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VARIATIONS IN THE HEALTH STATUS OF IRISH REGIONS

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Abstract

We construct composite indices of the health status in the 8 HSE regions of Ireland in 2010. Our composite index has 6 component indices. Each maps the prevalence of health conditions for which a corresponding anatomical therapeutic chemical (ATC) group of drugs was prescribed and weights it by its prescribing frequency. We construct a separate composite index for persons covered by each community drug scheme in each region. We take the coverage-weighted average of these in each region as our overall composite health index.

The Midlands, North–West, Western and South-Eastern regions have below average health status; the remaining regions have above average health status. The Midlands region had the poorest health status in 2010 (8% below the national average) and the Eastern Area had the best (6% above the national average). Regional health disparities are related to but not adequately explained by simple socio-economic and demographic factors such as mean income and age differences alone.

Respiratory, Cardiovascular, Central Nervous System and 'Other' conditions differ greatly from the national average between regions and impact inter-regional health status most. Improving cardiac health offers the greatest opportunity for improving national health status; narrowing disparities in CNS regional prevalence rates also offers the potential for greatly reducing regional inequalities in health status.

Introduction

WHO (1984) refer to Health as "… the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" and describe it as a "… positive concept, emphasizing social and personal resources as well as physical capabilities". Health indicators, rooted in conceptual models of what influences health status[1], help us map the achievement over time of health goals and to compare different geographic areas and regional populations. International[2], national [3]and regional[4] organizations routinely construct many health indicators, whose composition and variety reflect their intended purpose and use. Established indicators[5], such as life expectancy, maternal and infant mortality rates have standard definitions and widespread currency in international comparisons and in benchmarking progress in meeting health goals. Some policy analysts propose refining simple indicators. For example, Wolfson & Lievesely (2007) propose refining the life expectancy index into a health-adjusted life expectancy (HALE) index to measure 'not merely the absence of death' but also the quality of health during the survival period. A parallel strategy promotes the development of more broadly-based multidimensional composite indicators. The World Bank, for example, combines the three dimensions of life expectation, knowledge and income into a single Human Development Index (HDI) that is closer to the WHO ideal.

The aim of this study is to construct composite indices of population health status in the 8 HSE regions of Ireland. Our composite index is sufficiently broad to enable inter-regional comparisons: its component indicators are sufficiently detailed to track the main sources of inter-regional difference. The indicators shorten the distance to the WHO ideal, have wide application and a role to play in policy formation.

Methods

[1] See Wold 2008.
[2] For example, the OECD and WHO.
[3] See, for example, Statistics Canada and the Canadian Institute for Health Information. The Health Protection Surveillance Group, HSE (2012) provides prevalence rates for specific diseases at regional level in Ireland. IPH provides disease prevalence rates at county level and CSO for 21 doctor diagnosed medical conditions.
[4] For example Manitoba Centre for Health Policy.
[5] Wold 2008, p.25 provides a list of indicators and data sources in common usage in the US.

The first step in constructing a composite index[6] is to settle its scope i.e. the number of dimensions it will contain. These are governed by purpose and use and often are pragmatically constrained by the data available for their construction. Our composite index – the CPS Composite Health Index (CHI), has 6 dimensions. The first 5 correspond to health conditions for which: (i) Alimentary Tract and Metabolism (ii) Cardiovascular system (iii) Nervous system (iv) Respiratory system (v) Various anatomical therapeutic chemical (ATC) drugs[7] are prescribed; the sixth to health conditions for which the remaining 9 first level ATC therapeutic drug groups (combined in a single (vi) Other category) are prescribed.

The 24 therapeutic drug groups in these 6 ATC categories are set out in Table 1 and account for around 80% of all community drug prescriptions in 2010.

We associated one or more major health condition[8] with each therapeutic drug group and tabulated their prevalence rates. We did this separately for each of the 24 therapeutic groups in the 6 ATC categories and for each of the 8 HSE regions.

We did this by aggregating the county-level prevalence rates of 14 medical conditions and/or associated hospital admissions/operations together with 8 associated contributory factors into population-weighted regional indexes. We used 8 regional indicators for medical and/or associated consultations/hospital admissions, having adjusted the CSO regional indicators to conform to HSE-defined regions; Table A in the appendix sets out the details and gives the data sources.

When two or more health indicators were available for the *same* therapeutic group of drugs we used their geometric mean. For example, since 'Drugs for bone disease' are required for clinically diagnosed back conditions, osteoarthritis and osteoporosis we took their geometric mean $p_{bone} = \sqrt[3]{p_{back} * p_{osteoarth} * p_{osteopor}}$ as our composite 'bone disease' prevalence rate. We then 'normalised' or anchored each regional prevalence rate by dividing it into the corresponding national prevalence rate and multiplying by 100.

For each ATC sub-index we then took the geometrically weighted average of these normalised rates, weighting them by their prescribing shares in that ATC group. For example, the 'Other' ATC sub-index contains 5 therapeutic drug groups and has the form,

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[6] Gaye (2007) sets out the steps to be taken in constructing composite indices.

[7] These are WHO first level ATC therapeutic group categories. For a brief history of the ATC classification system see http://www.whocc.no/atc_ddd_methodology/history/

[8] or other indicators, where appropriate.

$I_o = \prod_{i=1}^{5} p_i^{w_i} = (p_1)^{w_1}(p_2)^{w_2}(p_3)^{w_3}(p_{bone})^{.0801}(p_{rheu})^{.1781}$, where p_{bone} is the prevalence of 'bone disease' in that region relative to the national rate: the other p values are similarly defined. PCRS data[9] show that in 2010 'Drugs for Bone Disease' accounted for 8.01% and 'Anti-inflammatory and Rheumatic' medicines accounted for 17.81% of GMS prescriptions in the 5 'Other' therapeutic groups covered. Hence, $w_4 = .0801$, $w_5 = .1781$ and $\sum_{i=1}^{5} w_i = 1$.

Our composite GMS health indicator is the geometric average of the 6 ATC sub indices, $I = \prod_{j=1}^{6} I_j^{w_j} = (I_1)^{w_1}(I_2)^{w_2}(I_3)^{w_3}(I_4)^{w_4}(I_5)^{w_5}(I_6)^{w_6}$, where the weights are the GMS prescribing shares of each ATC group set out in Table 1.

We repeated this exercise, using the weights set out in Table 1 to derive separate composite health indicators for the remaining DP and LTI community drug schemes.

Table 1. 2010 Prescribing Frequencies by Anatomical Group, Listed Therapeutic Group & Drug Scheme

Anatomical Therapeutic Chemical Classification

[9] Primary Care Reimbursement Service (PCRS), Statistical Analysis of Claims and Payments 2010, Table 20, pg 101.

	GMS	**DP**	**LTI**
Alimentary Tract & Metabolism Total *(of which)*	***13.64***	***11.99***	***26.44***
1. Drugs for Acid related Disorders	*6.02*	6.6	0.68
2. Drugs for Diabetes	*2.35*	0.51	24.2
3. Laxatives	*1.4*	0.67	0.26
4. Mineral Supplements	*1.93*	2.01	0.24
Therapeutic Groups as a % of Anatomical Group	**86%**	**82%**	**96%**
Cardiovascular System Total *(of which)*	***24.03***	***27.01***	***30.88***
1.Lipid Modifying Agents	6.47	9.56	11.19
2.Renin-Angiotensin Agents	5.85	7.27	10.68
3.Calcium Channel Blockers	2.52	2.51	2.92
4. Beta Blocking Agents	3.74	4.08	3.27
5. Diuretics	3.11	1.81	1.51
Therapeutic Groups as a % of Anatomical Group	**90%**	**93%**	**96%**
Nervous System Total *(of which)*	***19.44***	***15.47***	***10.52***
1. Psychoanaleptics	4.59	4.64	0.55
2. Psycholeptics	6.85	5.16	0.67
3. Anti-epileptics	1.98	1.57	7.9
4. Analgesics	4.76	3.42	0.26

Therapeutic Groups as a % of Anatomical Group	**94%**	**96%**	**89%**
Respiratory System *(of which)*	***7.47***	***9.55***	***0.47***
1. Drugs for Obstructive Airways	5.4	6.78	0.32
2. Nasal Preparations	0.65	1.3	0.05
3. Antihistomines	0.75	1.11	0.05
Therapeutic Groups as a % of Anatomical Group	**91%**	**96%**	**89%**
Various Total *(of which)*	***3.02***	***1.98***	***17.64***
1. Clinical Nutritional Products	1.1	0.96	1.26
2. Other Non-Therapeutic Products	1.04	0.82	6.26
3. Diagnostic Products	0.83	0.17	10.11
% of Various Total	**98%**	**98%**	**100%**
Other Total *(of which)*	***32.4***	***34.00***	***14.05***
1. Antithrombotics	6.9	6.86	9.72
2. Urologicals	1.7	1.85	1.03
3. Antibacterials for Systemic Use	4.64	4.2	0.52
4. Drugs for Bone Disease	1.43	1.6	0.08
5. Anti-inflammatory and Rheumatic	3.18	4.05	0.15
Therapeutic Groups as a % of Anatomical Group	**55%**	**55%**	**82%**

Therapeutic Groups as a % of Total Prescribed Items	**79%**	**80%**	**94%**
Total Items Prescribed	***54,424,660***	***11,070,446***	***2,807,757***

Finally, we constructed the geometric average of these scheme-specific composite health indicators for each region using the scheme coverage rates of that region as weights. For example, the GMS scheme coverage rate of 28% in the East region so the GMS composite health indicator is assigned a weight of .28: the DP scheme weight is .68; LTI is .04. The scheme coverage weights used in each region are given in Table 2.

Table 2. Scheme Coverage Rates and National Prescribing Frequencies by Region in 2010

Region/ Scheme Coverage Rates S_j	**GMS**	**DP***	**LTI**	**Total**
1.Eastern Area	0.28	0.68	0.04	1.00
2. Midlands	0.38	0.59	0.03	1.00
3. Mid-West	0.38	0.60	0.02	1.00
4. North-East	0.38	0.59	0.03	1.00
5. North-West	0.49	0.47	0.03	1.00
6. South-East	0.41	0.56	0.03	1.00
7. Southern	0.36	0.62	0.02	1.00
8. Western	0.41	0.57	0.02	1.00
Ireland	0.35	0.62	0.03	**1.00**

*Persons not covered by the GMS are covered by the DP scheme. We assigned covered but unregistered persons (i.e. those with medicines bills under €120/month entitlement threshold) to the DP scheme.
**We assigned the 54,974 HTD registered persons in 2010 (PCRS 2010 p.14) to each region in proportion to that region's share of HDT items prescribed (PCRS 2010 p.15).

For convenience we refer to the resulting general CPS Composite Health Index as CHI[10]. The relative frequencies of the major health conditions it contains reflect regional epidemiology and its construction embeds differences in the regional coverage of community drug schemes.

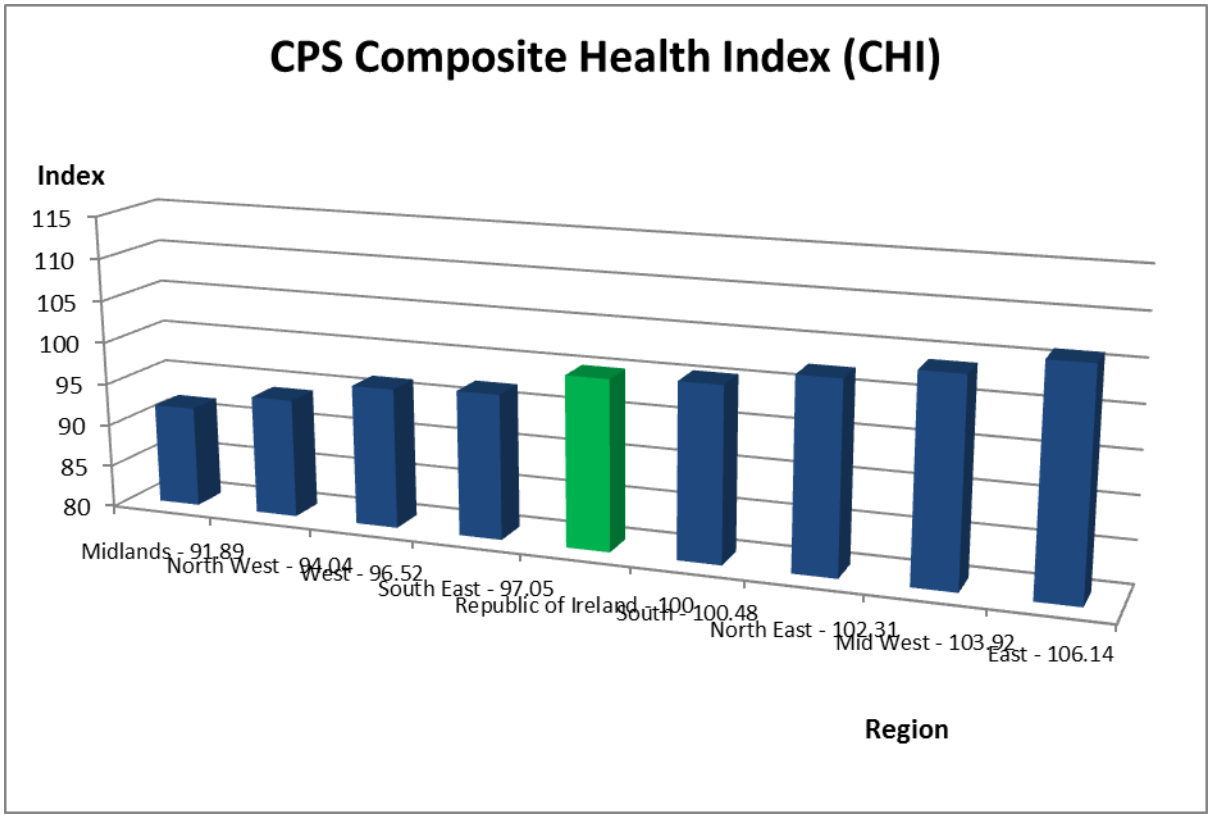
Results

Figure 1 plots regional CHI index values in ascending order. Ireland has a benchmark value of 100: low values signify good health and high values poor health. The Midlands, North – West, Western and South-Eastern regions have below average health status; the remaining regions have above average health status.

The Eastern Area[11] has the best health status (6% better than the national average). It has consistently good health in each ATC category, ranking best in 3 of the 6 categories – Alimentary Tract, Cardiovascular and Other. The Midlands[12] has the poorest health status; (8% below the national average) and ranks bottom in 4 out of 6 ATC categories (excluding Alimentary tract and Various).

Figure 1

[10] The CPS Composite Health Index.
[11] i.e. counties Kildare, Wicklow, Dublin (including Dun Laoghaire/Rathdown, Dublin City, Fingal and South Dublin)
[12] i.e. counties Laois, Longford, Offaly and Westmeath



The total regional gap in health status is 14.25% between Eastern Area and the Midlands. Figure 2 breaks down the gap between both regions by each ATC component. The biggest ATC gap between the two regions is in cardiovascular health status (23%). Because cardiovascular health has a high CHI index weight of 26% it accounts for 5.96%[13] of the overall 14.25% health gap between the regions.

The Midlands/Eastern Alimentary, Central Nervous System and 'Other' ATC health gaps are 4.75%, 10.79% and 13.10%, respectively. They have high CHI index weights of 12.85%, 16.58% and 32.54%, respectively. Hence they contribute 0.06%[14] , 1.79% and 4.26%, respectively, - over 40% of the 14.25% overall Midlands/Eastern health gap. Respiratory and 'Various' ATC health gaps contribute the remaining gap of 1.28%.[15]

Figure 2

[13] i.e. .23*.2602=.0596 = 5.96%
[14] i.e. Alimentary =.0475*.1285=.006 or 0.6%; CNS =.1079*.1658=.0179 or 1.79% and Other =.1310*.3254 =.0426 = 4.26%
[15] i.e. Alimentary = .1364*.0155=.0021=0.21% and 'Various' =.0302*.0658=.00198=0.19%

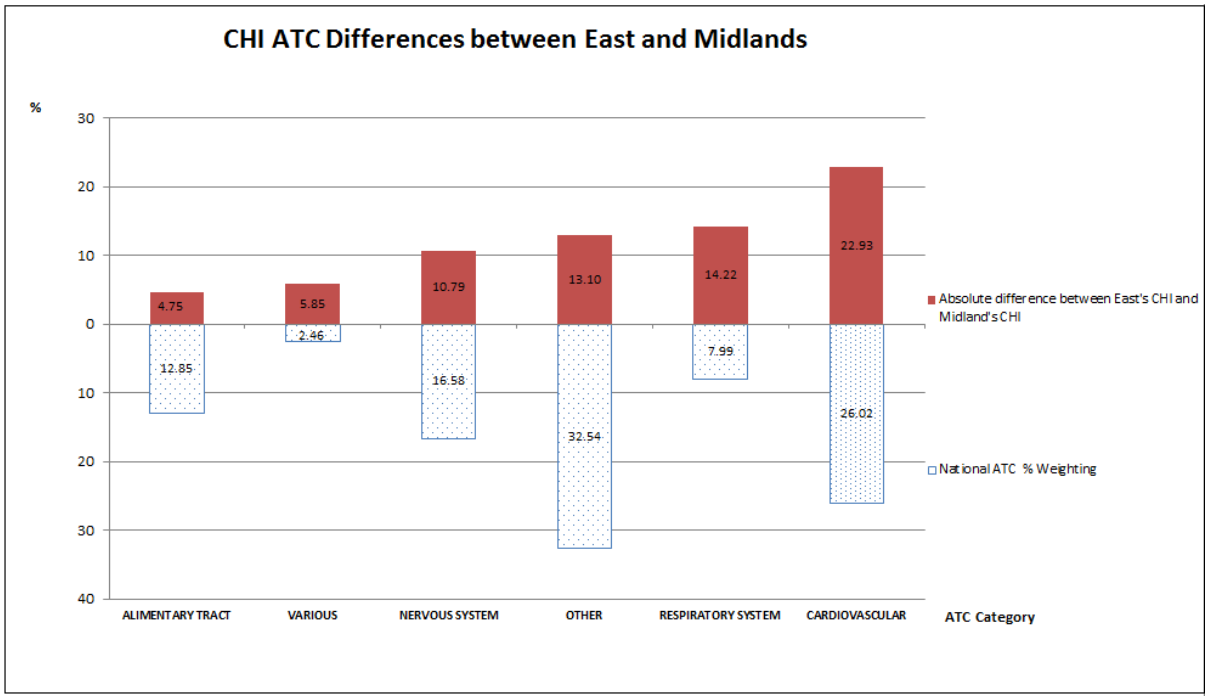
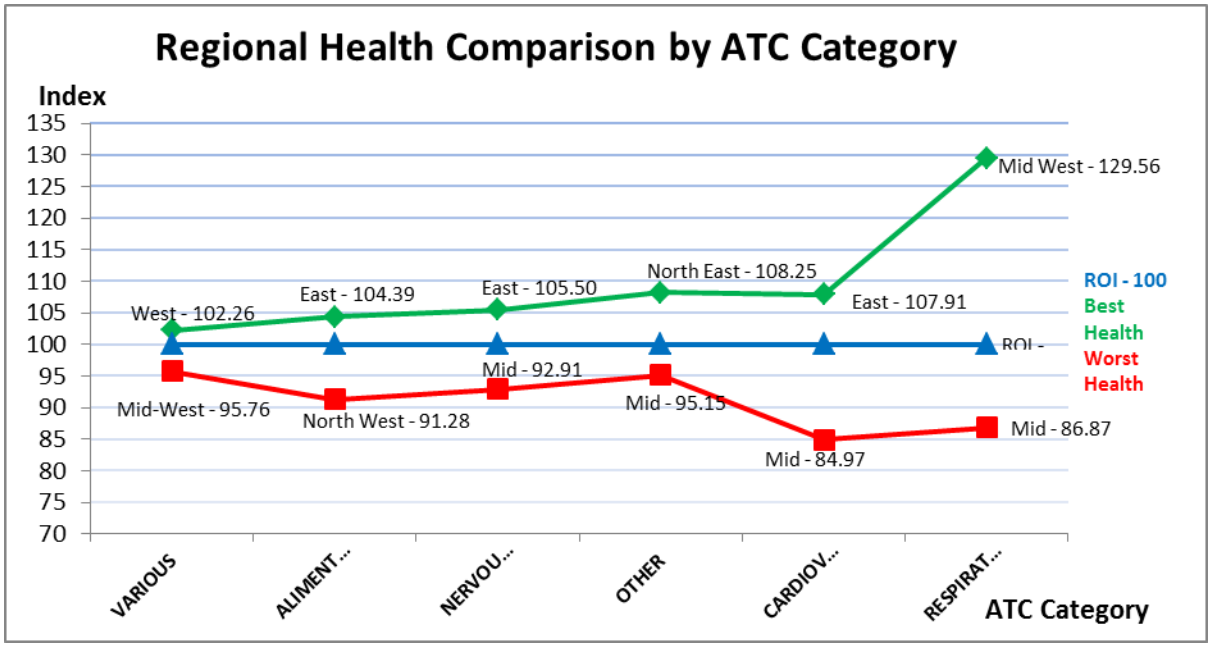


Figure 3 identifies the regions with the best and the worst health status in each ATC category when compared to the national average and the size of the gaps between them. Respiratory health displays the greatest health gap but, as noted above, has a low CHI index weight of 7.99%, which lessens its contribution to inter-regional health gaps. Sizable inter-regional gaps in mental (CNS) and cardiovascular health also exist: these have high index weights and contribute significantly to inter-regional health gaps.

Figure 3 highlights that the Midlands has the worst ill health prevalence in 4 out of the 6 ATC categories, whereas 4 different regions share the best health status in the 6 ATC categories (the East is best in 3 of the high weighted ATC categories, Alimentary Tract, CNS and Cardiovascular). Note also that while the Mid-West has the second best overall health status, it has best status in only 1 ATC category – Respiratory health - which has a low index weight.

Figure 3



It is tempting to attribute specific health gaps to specific causes. The Midlands, for example, has high rates of asthma and respiratory ill-health that may partly result from regional climatic factors connected to its status as the sole non-coastal inland region. But such specific accounts leave its wider ill-health status unexplained, for example, it's very high rates of cholesterol and hospital admission for circulatory disease cardiovascular.

It is similarly tempting to promote general causes of differences in inter-regional health. Table 3 shows that good health is well correlated with regional income. Surprisingly, it is better correlated with unadjusted disposable income per capita (R^2 = 0.74) than with equivalised net disposable income (R^2 = 0.53) and is inversely and moderately well correlated (R^2 = .54) with the share of the regional population aged over 65.

Table 3:Correlation between Health Status, Income and Age

	Income	Equivalised-Income	Population Percent over 65	CHI
Income	1.00	0.70	-0.22	0.74
Equivalised-Income		1.00	-0.59	0.53
Population Percent over 65			1.00	-0.54
CHI				1.00

Income refers to CSO county incomes; equivalised income refers to SILC family-size adjusted incomes.

We therefore expect that these key demographic and socio-economic variables will provide, at best, a partial and incomplete account of regional variations in good health.

Moreover, the pattern of causality is complex. The below-average health status regions - Midlands, North-West, West[16], and South East have low incomes and, apart from the Midlands, tend to have high population shares aged over 65. They tempt us to cite poor socio-economic conditions and unfavourable demographics as general sources of inter-regional health differences. However, while 4 regions with low income and poor demographics have the poorest health the converse is not true. The Eastern region has the highest income and lowest elderly population share, but the Mid-West, which ranks a close second, has an income of around €1,000 less than the East and has a population share aged over 65 (i.e. 11.8%) that is nearly 2 percentage points higher than the East. Similarly, the Western region has higher net disposable income and substantially less favourable demographics than the Midlands but has a better health status.

Perhaps, socio-economic and demographic factors exert non-linear threshold effects on health status: it is no less likely that other confounding health, life-style and other medical variables also play a significant role.

The North West has the highest GMS coverage rate in Ireland, at roughly 49-50%, almost 10% higher than the Midlands which has a GMS coverage rate of 38%. Hence despite its poor health status the Midlands has less favourable access to GMS health services which may contribute to its poor health status.

[16] These 3 regions broadly conform to the NUTS 2 BMW i.e. the Border (Cavan, Donegal, Leitrim, Louth, Monaghan and Sligo), Midlands (Laois, Longford, Offaly and Westmeath) and West (Galway city and county, Mayo and Roscommon) regions.

Discussion and Conclusions

Our CHI index adopts World Bank, UNDP and EU index construction methodology and conforms to their guidelines (Gaye 2007; IMF, 2010; OECD 2008). The 30 Illness/ill-health indicators that make up its 6 ATC sub-indices are sampled and reported by the primary statistics agencies the IPH, CSO and PCRS and most of the underlying statistics are sampled and reported at county level. We make these observations;

First, most noticeable to us in constructing CHI is the lack of a key indicator for 'Alimentary Tract and Metabolism'. It is also true that CHI falls short of the World Bank ideal by dealing with ill-health rather than health and excludes positive medical interventions, such as immunization.

Second, it might be contended that prescribing value rather than prescribing frequency weights should be used but both yield broadly similar and robust CHI values.

Third, as with any summary indicator the sample weights and coverage might fruitfully be modified depending on their intended application. The CHI also under-represents conditions that do not employ drug therapy and excludes hospital-originated HTD prescribing (e.g. Antineoplastic & Immunomodulating Agents drugs group). For example, if we wished to map primary care need we might usefully expand CHI and adjust its component weights to include pregnancy and immunization services, depending on application, we might also wish to scrutinize its disaggregated components.

Our findings indicate sizable disparities in overall health status of Irish regions. We have tabulated the main categories of health conditions and outcomes that are the source of these disparities. For example, cardiovascular health has the largest weight in the CHI index: improving it offers the greatest scope for improving national health status. As yet, we cannot isolate the separate contributions socio-economic, demographic, lifestyle and medical factors make to the observed outcomes. Equally, we need to extend CHI over a number of years to assess how health status is changing nationally over time.

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APPENDIX A

Table A. Therapeutic Main Group Indicators

Therapeutic Main Groups	**Indicators and Sources (All of the below are from PHIS)**
1. Drugs for Acid Related Disorders	(i) Population % aged 50 and over[20]
2. Drugs for Diabetes	(i) Clinical diagnosis of self-reported, doctor-diagnosed diabetes in the previous 12 months (RoI 2010)[17]
3. Laxatives	(i) Percentage of people who are physically inactive (RoI, 2007) [17]
4. Mineral Supplements	(i) Percentage of children aged 0-5 years (2011) [18]
Cardiovascular System Total	
5.Lipid Modifying Agents	(i) Percentage of people being prescribed statins (RoI 2005) [18] (ii) Percentage of people who have high cholesterol, (RoI 2007) [18]
6.Renin-Angiotensin Agents	(i) Directly age and gender standardised rate per 100,000 European Standard Population of operations for CABG/angioplasty, (RoI 2010) [18] (ii) Rate of admissions to hospital for circulatory diseases per 100,000 European standard population, (RoI 2010) [18] (iii) Clinical diagnosis of Self-reported, doctor-diagnosed hypertension in the previous 12 months, (RoI 2010) [18]
7.Calcium Channel Blockers	(i) Clinical diagnosis of Self-reported, doctor-diagnosed hypertension in the previous 12 months, (RoI 2010) [18] (ii) Clinical diagnosis of Self-reported, doctor-diagnosed angina or heart attack in the previous 12 months, (RoI 2010) [18]
8. Beta Blocking Agents	(i) Rate of admissions to hospital for circulatory diseases per 100,000 European standard population, (RoI 2010) [18]
9. Diuretics	(i) Clinical diagnosis of Self-reported, doctor-diagnosed hypertension in the previous 12 months, (RoI 2010) [18]
Nervous System Total	
10. Psychoanaleptics	(i) Percentage of the population in receipt of prescriptions for depression and/or anxiety, (RoI 2005) [18] (ii) Number of admissions to hospital for anxiety or depression per 1,000 people, (RoI 2009) [18] (iii) The percentage of people suffering from mood and anxiety disorders estimated using prescription data, (RoI 2005) [18]

[17] Healthwell, Institute of Public Health in Ireland (IPH), Community Profile http://www.thehealthwell.info/communityprofiles/area/area.php

[19] The Quarterly National Household Survey (QNHS), Health Status and Health Service Utilisation for Quarter 3 2010, Table 3

[20] The Healthwell, Department of Health, PHIS, http://www.thehealthwell.info/phis-tables

11. Psycholeptics	(i) The percentage of people suffering from mood and anxiety disorders estimated using prescription data, (RoI 2005) [18] (ii) The percentage of people who currently smoke cigarettes,(RoI 2007) [18]
12. Anti-epileptics	(i) Percentage of the working age population aged 15-64 years in receipt of benefits for depression and/or anxiety, (RoI 2010) [18] (ii) Percentage of working population aged 15-64 years in receipt of benefits for mental and behaviour disorders, (RoI 2010) [18]
13. Analgesics	(i) Percentage of adults diagnosed with osteoarthritis[19]
Respiratory System	
14. Drugs for Obstructive Airways Diseases	(i) Percentage of adults diagnosed with asthma[19] (ii) Percentage of adults diagnosed with chronic bronchitis[19]
15. Nasal Preparations	(i) Clinical diagnosis of Self-reported, doctor-diagnosed chronic bronchitis, chronic obstructive lung (pulmonary) disease, or emphysema in the previous 12 months, (RoI 2010) [18] (ii) The percentage of people suffering from mood and anxiety disorders estimated using prescription data, (RoI 2005) [18]
16. Antihistamines	Missing Indicator: Accounts for 1.11 of the 9.55% share (For allergies, stomach ulcers)
Various	
17. Clinical Nutritional Products	(i) Birth rate (2005 – 2010)[20]
18. Other Non-Therapeutic Products	(i) Percentage of adults with 1 or more admission to hospital[19] (ii) Clinical diagnosis of self-reported, doctor-diagnosed diabetes in the previous 12 months (RoI 2010) [18] (iii) Average number of GP consultations (including no visits) [19] (iv) Percentage of adults diagnosed with urinary incontinence[19]
19. Diagnostic Products	(i) Percentage of adults with 1 or more admission to hospital[19] (ii) Clinical diagnosis of self-reported, doctor-diagnosed diabetes in the previous 12 months (RoI 2010) [18]
Other	
20. Antithrombotic Agents	(i) Directly age and gender standardised rate per 100,000 European Standard Population of operations for CABG/angioplasty, (RoI 2010) [18] (ii) Rate of admissions to hospital for circulatory diseases per 100,000 European standard population,(RoI 2010) [18] (iii) Clinical diagnosis of Self-reported, doctor-diagnosed hypertension in the previous 12 months, (RoI 2010) [18]

21. Urologicals	(i) Percentage of adults diagnosed with urinary incontinence [19]
22. Anti-bacterials for Systemic Use	Missing indicator : Accounts for 4.2 of the 34% share
23. Drugs for Bone Diseases	(i) Percentage of working population aged 15-64 years in receipt of benefits for diseases of the musculoskeletal system, (RoI 2010)[18] (ii) Clinical diagnosis of Self-reported, doctor-diagnosed osteoarthritis (arthritis, joint degradation) in the previous 12 months, (RoI 2010)[18] (iii) Percentage of adults diagnosed with osteoporosis[19]
24. Anti-inflammatory & Anti-rheumatic Products	(i) Clinical diagnosis of Self-reported, doctor-diagnosed rheumatoid arthritis (inflammation of the joints) in the previous 12 months, (RoI 2010) [18]
Other HTD Therapeutic Main Group	
25. Immunosuppressive Agents	(i) Clinical diagnosis of Self-reported, doctor-diagnosed rheumatoid arthritis (inflammation of the joints) in the previous 12 months, (RoI 2010) [18] (ii) Percentage of adults diagnosed with asthma[19] (iii) Percentage of adults diagnosed with chronic bronchitis[19]
26. Immunostimulants	(i) Crude incidence rate of all cancers[20]
27. Antineoplastic	(i) Crude incidence rate of all cancers[20] (cancer inhibiting)
28. Endocrine Therapy	(i) Crude incidence rate of all cancers[20] (cancer blockers, diabetes & menopause)
29. Anti-anemic Preparations	(i) Crude incidence rate of all cancers[20]
30. Pituitary and Hypothalamic Hormones and Analogues	Missing indicator: accounts for 4.63 of the 90.03% share
31. Antihypertensives	(i) Clinical diagnosis of Self-reported, doctor-diagnosed hypertension in the previous 12 months, (RoI 2010) [18]
32. Calcium Homeostasis	(i) Crude incidence rate of all cancers[20] (ii) Percentage of adults diagnosed with osteoporosis[19]