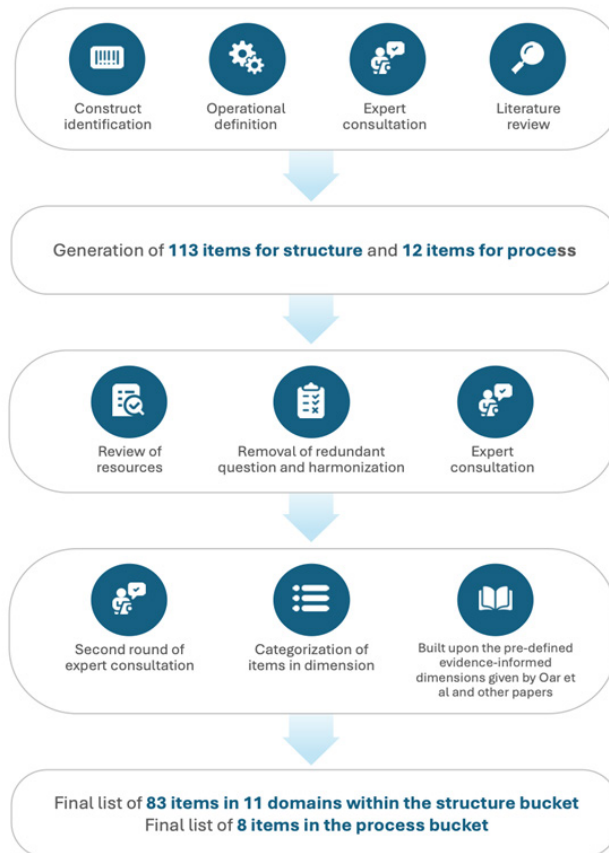**Figure B1:** Framework of assessment of NCCPs.

Figure B2: Generation of questionnaire items.

Appendix C: Selected countries (alphabetical order) by regime type, region, and World Bank (WB) income level.

Country	Regime	Region	Income level (WB)
Algeria	EA	Africa and Middle East	LMIC
Argentina	ED	Americas	UMIC
Australia	LD	Asia and Oceania	HIC
Brazil	ED	Americas	UMIC
China	CA	Asia and Oceania	UMIC
Colombia	ED	Americas	UMIC

Costa Rica	LD	Americas	UMIC
Cuba	CA	Americas	UMIC
Egypt	EA	Africa and Middle East	LMIC
El Salvador	EA	Americas	UMIC
France	LD	Europe	HIC
Germany	LD	Europe	HIC
Ghana	ED	Africa and Middle East	LMIC
Haiti	CA	Americas	LMIC
Hungary	EA	Europe	HIC
India	EA	Asia and Oceania	LMIC
Indonesia	ED	Asia and Oceania	UMIC
Iran	CA	Africa and Middle East	LMIC
Italy	LD	Europe	HIC
Japan	LD	Asia and Oceania	HIC
Kenya	ED	Africa and Middle East	LMIC
Mexico	ED	Americas	UMIC
Namibia	ED	Africa and Middle East	UMIC
Nepal	ED	Asia and Oceania	LMIC
Nigeria	EA	Africa and Middle East	LMIC
Pakistan	EA	Asia and Oceania	LMIC
Poland	EA	Europe	HIC
Portugal	ED	Europe	HIC
Qatar	CA	Africa and Middle East	HIC
Russia	EA	Europe	UMIC
Saudi Arabia	CA	Africa and Middle East	HIC
South Africa	ED	Africa and Middle East	UMIC
South Korea	LD	Asia and Oceania	HIC
Spain	LD	Europe	HIC
Tanzania	EA	Africa and Middle East	LMIC
Thailand	EA	Asia and Oceania	UMIC
Türkiye	EA	Europe	UMIC
UK	LD	Europe	HIC
USA	LD	Americas	HIC
Vietnam	CA	Asia and Oceania	LMIC

Abbreviations: NCCP: National Cancer Control Plan; CA: Closed Autocracy; EA: Electoral Autocracy; LD: Liberal Democracy; ED: Electoral Democracy; IMR: Infant Mortality Rate; ICCP: International Cancer Control Partnership: MoH: Ministry of Health; WHO: World Health Organization; GDP: Gross domestic product; BAL: Budget Allocation; WGI: World Governance Indicator; GII: Gender Inequality Index; GDI: Gender Development Index; NCDs: Non-communicable Diseases; PCA: Principal Component Analysis; FA: Factor Analysis; AIC: Akaike Information Criterion

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