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A Comparative Analysis Of Multiple Indices of Wellbeing, Vitality and Multiple Deprivation For Communities in Newfoundland and Labrador, Canada

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A Comparative Analysis of Multiple Indices Of Wellbeing, Vitality and Multiple Deprivation For Communities in Newfoundland And Labrador, Canada

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Abstract

Indices of overall socio-economic conditions of communities are important for both researchers and community practitioners. Many types of quantitative indices are available for rural, remote and coastal communities in Canada that measure different aspects and dimensions of overall socio-economic conditions. Herein, we present a comparative analysis of four indices for a select number of communities in Newfoundland and Labrador to explore and illustrate these differences. Included in this analysis are two indices of wellbeing, one of vitality, and one of deprivation. Quantitative correlation measures are used to explore similarities and differences among the four indicators, complemented by a meta-analysis answering 'who, what, why, when, where and how' questions about each indicator. Results illustrate that due to differences in purpose, terms and definitions, time periods covered, spatial representation and methodologies, the interpretability and application of such indices must be done with caution. Our results provide a useful example for researchers and practitioners to use as a guideline when using these types of community indices.

Keywords: community, wellbeing, vitality, socio-economic, Newfoundland and Labrador

Une analyse comparative de plusieurs indices de bien-être, de vitalité et de privation multiple Pour les communautés de Terre-Neuve Et Labrador, Canada

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Resumé

Les indices des conditions socio-économiques globales des communautés sont importants tant pour les chercheurs que pour les praticiens communautaires. De nombreux types d'indices quantitatifs sont disponibles pour les communautés rurales, éloignées et côtières du Canada et mesurent différents aspects et dimensions des conditions socio-économiques globales. Nous présentons ici une analyse comparative de quatre indices pour un certain nombre de communautés de Terre-Neuve-et-Labrador afin d'explorer et d'illustrer ces différences. Cette analyse comprend deux indices de bien-être, un de vitalité et un de privation. Des mesures de corrélation quantitatives sont utilisées pour explorer les similitudes et les différences entre les quatre indicateurs, complétées par une méta-analyse répondant aux questions « qui, quoi, pourquoi, quand, où et comment » sur chaque indicateur. Les résultats montrent qu'en raison des différences dans l'objectif, les termes et définitions, les périodes couvertes, la représentation spatiale et les méthodologies, l'interprétabilité et l'application de ces indices doivent être faites avec prudence. Nos résultats fournissent un exemple utile que les chercheurs et les praticiens peuvent utiliser comme ligne directrice lors de l'utilisation de ces types d'indices communautaires.

Mots-clés : communauté, bien-être, vitalité, socio-économique, Terre-Neuve-et-Labrador

1.0 Introduction

The use of indices that capture the overall socio-economic conditions of communities is becoming increasingly important in assessing the cumulative effects of new developments related to renewable energy and natural resources (Antwi et al., 2023) and of particular importance in the conduct of regional and project-specific impact assessments (Eddy et al., 2024). Such indices are a useful starting point for assessing socio-economic conditions as part of a social component of cumulative effects and impact assessments. For these purposes, because socio-economic conditions need to be assessed in conjunction with environmental and natural resources dimensions, it is desirable to have socio-economic data and indices that are spatially explicit at a community level.

A collaborative research project between Natural Resources Canada (NRCan) and Memorial University of Newfoundland-Grenfell Campus was initiated in 2023 to explore and compare several indices for these purposes, with the aim of contributing to anticipated future assessments (Eddy et al., 2024; Marine Biomass Innovation Project [MBI], 2024). This research note serves to document our findings and share our experience in the assessment, interpretation and use of such indicators, not only for Newfoundland and Labrador, but for the benefit of practitioners who use these indicators elsewhere in Canada.

Herein, we provide results of a comparison of four existing quantitative indices:

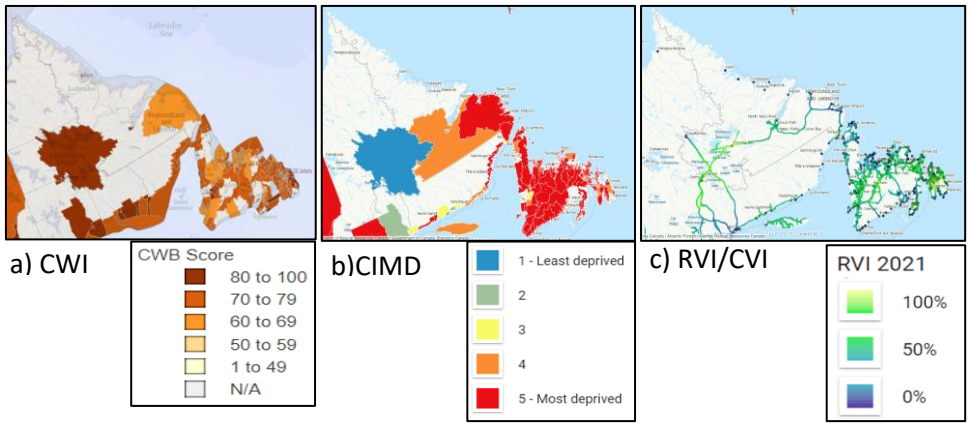
1. the Canadian Wellbeing Index (CWI) (ISC, 2021),
2. the Canadian Index of Multiple-Deprivation (CIMD) (Statistics Canada [StatsCan], 2024),
3. the Newfoundland and Labrador Wellbeing Index (NLWI) (NLCA, 2021), and
4. the Regional and Community Vitality Index (RVI/CVI) (Natural Resources Canada, 2024; Eddy, 2024).

Maps for three of these indices presented in Figure 1 reveal similarities but also notable differences in how regions in the province are portrayed. Differences in definitions, indicators, measurement scales, and cartographic stylizations result in contrasting regional characterizations at a provincial scale.

Three of the four indices (1, 2, and 4) were selected as a subset of a larger number of indices reviewed by Eddy (2024) on the basis that they are mappable at a community level and cover all of Canada. The NLWI is included for its coverage of all of Newfoundland and Labrador[1] Key characteristics of these indices were reviewed and compared, including authorship, purpose, scope, and methodology. This was followed by a comparative analysis of calculated index values for a sample of fifty communities in Newfoundland and Labrador. Finally, we reflected on factors that explain why index values may not correlate well on an individual community or subregional level and offer suggestions when applying them for research or practical application at this scale, and further offer recommendations for future research.

[1] Other indices considered for this analysis include: (1) Social Vulnerability Index (Chakraborty et al., 2020) (data not available); (2) Socio-Economic Status Index (Chan et al., 2015) (not mappable geographically); (3) Canadian Social Vulnerability Model (Journeay et al., 2022) (data only available at a neighbourhood level); and (4) Canadian Index of Wellbeing (Scott, 2016) (not mappable geographically).

Figure 1: Online maps showing three types of community indices: (a) CWI (ISC, 2016); (b) CIMD (StatsCan, 2024); and (c) RVI/CVI (Eddy, 2024; NRCan, 2024). (*Note:* No map was available for the NLWI (NLCA, 2021) at time of publication).



2.0 Methodology

Our methodology involved a two-stage process. First, we compared the key characteristics of each index under consideration, drawing from official documentation for each index. Answering "who, what, why, and where, when and how" questions about each index included the author or creator of each, purpose, spatial and temporal coverage and delineations, and methodologies (see Table 1). Indicators and/or variables included within each index, as well as how they were represented and ranked, were reviewed.

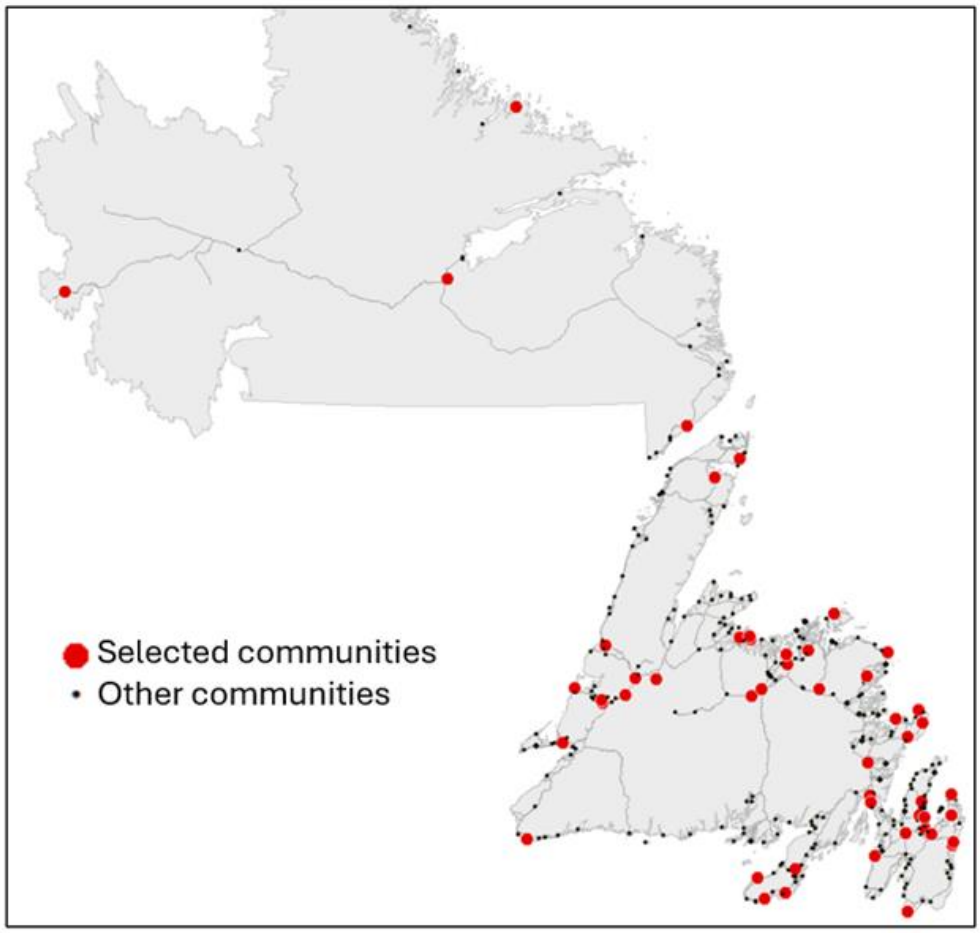
We then compared index scores for a semi-random sample of communities across the province of Newfoundland and Labrador (see Figure 2). The majority of communities in the province are smaller rural and coastal communities. A purely random sample selection, therefore, resulted in a bias of smaller coastal communities on the island portion of the province over larger cities and towns and communities in Labrador. Therefore, a semi-random approach was taken to ensure sufficient representation based on community size and geographic distribution. This included larger cities and towns, as well as several communities in Labrador, to ensure this representation in the sample. The remainder of the communities were selected randomly. The communities were selected from the CanEcumene 3.0 Geodatabase as it contains a standardized representation for all communities in Canada (NRCan, 2024; Eddy et al., 2020). A sample of 50 communities (16%) were selected from a total of 314 and deemed sufficient for comparative analysis (see Table 2).

Data values for each index were collected for each community using respective online tables and maps (see Table 2). This task proved challenging for some communities due to the different spatial units used for each index, as described further below. Data values were unavailable for five communities with the NLWBI, and eight communities with the CWI.

Table 1. *Comparison of Four Community Indices Used in This Study.*

	Indicator	RVI/CVI	NLWBI	CWBI	CIMD
WHO	**Author**	Natural Resources Canada (NRCan), Atlantic Forestry Centre (AFC)	NL Community Accounts, Department of Finance / Newfoundland and Labrador Statistics Agency (NLCA)	Strategic Research and Data Innovation Branch, Indigenous Services Canada (CIRNAC)	Canadian Centre for Justice and Community Safety Statistics (CCJCSS), Statistics Canada
WHAT	**Description**	Spatially explicit indicators of regional and community vitality as overall socio-economic conditions.	An overall index of wellbeing for communities in NL derived from multiple indicators.	Measures the socio-economic wellbeing of First Nations, Inuit, and non-Indigenous communities in Canada.	A measure of deprivation for an understanding of inequalities.
WHY	**Purpose**	Mapping socio-economic conditions for use in natural resource and environmental management applications.	To better understand factors that determine the progress of communities and regions.	Identify gaps in wellbeing between Indigenous and non-Indigenous.	Understand social inequalities by region, especially outside major urban centres.
WHERE	**Spatial Coverage**	National	Provincial (NL)	National	National
	Spatial Units	Ecumene places (derived from night lights imagery)	Communities using postal codes	Census subdivision (CSD)	Census Dissemination area (DA)
WHEN	**Time Coverage**	2001, 2006, 2011, 2016, and 2021	Data for various indicators may be taken from different years.	1981, 1991, 1996, 2001, 2006, 2011, 2016, and 2021	2016, 2021
	Time Interval	Every five years (census-based)	Ongoing	Every five years (census-based)	Every five years (census-based)
HOW	**Methodology**	CVI scores calculated as the average of five indicators: population change, age structure, education, employment and economic wealth, as standardized percentile rank values (0-1).	Approx. 30 variables ranked according to an indication of wellbeing. CWB score calculated as the number of top and bottom 25th percentiles. Values range from -15 to + 15.	CWB score (0-100) calculated as an average of four indicators: education, income, labour force, and housing. Each indicator was calculated differently.	Principal component analysis on 22 census variables, four components: economic dependency, ethno-cultural composition, residential instability and situational vulnerability. Scores assigned on a 1-5 scale.

Figure 2. Location of selected communities for analysis.



Source: CanEcumene 3.0 Geodatabase (Eddy et al., 2020).

Another important difference among indices is the associated timeframes. CVI, CWI and CIMD values are taken for the year 2021 (the most recent year available at the time of this analysis). The NLWBI values are, however, averaged from subdimensions that are collected at various time periods between 2016 and 2021 (Greg Tucker, personal communication). Therefore, a CVI value was also averaged for both 2016 and 2021 for comparison with the NLWBI. These and other differences between the indices are acknowledged as a limitation and considered further in the comparative analysis of index values that follows. In comparing community-level assessments according to their index values, Pearson's r correlation values are used along with visualization of correlations in a scatter plot matrix.

3.0 Results

3.1 Index Comparison

As illustrated in Table 1, three of four indices were developed by federal government departments, while NLWI considers NL communities specifically and was developed as part of the provincial Community Accounts system for Newfoundland and Labrador. Three consider wellbeing or vitality, while the CIMD, in contrast, aims to

measure aspects of deprivation. All provide a way to better understand inequalities but for different purposes (RVI/CVI on natural resource development, for example, versus the comparison of Indigenous and non-Indigenous communities in CWBI).

Table 2. *Community index values for select communities in Newfoundland and Labrador*

ECUID	ECUName	PopCat21	PopCatDesc21	CVI21avg	CVIAvg1621	NLWBI	CWBI21	CIMD_AVG
64	St. John's	7	Large City	0.58	0.60	8	84	3.8
79	Corner Brook	5	Small City	0.53	0.56	6	80	4.0
28	Happy Valley-Goose Bay	4	Large Town	0.46	0.54	7	83	2.3
57	Gander	4	Large Town	0.53	0.57	9	81	2.5
60	Clarenville	4	Large Town	0.56	0.57	11	81	2.5
61	Grand Falls-Windsor	4	Large Town	0.48	0.52	5	78	1.8
62	Carbonear	4	Large Town	0.45	0.47	4	76	3.3
65	Labrador City	4	Large Town	0.62	0.58	11	86	1.8
66	Bay Roberts	4	Large Town	0.44	0.51	4	78	3.0
92	Marystown	4	Large Town	0.47	0.47	-2	76	3.3
102	Stephenville	4	Large Town	0.49	0.53	2	75	2.5
55	Lewisporte	3	Small Town	0.47	0.52	3	76	3.3
73	Deer Lake	3	Small Town	0.44	0.46	2	77	3.5
133	Channel-Port aux Basques	3	Small Town	0.33	0.39	4	76	3.0
1312	Bonavista	3	Small Town	0.35	0.34	-2	73	3.8
1313	Bishop's Falls	3	Small Town	0.47	0.46	-3	75	3.3
1315	Pasadena	3	Small Town	0.56	0.62	10	81	3.3
1316	Grand Bank	3	Small Town	0.36	0.38	1	74	3.5
1317	St. Anthony	3	Small Town	0.46	0.45	9	79	2.5
1346	Fogo	3	Small Town	0.42	0.39	2	75	2.8
1479	Holyrood	3	Small Town	0.62	0.67	9	81	2.0
4258	Pouch Cove	3	Small Town	0.52	0.56	6	80	2.5
1533	Summerside	2	Village	0.47	0.53	6	77	3.0
4238	Whitbourne	2	Village	0.62	0.64	4	76	3.3
1459	Conception Harbour	2	Village	0.55	0.60	-1	76	3.3
1620	Port Rexton	2	Village	0.65	0.59	3	80	2.8
1367	Birchy Bay	2	Village	0.38	0.39	-4	70	3.3
1472	Point Verde	2	Village	0.70	0.71			3.0
4222	Arnold's Cove	2	Village	0.52	0.51	2	77	3.0
1402	Howley	2	Village	0.59	0.57	-4	69	2.8
1366	Lark Harbour	2	Village	0.41	0.46	-3	73	3.3
1418	Makkovik	2	Village	0.21	0.25	1	71	2.5
1537	Norris Point	2	Village	0.43	0.43	3	74	2.8
1618	Catalina	2	Village	0.35	0.39			3.8
4251	Southside	2	Village	0.60	0.62			3.3
1331	Triton	2	Village	0.34	0.35	2	75	3.0
4221	Witless Bay	2	Village	0.57	0.62	15	83	2.3
857	Red Bay	1	Hamlet	0.28	0.28	3	70	3.0
1403	Come By Chance	1	Hamlet	0.32	0.44	0	73	2.8
1570	Miles Cove	1	Hamlet	0.26	0.29	1	67	3.3
1508	Little St. Lawrence	1	Hamlet	0.53	0.46	4		3.0
1390	Main Brook	1	Hamlet	0.42	0.35	-1	68	3.3
1604	Cape Freels North	1	Hamlet	0.40	0.47	3		3.0
4242	Lord's Cove	1	Hamlet	0.58	0.58	-1	68	3.5
1579	Little Burnt Bay	1	Hamlet	0.31	0.33	-4	68	3.3
1614	Tickle Cove	1	Hamlet	0.14	0.37			2.8
1466	Mobile	1	Hamlet	0.81	0.74	10		2.5
1572	Brighton	1	Hamlet	0.36	0.25	2	74	3.0
1606	Indian Bay	1	Hamlet	0.30	0.35	-9	65	3.5
4256	St. Shotts	1	Hamlet	0.18	0.18			3.0

From a physical geography standpoint, our definition of *community* is any geographic area with concentrated human settlement (Poland & Maré, 2005). How such areas are delineated in practice often varies depending on the geographic scale of mapping and the methodology used. The CWBI, CIMD, and NLWI use CSD, DA, and postal code boundaries, respectively, while the RVI/CVI uses a

combination of regional (interpolation) and community (point) representations. Timeframes also varied, as discussed above. NLWBI values are averaged from data collected at various time periods between 2016 and 2021, differing from the other indices, which are typically based on census data gathered every five years. This is in part due to the wide-ranging provincial wellbeing framework, including seven different dimensions and data from diverse sources, including the Canadian Community Health Survey, tax filer information, and custom tabulations from the 2016 Census that are not yet completed for 2021 data (NLCA, 2024).

Each index also uses a different measurement scale. CVI uses a (0-1) interval, the NLWBI uses a (-15 – 15) range, the CWI uses a (0-100) interval, and the CIMD uses a (1-5) interval. The CIMD provides index values on a scale of (1-5) for four dimensions. The average of the four dimension values were calculated as an overall CIMD index (CIMD_AVG in Table 2). Similarly, CWBI calculates an overall average index across four indicators and RVI/CVI across five indicators. The NLWBI index, in contrast, calculates an overall community score by subtracting the number of indicators where the community is in the bottom 25th percentile from those in which they are in the top 25th percentile.

Another key consideration is the dimensions of wellbeing that are assessed within each index. All four indices consider measures associated with income, employment, and education, whereas three of four include housing and/or residential (in)stability. Health, life satisfaction, and sense of belonging are uniquely considered in the NLWI, and ethno-cultural composition is unique to the CIMD. Changes in demographic indicators such as population and age structure are considered in RVI/CVI and NLWBI.

3.2 Comparison of Index Values for Selected Communities

Table 2 provides index values for a sample of 50 communities across Newfoundland and Labrador. Statistical parameters for the five index values are presented in Table 3, and Pearson's r correlation values are presented in Table 4, along with a scatter plot matrix in Figure 3. It is first worth noting the high correlation between the CVI21avg and the CVIavg1621 values. This is somewhat expected due to these being the same indicator, but the latter includes values for the year 2016. Both the CVI21avg and CVIavg1621 values show a moderate positive correlation with the NLWBI, with Pearson r values equal to 0.53 and 0.56 respectively. The Pearson's r correlation value for the NLWBI and the CWBI21 is also high at a value of 0.84, while correlation values between the CVI21avg and the CVIavg1621 are slightly less at 0.64 and 0.67, respectively. Correlation values for the CIMD_AVG are much weaker and trend in the negative direction in comparison with all other indices.

Table 3. *Statistical Distribution Parameters for the Four Indices*

Descriptive Statistics	CVI21avg	CVIAvg1621	NLWBI	CWBI21	CIMD_AVG
Valid	50	50	45	42	50
Mean	0.46	0.48	3.07	75.69	3
Std. Error of Mean	0.02	0.02	0.73	0.77	0.07
Std. Deviation	0.14	0.13	4.87	4.96	0.49
Coefficient of variation	0.3	0.26	1.59	0.07	0.16
Minimum	0.14	0.18	-9	65	1.8
Maximum	0.81	0.74	15	86	4

Table 4. *Pearson's r correlation values for the four indices.*

Variable		CVI21avg	CVIAvg1621	NLWBI	CWBI21	CIMD_AVG
1. CVI21avg	Pearson's r	—				
	p-value	—				
2. CVIAvg1621	Pearson's r	0.92	—			
	p-value	0.000	—			
3. NLWBI	Pearson's r	0.53	0.56	—		
	p-value	0.000	0.000	—		
4. CWBI21	Pearson's r	0.64	0.67	0.84	—	
	p-value	0.000	0.000	0.000	—	
5. CIMD_AVG	Pearson's r	-0.21	-0.24	-0.52	-0.42	—
	p-value	0.15	0.10	0.000	0.000	—

4.0 Discussion

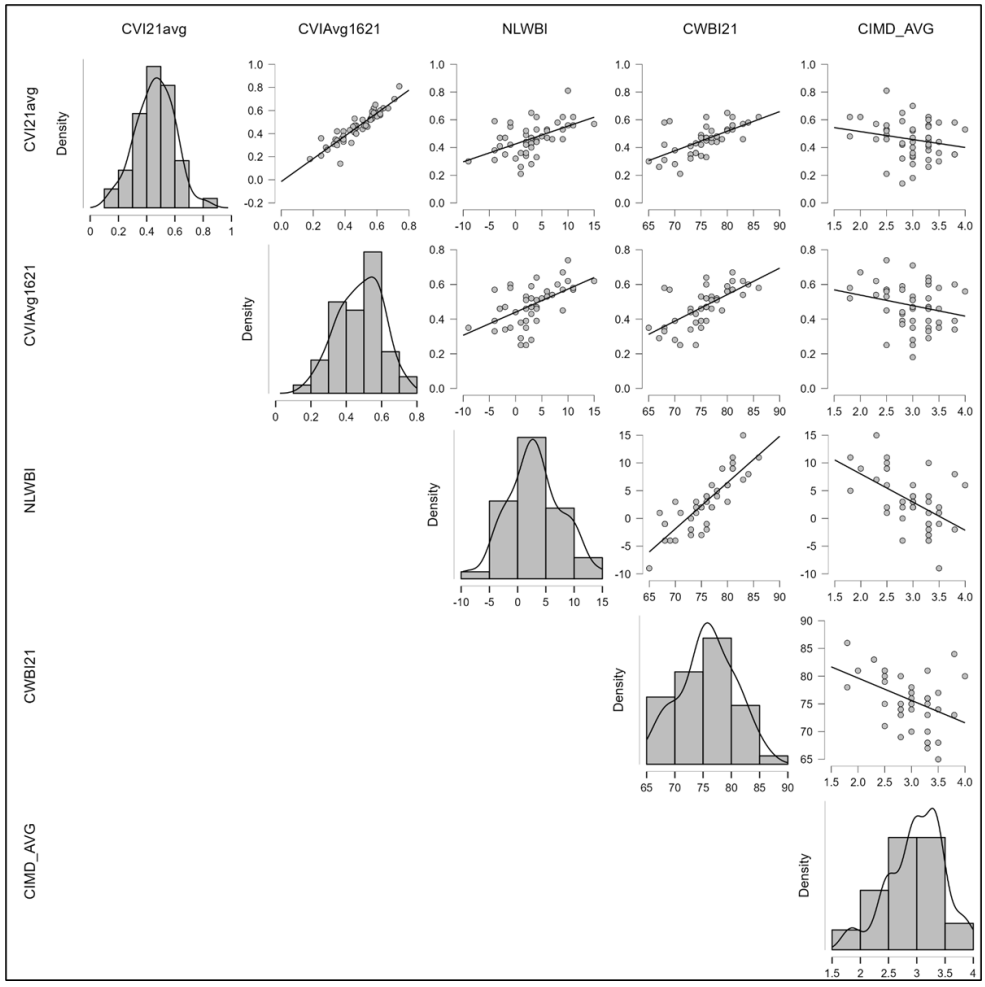
Overall, the results of community-based index values illustrate moderate to high positive correlations among all indices, apart from the CIMD, which shows a weak negative correlation with the other indices. Although this indicates some agreement among three of the four indices overall, index values may not correlate very well on an individual community or subregional level, and caution should be exercised when applying them for research or practical application. The information provided in Table 1 can be used as a starting point for a more thorough critical analysis.

For our purposes, several factors stand out. The first is the relationship among the organizations and authors (*who*), the description of *what* they are studying, and the *purpose* of the index/indicator. There are notable differences in the *what* factor in that they each focus on a different aspect of overall community conditions. The RVI/CVI focuses on *vitality*; the NLWBI and CWBI focus on *wellbeing*, and the CIMD focuses on *multiple deprivations*. The focus on deprivation, including consideration of factors related to ethno-cultural composition, for example, may partially account for its weak correlation with other indices. Rationales for the choice of focus and terms and how these terms are defined and ultimately measured are closely tied to the purpose they serve and further linked to the method (*how*) in terms of which data sources or sub-indicators are used to construct the overall index.

Especially important are the spatial (*where*) and temporal (*when*) factors. Whereas three sources are national in scope, the NLWBI covers only the Province of Newfoundland and Labrador. The geographic scope has bearing on the choice of the spatial and temporal scale of analysis, including the selection of spatial units (how a community is defined) and the time intervals selected within the chosen timeframe. These spatial and temporal factors, in turn, also have a bearing on the methodology in terms of data sources available and choice of analytical methods.

As mentioned above, the data variables used in the NLWBI were collected, for example, at different time intervals between the years 2016-2021, whereas the other indices rely primarily on Canada Census data collected regularly at five-year intervals. This was linked to the inclusion of indicators such as health and sense of belonging in the NLWBI, with differing data sources. Even among those that use standard census data, the time intervals and range vary.

Figure 3: Scatter plot matrix for the four indices. See text for discussion.



Most notable for mapping purposes are the choices made for the spatial framework and spatial units of analysis. None of the indices use the same spatial framework, including the three indices that use Census data. The NLWBI use postal codes for communities, while the CWBI uses standard CSDs. These may be similar in most cases, but rarely exact. The CIMD uses Census DAs, which are more detailed than CSDs, and the RVI/CVI uses the CanEcumene Geodatabase which uses natural boundaries for all communities in Canada.

5.0 Conclusions

This research note aims to provide readers with insights into the similarities and differences across indices to aid in their application and communication. At issue is how such indicators can be used in applied settings in terms of providing baseline information for assessing future impacts of resource development or other regional economic development initiatives, for example. Differences in measurement scales, methodologies used, and other factors can present a challenge for practitioners interpreting these indicators, which can further be an impediment to communicating with communities and stakeholders. This is significant given

the demonstrated potential for indices in facilitating discourse and shared understanding (Holman, 2009).

While there is some agreement among three of the four indices, it is important to keep in mind that each index aims to measure a different aspect of overall community conditions, and for different purposes. They cover different levels of geographic detail and scope, are measured at different time intervals and use different methodologies. It is also worth noting that the primary data used in each of these indices are derived from surveys that can have varying degrees of accuracy along the urban-to-rural spectrum of community size and location, including Canada's community census data (Beckley et al., 2002; Deziel, 2022). While acknowledging such differences and limitations, they collectively provided different perspectives on the overall socio-economic conditions of communities and regions for Newfoundland and Labrador and for all of Canada (for those with national coverage). No one index should be considered more correct than the others, and nor would we advise the use of only one index as an indication of overall community conditions. A suggested practice is to use a combination of indices when interpreting the conditions of individual communities or regions, while being cognizant of their differences and purpose.

Future research efforts should include a detailed review of the similarities and differences in the values assigned to specific communities by each index, including a critical analysis of the implications of such comparisons and how such indices have and can, ultimately, contribute to enhanced wellbeing. Limitations of using quantitative approaches exclusively using standardized datasets assessing wellbeing are also well documented (see for example, Beckley et al., 2002; Lowery et al., 2020). Further work will also compare the quantitative indices discussed in this research note with more qualitative and collaborative assessments conducted at community and sub-regional scales, such as Vital Signs (Community Foundation of Newfoundland & Labrador [CFNL], 2024) and similar research.

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