Globalization and Disability Addiction in Working Populations: Unlocking the Global Correlates to Disability Addiction Calls for the Healthicization of Society

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Abstract

Addiction behavior and the resulting short-term or long-term disabilities continue to increase globally, especially during the current COVID pandemic. We analyze how national measures of 38 global indices correlate with national addiction-related disability rates resulting from four primary addictive substances: alcohol, tobacco, drugs, and food. We utilized a canonical correspondence analysis to explore the relationships between 38 political, economic, and cultural characteristics and years of life lived with a short-term or long-term health loss in 78 countries. The model selection approach reduced 38 global indices to 13 explanatory variables (final model: $F_{13} = 5 \cdot 64$, $p < 0.001$ after 1000 permutations). Results show that the following factors are correlated with increased addiction disabilities stemming from obesity, alcohol, drug, and tobacco use: political stability; voice and accountability; control of corruption; economic freedom; women economic opportunity; Human Development Index; individuality; masculinity; long-term orientation; indulgence; uncertainty avoidance; personal contact; and religious diversity. Health care policy makers should consider that national culture, political attributes, and economic characteristics can influence national disability rates resulting from addictions.

Keywords Addiction · Disability · Globalization · Alcohol · Tobacco · Drugs · BMI

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Background

In the context of the current COVID-19 pandemic, with its ever resurrecting waves and extending over its second year, the globe's population experiences, in some form, the effects of this unusual global event. For example, people suffer from "pandemic fatigue" (Meichtry et al. 2020), a combination of exhaustion and demoralization of isolation, restrictions, and fighting the virus; from pandemic-related anxiety due to the generalized uncertainty and the fear of the virus (Smith & Robinson, 2021); and/or from Pandemic Trauma and Stress Experience (PTSE), having had to abruptly change routines and habits, lacking time outdoors and socialization, leaving us with a constant feeling of being jet-lagged (a sign of depression) and on alert in the same time, overturning our biorhythms (Karlis, 2021).

Current Mental Health Pressures and Addiction

Starting with 2020 and constantly updating, various authorities on mental health have issued reports on risks during the pandemic and suggestions on coping with the pandemic-related stress. Stress (external and internal) is the common factor in how people deal with addiction (WebMD, 2022). In turn, socio-cultural and economic factors are the ones that influence how we deal with stress. For example, in different cultures and depending on funds available, one of the following factors can gain priority on how people cope: tobacco, food, alcohol, drugs, or other factors (e.g., professional counseling). Even with the new type of pressures caused by the ubiquitous pandemic, people are relying on old, as well as new, coping strategies in dealing with stress. Despite the nationally mandated guidelines and professional recommendations about dealing with stress during the current pandemic, the rates of addiction are spiking, which makes it so much more compelling to look at global available data on addiction correlates.

The American Medical Association (AMA, 2021), through its Advocacy Resource Center, starts an issue brief with the sentence "[t]he nation's COVID pandemic made the nation's drug overdose epidemic worse," referring to the USA. The Centers for Disease Control and Prevention (CDC, 2021) has warned that "increased use of tobacco, alcohol, and other substances" is partially a byproduct of pandemic-related stress. The American Psychological Association warns the public that "opioid and stimulant use is on the rise" during the pandemic (Abramson, 2021), reporting that in June 2020, 13% of Americans confessed to starting or increasing their substance use in trying to cope with the COVID pandemic-related strain. The National Institute on Drug Abuse reports that "people with substance use disorders are at increased risks for poor COVID-19 outcomes" (NIDA, 2021). The above compelling examples create a picture of the added risks of the COVID-19 global pandemic to the already problematic issue of addiction.

Tackling Addiction

This manuscript looks at the most complete available global data from the Institute for Health Metrics and Evaluation, specifically the Global Burden of Disease 2013 study (GBD, 2022), which looked at data from 1980 to 2015 to identify determinants of global life expectancy. It found war, obesity, and substance abuse as top factors in decreasing lifespan. Smoking alone contributes to 6.3% of the global health loss, while high body mass index (BMI) explained another 5% of the global health decline. The present study

seeks to understand influences of global and national factors on the length of time that 15 to 49-year-old individuals live with a disability (YLD) due to the following addictive behaviors: alcohol, drug, tobacco, and food overconsumption. This study used a multivariate approach to investigate correlations of standard indices of 38 variables related to globalization, economic status, and socio-cultural features with national YLD (World Health Organization, 2022). While no set of standardized indices can completely capture a country's level of globalization or culture, they can provide a "picture" of the status of a nation at the moment of data collection. All the data variables considered in this study are national data or indices, recognizing that national policies have a key role in controlling the economic, physical, and social availability of the harmful products studied.

Globalization and Addiction

Globalization is a dynamic process that interconnects people and countries at different levels: social, economic, political, and ecological. Developments in communication technologies, transportation, trade, multinational companies, and global banking are leading to increased globalization and changing the way we live, potentially including our addictive behaviors. The effects of globalization on the health of nations and individuals are an area of great interest to both health care and policy officials, especially during the COVID pandemic. In 2010, Martens, Akin, Maud, and Mohsin inquired whether globalization is healthy, using the Maastricht Globalization Index against the infant, under-five, and adult mortality rates. The study concluded that high globalization correlates with low levels of mortality at all ages. When correcting for confounders (such as, Gross Domestic Product (GDP); water quality; health expenditures and financing; smoking; secondary education; and public health resources), all mortality indicators have raised their explanatory power, meaning that they play a significant role in these relationships. Technological and socio-cultural globalizations were especially strongly correlated to the mortality indicators.

Well-Being and Addiction

The connection between globalization and human well-being was also assessed by Mukherjee and Krieckhaus in 2012. Their time-series (1970–2007) and cross-sectional (132 countries) analysis correlated greater economic, social, and political globalization with lower infant mortality, lower child mortality, and higher life expectancy. Their study found that higher values of economic, social, and political globalization are correlated with lower infant and child mortality and higher life expectancy. These studies provide evidence of the impact of globalization on health. This study adds to the growing discussion by investigating the effects of globalization on addictive behavior outcomes, specifically YLD.

Addiction has been correlated with loss of quality of life (e.g., physical and psychological dependence; inability to learn and recall information), short- or long-term disability (damage to vital organs such as the brain, heart, lungs, liver; depression; severe anxiety), and possible mortality (e.g., blackouts, poisoning, overdose, death). Four major substances are likely to cause addiction: alcohol, drugs, tobacco, and food. The consumption of these four substances falls under the category of non-communicable diseases or "socially transmitted diseases" (Allen & Feigl, 2017) resulting from behavioral risk factors (WebMD, 2022).

Mukherjee and Krieckhaus (2012) identified three forms of globalization: economic, social, and political globalization. Numerous studies have linked economic factors to addictive behaviors. Allen and Feigl (2017) summarized the findings of 75 studies and

found that lower socioeconomic groups are more likely to drink alcohol, smoke tobacco, and consume insufficient fruit and vegetables, while more financially advantaged groups are more likely to be inactive, and consume more fats, salt, and processed food. Another study showed that over time, the higher burden of behavioral risk factors has recently shifted from high-income groups at the beginning of the twentieth century (nicknamed "diseases of affluence") to low-income groups towards the end of the century (Stringhini & Bovet, 2017). A 2013 study (Vogli et al. 2013) used time-series (1980–2008) and longi-tudinal cross-national (127 countries) analyses to look at the impact of the KOF Economic Globalization Index and inequality on BMI. The increase in BMI correlated positively with inequality between countries, economic globalization across countries, and economic ine-quality within countries only in high-income states. A recent global study concluded that smoking remained among the leading risk factors for early death and disability in more than 100 countries in 2015, especially in low to middle developing countries (Gakidou, Murray, & Forouzanfar, 2017).

Other studies link the dual burden of over nutrition and undernutrition among disad-vantaged populations (Delisle & Batal, 2016) to illicit drug use (Sigmon, 2016), and both are significantly correlated to poverty (Davey-Rothwell, 2014; Himmelgreen et al. 1998; Mysels & Sullivan, 2010). In terms of alcohol, a recent study reveals that socioeconomic status (SES) is an effect modifier of alcohol consumption and its side effects, with a low SES being correlated to increased alcohol-attributable diseases (Katikireddi et al. 2017).

Purpose of Study

In an effort to add to these studies, this study looks at the broad research question: What is the impact of globalization on a nation's YLD due to addictive behaviors (alcoholism, drug use, tobacco use, and BMI) for both males and females? The answers to this question could provide a glimpse into how to bridge the global health gap by better understanding the mechanisms of "health beyond health" (Khanal & Bhattarai, 2016) and to healthicization. A healthicization approach to causes and treatment of health problems is different than the medicalization perspective. It emphasizes changes in lifestyles and behaviors rather than pharmaceutical treatments (Conrad, 2005). This study provides information on whether culture, social factors, economic growth, political variables, and other globalization factors correlate with addiction disabilities.

Data and Methods

Data Sources and Measures

The dependent variable targets four addictive behaviors for both males and females: alco-hol, drug, and tobacco use, and BMI. The dependent variable is expressed in years lived with disability (YLD), referring to years that people live with a health loss condition (dis-ability) or its consequences: "Years of life lived with any short-term or long-term health loss" (IHME, 2016). To obtain an estimate of YLD, the number of incident cases within the targeted period is multiplied by the average duration of the disease and a weight factor reflecting the disease severity on a scale from 0 (perfect health) to 1 (dead). The source

for the YLD data is the Institute for Health Metrics and Evaluation (2016), specifically the Global Burden of Disease 2013 study.

Thirty-eight explanatory variables were selected to reflect globalization measures from all aspects of life including economic, social, and political globalization. Also included are six socio-cultural factors captured utilizing Hofstede's framework of national culture (Hofstede, 1994) which is comprised of power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence. National culture may capture additional aspects of globalization not included in standard indices.

All 38 descriptive variables are explained, referenced, and coded in Table 1. Detailed explanations on sampling, validity, and methodology are provided on each website that provided the data as open source.

Sample

Data on Hofstede's dimensions for 78 countries was last reported in 2010 (Institute for Training in Intercultural Management International, 2021) (Table 1), and this study aligns all the other variable years to those countries and to the year of 2010 (or the closest option) to ensure consistency. The 78 countries covered include the full range of globalization development levels: very high ($N=32$), high ($N=23$), moderate ($N=12$), and low ($N=9$).

Statistical Analyses

An inferential descriptive (exploratory) statistics approach was used, rather than a hypothesis-driven (confirmatory) approach. A canonical correspondence analysis (CCA) explored the associations between addictive behaviors and globalization indices using the R package vegan, version 2.4–1 (Oksanen et al. 2022). CCA is often used in biology and ecology to explore complex patterns of distribution between numerous species and multiple environmental variables. Its ability to explore correlations between multiple independent and dependent variables makes it an appropriate statistical method for this study. It is a weighted averaging method that directly relates dependent variables to independent variables by constraining dependent variables to a pattern that correlates maximally with independent variables (Braak & Cajo, 1986). It assumes a Gaussian (i.e., bell-shaped) relationship between sets of variables. The assumption in this study is that addictive behaviors are Gaussian functions of globalization indices. CCA builds competing models by testing correlations between different groups of both independent and dependent variables. It seeks to build a model with high explanatory power using the minimum number of independent variables.

Results

The model selection resulted in a reduced model of 13 explanatory variables ($F_{13}=5.64$, $p<0.001$ after 1000 permutations), which captured 0·131 of the total inertia (i.e., weighted variance) in the dataset. Of that total inertia, 0·070 (i.e., explains 53% of the total) was constrained (i.e., the analysis that uses the explanatory variables) and 0·061 (47%) was unconstrained (i.e., CCA of the residuals). The first two axes (i.e., CCA1 and CCA2) of the reduced model cumulatively accounted for 87·7% of variance of the addictive behavior-societal relationship (Fig. 1A and B).

Table 1 Variables, codes, sources, and sample

No	Variable name & code	Explanation & value	Reference & data year
Political factors			
1	Conflict—Global Diplomacy Index (*ConflDiplomacy*)	Measures the diplomatic networks of all G20 and OECD nations. The index counts four types of diplomatic posts: (1) embassies and high commissions, (2) consulates-general and consulates, (3) permanent missions and representations or delegations to multilateral organizations, and (4) representative offices or delegations to countries where there is no formal diplomatic relationship. Scores here account for the total number of posts from each nation, currently ranging from 22 to 270	*Lowy Institute for International Policy, 2016, https://www.lowyinstitute.org/global-diplomacy-index/
2	Conflict—State Fragility Index (*ConflFragility*)	Measures state effectiveness and legitimacy. The index's 14 indicators are derived from expert data and public statistics, which measure (1) security, (2) political, (3) economic, and (4) social dimensions for both categories of effectiveness and legitimacy. Dimensions are ranked on a four-point fragility scale: 0 (no fragility), 1 (low fragility), 2 (medium fragility), and 3 (high fragility). Dimensions and categories are weighted equally. Total scores range from 0 (best) to 25 (worst)	*Center for Systemic Peace, 2010, http://www.systemicpeace.org/inscrdata.html
3	Corruption Perceptions Index (*PerceivedCorrupt*)	Measures the levels of perceived public sector corruption in countries around the world. The index draws from 13 data sources from organizations such as the African Development Bank, Bertelsmann Foundation, Freedom House, and the World Bank. Country experts and business leaders determine standardized scores for each source with assessments and opinion surveys. Scores range from 0 (highly corrupt) to 100 (very clean)	*Transparency International, 2010, http://www.transparency.org/research/cpi/overview

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
4	Empowerment Rights Cingranelli-Richards (CIRI) Index (*EmpowerRights*)	Measures governments' overall level of respect for 15 internationally recognized human rights. The data here reflects the index's subset of scores on empowerment rights. The Empowerment Rights Index is based on seven indicators: (1) foreign movement, (2) domestic movement, (3) freedom of speech, (4) freedom of assembly and association, (5) workers' rights, (6) electoral self-determination, and (7) freedom of religion. Scores range from 0 (no government respect of rights) to 14 (full government respect of rights)	CIRI Human Rights Data Project, 2010, http://www.humanrightsdata.com/p/data-documentation.html
5	Freedom in the World Index (*Freedom*)	Measures levels of political rights and civil liberties. The index rates 25 indicators, grouped into two categories: (1) political rights (e.g., electoral process, political pluralism and participation, and functioning of government) and (2) civil liberties (e.g., freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights). Scores are an average of the two categories and currently range from 1.0–2.5 (free), 3.0–5.0 (partly free), to 5.5–7.0 (not free)	*Freedom House, 2010, https://freedomhouse.org/report/freedom-world/freedom-world-2010
6	KOF Globalization Index: Political Globalization Index (*PolGlobal*)	Referring to the number of embassies in a country, membership in international organizations, participation in United Nations Security Council missions, and international treaties	KOF ETH Zurich, 2010, http://globalization.kof.ethz.ch/

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
7	Physical Integrity Rights Index (*PhysIntegr*): Cingranelli-Richards (CIRI) Human Rights Database	Measures governments' overall level of respect for 15 internationally recognized human rights. The data here reflects the index's subset of scores on physical integrity rights. The Physical Integrity Rights Index is based on four indicators: (1) torture, (2) extrajudicial killing, (3) political imprisonment, and (4) disappearance. Scores range from 0 (no government respect of rights) to 8 (full government respect of rights)	L. Cingranelli, and David L. Richards, 2010, http://www.humanrightsdata.com/p/data-documentation.html
8	Political Risk Index (*PolRisk*)	*Is an overall measure of risk for a given country, calculated by using 17 risk components including turmoil, financial transfer, direct investment, and export markets*	*The PRS Group, 2010,* https://www.prsgroup.com/category/risk-index
9	Press Freedom Survey (*FreePress*)	Measures the degree of print, broadcast, and internet freedom around the world. The survey rates countries in three categories: (1) legal environment, (2) political environment, and (3) economic environment. Scores range from 0–30 (free), 31–60 (partly free), to 61–100 (not free)	*Freedom House, 2010,* https://freedomhouse.org/report-types/freedom-press#.VMwOB17F921
10	Worldwide Governance Indicators: Voice and Accountability (*VoiceAcc*)	Measures the extent to which people are allowed to participate in elections and express their will, to associate with one another, and to have access to veridic information (free media)	*The World Bank Group, 2010, http://info.worldbank.org/governance/wgi/index.aspx#home
11	Worldwide Governance Indicators: Political Stability and Absence of Violence (*PolStab*)	Measures perceptions of whether the government is at risk of being overthrown and destabilized through unconstitutional or violent acts	*The World Bank Group, 2010, http://info.worldbank.org/governance/wgi/index.aspx#home
12	Worldwide Governance Indicators: Government Effectiveness (*GovEffec*)	Refers to the extent of the quality of public and civil services and its dependence on political obligations, the quality of the policy development and enforcement, and the credibility of state's loyalty to implement such policies	*The World Bank Group, 2010, http://info.worldbank.org/governance/wgi/index.aspx#home

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
13	Worldwide Governance Indicators: Regulatory Quality (*RegQual*)	Measures perceptions of government ability to develop and implement policies that promote the private sector	*The World Bank Group, 2010, http://info.worldbank.org/governance/wgi/index.aspx#home
14	Worldwide Governance Indicators: Rule of Law (*RuleLaw*)	Measures perceptions of the confidence people have that the government enforces rules in society, especially the contract sanctity, title rights, police and the courts, and the probability of crime and violence	*The World Bank Group, 2010, http://info.worldbank.org/governance/wgi/index.aspx#home
15	Worldwide Governance Indicators: Control of Corruption (*ControlCorrupt*)	Refers to the magnitude to which public power is used for private gain, from small to important forms of corruption, as well as the monopoly of elites on state and private interests	*The World Bank Group, 2010, http://info.worldbank.org/governance/wgi/index.aspx#home
Economic factors			
16	Education level (*EducF*)	Average school attendance for females, per country; school life expectancy (primary to tertiary education)	Central Intelligence Agency, 2010, https://www.cia.gov/library/publications/the-world-factbook/fields/2205.html
17	Education level (*EducM*)	Average school attendance for males, per country; school life expectancy (primary to tertiary education)	Central Intelligence Agency, 2010, https://www.cia.gov/library/publications/the-world-factbook/fields/2205.html
18	Fraser Economic Freedom in the World Index (*EcFreedom*)	Measures the degree to which the policies and institutions of countries are supportive of personal choice, voluntary exchange, freedom to compete, and security of privately-owned property. The index is based on 42 indicators, grouped into five categories: (1) size of government, (2) legal structure and security of property rights, (3) access to sound money, (4) freedom to trade internationally, and (5) regulations of credit, labor, and business. Scores range from 0 (worst) to 10 (best)	*Fraser Institute, 2010, https://www.fraserinstitute.org/economic-freedom/map?page=map&year=2010

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
19	Gross Domestic Product (*GDP*)	Gross Domestic Product per capita as a measure of poverty; the monetary value of all the finished goods and services produced within a country's borders in a given year	World Data Bank, 2010, http://databank.worldbank.org/data/reports.aspx?Code=NY.GDP.PCAP.CD&id=af3ce82b&report_name=Popular_indicators&populartype=series&ispopular=y#advancedDownloadOptions
20	Health Expenditure (*HealthExp*)	As % of GDP, and is the sum of public and private health expenditure as a percentage of GDP. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. The World Bank derived this indicator from the World Health Organization National Health Account database	*World Bank, 2010, http://data.worldbank.org/indicator/SH.XPD.TOTL.ZS
21	Human Development Index (*HDI*)	Measures progress in development in terms of economic growth and the capabilities of people. The index measures development by averaging composite indices on (1) life expectancy, (2) educational attainment (i.e., mean years of schooling and expected years of schooling), and (3) income (i.e., gross national income per capita (PPP $US)). Scores range from 0 (worst) to 1 (best)	*United Nations Development Programme, 2010, http://hdr.undp.org/en/data
22	KOF Globalization Index: Economic Globalization Index (*EcGlobal*)	Including data on: actual flows in trade, foreign direct investment, portfolio investment, and income payments to foreign nationals; restrictions regarding hidden import barriers, mean tariff rate, taxes on international trade, and capital account restrictions	KOF ETH Zurich, 2010, http://globalization.kof.ethz.ch/

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
23	Women's Economic Opportunity Index (*WomenE-cOpp*)	The Women's Economic Opportunity Index measures the underlying factors affecting women's economic opportunities as employees and entrepreneurs in countries around the world. The index is based on approximately thirty indicators, grouped into five categories: (1) labor practice and policy, (2) access to finance, (3) education and training, (4) women's legal and social status, and (5) general business environment. Scores range from 0 to 100	*Economist Intelligence Unit, 2010, https://www.eiu.com/public/topical_report.aspx?campaignid=weoindex2012
Socio-cultural factors			
24	Gender Inequality Index (*GenderIneq*)	Is a composite of indicators measuring inequalities between women and men in three categories: (1) reproductive health (i.e., maternal mortality ratio and adolescent birth rates), (2) empowerment (proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education), and (3) the labor market participation (i.e., labor force participation rate of female and male populations aged 15 years and older). Scores range from 0 (equal) to 1 (unequal)	*United Nations Development Programme, 2010, http://hdr.undp.org/en/composite/GII
25	KOF Globalization Index: Social Globalization Index (*SocGlobal*)	As a general measure of the following variables: personal contact, information flow, and cultural proximity	KOF ETH Zurich, 2010, http://globalization.kof.ethz.ch/
26	KOF Globalization Index: Social Globalization Index—Personal Contact Sub-Index (*PersContact*)	Including telephone traffic; transfers of goods, services, income, or financial items as percent of GDP; international tourism; foreign population; and international letters	KOF ETH Zurich, 2010, http://globalization.kof.ethz.ch/
27	KOF Globalization Index: Social Globalization Index—Information Flow Sub-Index (*InfoFlow*)	Including internet users, television, and trade in newspapers	KOF ETH Zurich, 2010, http://globalization.kof.ethz.ch/

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
28	KOF Globalization Index: Social Globalization Index—Cultural Proximity Sub-Index (*CultProx*)	Including number of McDonald's restaurants, Ikea stores, and trade in books	KOF ETH Zurich, 2010, http://globalization.kof.ethz.ch/
29	Global Index of Religiosity (*GIRel*)	Was established after independent pollsters asked more than 50,000 respondents one question: "Irrespective of whether you attend a place of worship or not, would you say you are a religious person, not a religious persons or a convinced atheist?". Scores range from 0 (not religious) to 100 (religious)	*WIN-Gallup International, 2012, http://www.wingia.com/web/files/news/14/file/14.pdf
30	Geert Hofstede: Power Distance (*PDist*)	This dimension expresses the degree to which the less powerful members of a society accept and expect that power is distributed unequally. The fundamental issue here is how a society handles inequalities among people. People in societies exhibiting a large degree of Power Distance accept a hierarchical order in which everybody has a place and which needs no further justification. In conclusion, Power Distance refers to engrained hierarchical inequality	Institute for Training in Intercultural Management (itim) International, the Hofstede Institute 2010, http://geert-hofstede.com/countries.html

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
31	Geert Hofstede: Individualism versus Collectivism (*Indiv*)	The high side of this dimension, called individualism, can be defined as a preference for a loosely-knit social framework in which individuals are expected to take care of only themselves and their immediate families. Its opposite, collectivism, represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty. A society's position on this dimension is reflected in whether people's self-image is defined in terms of "I" or "we." In conclusion, Individualism refers to interpersonal connection within a community	Institute for Training in Intercultural Management (itim) International, the Hofstede Institute 2010, http://geert-hofstede.com/countries.html
32	Geert Hofstede: Masculinity versus Femininity (*Masc*)	The Masculinity side of this dimension represents a preference in society for achievement, heroism, assertiveness and material rewards for success. Society at large is more competitive. Its opposite, femininity, stands for a preference for cooperation, modesty, caring for the weak and quality of life. Society at large is more consensus-oriented. In the business context Masculinity versus Femininity is sometimes also related to as "tough versus tender" cultures. In conclusion, Masculinity refers to gender role distribution	Institute for Training in Intercultural Management (itim) International, the Hofstede Institute 2010, http://geert-hofstede.com/countries.html

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
33	Geert Hofstede: Uncertainty Avoidance (*Uncertai-nAv*)	The Uncertainty Avoidance dimension expresses the degree to which the members of a society feel uncomfortable with uncertainty and ambiguity. The fundamental issue here is how a society deals with the fact that the future can never be known: should we try to control the future or just let it happen? Countries exhibiting strong UAI maintain rigid codes of belief and behavior and are intolerant of unorthodox behavior and ideas. Weak UAI societies maintain a more relaxed attitude in which practice counts more than principles. In conclusion, Uncertainty Avoidance refers to inclusiveness and openness in society versus anxious about the future	Institute for Training in Intercultural Management (itim) International, the Hofstede Institute 2010, http://geert-hofstede.com/countries.html
34	Geert Hofstede: Long Term Orientation versus Short Term Normative Orientation (*LongTerm*)	Every society has to maintain some links with its own past while dealing with the challenges of the present and the future. Societies prioritize these two existential goals differently Societies who score low on this dimension, for example, prefer to maintain time-honored traditions and norms while viewing societal change with suspicion. Those with a culture which scores high, on the other hand, take a more pragmatic approach: they encourage thrift and efforts in modern education as a way to prepare for the future In the business context this dimension is related to as "(short term) normative versus (long term) pragmatic" (PRA). In conclusion, Long Term Orientation refers to pragmatic and modest versus normative, religious, and nationalistic society	Institute for Training in Intercultural Management (itim) International, the Hofstede Institute 2010, http://geert-hofstede.com/countries.html

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
35	Geert Hofstede: Indulgence versus Restraint (*Indulg*)	Indulgence stands for a society that allows relatively free gratification of basic and natural human drives related to enjoying life and having fun. Restraint stands for a society that suppresses gratification of needs and regulates it by means of strict social norms. In conclusion, Indulgence refers to strict-ness of norms that regulate people's behaviors	Institute for Training in Intercultural Management (itim) International, the Hofstede Institute 2010, http://geert-hofstede.com/countries.html
36	National Happiness (*Happy*)	Reflecting a "growing global interest in using happi-ness and subjective well-being as primary indica-tors of the quality of human development", using a Gallup World Poll methodology	Sustainable Development Solutions Network (SDSN). 2012. http://unsdsn.org/wp-content/uploads/2014/02/WorldHappinessReport2013_online.pdf
37	Religious Diversity (*RelDiverse*)	Is calculated based on the shares of eight major world religions (Buddhism, Christianity, folk or traditional religions, Hinduism, Islam, Judaism, other religions considered as a group, and the religiously unaffiliated)	Pew Research Center, 2010, http://www.pewforum.org/2014/04/religious-diversity-index-scores-by-country/
Environmental factors			
38	Environment Protection Index (*EnvProtection*)	Ranks countries on environmental health and eco-system vitality. The index measures 20 indicators, grouped into two categories: (1) environmental health (e.g., health impacts, air pollution, and water and sanitation) and (2) ecosystem vital-ity (e.g., water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy). Scores range from 0 (worst) to 100 (best)	*Yale University Center for Environmental Law and Policy and the Center for International Earth Sci-ence Information Network at Columbia University in collaboration with the World Economic Forum and the Samuel Family Foundation, 2010, http://epi.yale.edu/

*These indices are featured on the Catalog of Indices 2016, from the International Peace Institute Global Observatory: https://theglobalobservatory.org/catalogue-indices-map/

Table 1 (continued)

No	Variable name & code	Explanation & value	Reference & data year
Sample		78 countries: Albania, Angola, Argentina, Australia, Austria, Bangladesh, Belgium, Brazil, Bulgaria, Burkina Faso, Canada, Cape Verde, Chile, China, Colombia, Croatia, Czech Republic, Denmark, Dominican Republic, Egypt, El Salvador, Estonia, Finland, France, Germany, Ghana, Greece, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Italy, Japan, Jordan, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Morocco, Mozambique, the Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Tanzania, Thailand, Trinidad and Tobago, Turkey, Ukraine, UK, USA, Uruguay, Venezuela, Vietnam, and Zambia	

Axis 1 ($F_1 = 51 \cdot 27$, $p < 0.001$) separated the countries in the bivariate space (Fig. 1B), accounting for a variation of 64%, and was positively correlated with *voice and account-ability* (0·51; $F_1 = 18 \cdot 97$, $p < 0.001$), *long-term orientation* (0·46; $F_1 = 5 \cdot 49$, $p = 0.005$), *women economic opportunity* (0·44; $F_1 = 4 \cdot 71$, $p = 0.006$), and *political stability* (0·40; $F_1 = 2 \cdot 11$, $p = 0 \cdot 12$) and negatively correlated with *masculinity* (−0·30; $F_1 = 4 \cdot 42$, $p = 0.02$). The second axis was positively correlated with *HDI* (0·59; $F_1 = 3 \cdot 93$, $p = 0.02$), *personal contact* (0·58; $F_1 = 18 \cdot 97$, $p < 0.001$), *uncertainty avoidance* (0·35; $F_1 = 2 \cdot 94$, $p = 0.05$), *women economic opportunity* (0·34; $F_1 = 4 \cdot 71$, $p = 0.006$), *voice and accountability* (0·32), *long-term orientation* (0·27), *political stability* (0·27), and *control of corruption* (0·26; $F_1 = 11 \cdot 01$, $p < 0.001$) and negatively correlated with *religious diversity* (−0·29; $F_1 = 4 \cdot 15$, $p = 0.02$) and *indulgence* (−0·26; $F_1 = 3 \cdot 71$, $p = 0.02$). The variation along the second axis ($F_1 = 18 \cdot 99$, $p < 0.001$) explained a further 23·7% of the variance between the addictive behavior-societal relationship.

The correlation of the behavioral pattern with the explanatory variables is illustrated in the patterns of addictive behavior frequency in relation to the societal descriptors (Table 2; Fig. 1A). For example, higher-than-average frequency of *tobacco* use in females is associated with increasing *personal contact* and *HDI* projected for the countries such as Bulgaria, Hungary, Croatia, Serbia, and Albania, whereas lower-than-average frequency of *tobacco* in females is associated with decreasing *personal contact* and *HDI* projected for the countries such as Vietnam, Australia, Japan, Italy, and Ghana (Fig. 1A and B). Overall, *alcohol (males)* (0·33), and *alcohol (females)* (0·32) are positively correlated with axis 1, whereas *drug (males)* (−0·24) and *drug (females)* (−0·18) are negatively correlated with axis 1 (Fig. 1A). In addition, *tobacco (females)* (0·20), *body (males)* (0·17), and *body (females)* (0·13) are positively correlated with axis 2, whereas *drug (females)* (−0·18), *drug (males)* (−0·13), and *alcohol (females)* (−0·11) are negatively correlated with axis 2.

Discussion

The dynamic nature of the globalization process is difficult to capture. To the extent that our 38 variables were able to capture that complexity, the results reveal that three national political factors, three national economic factors, and seven national and global socio-cultural factors are correlated with the four addictive behaviors.
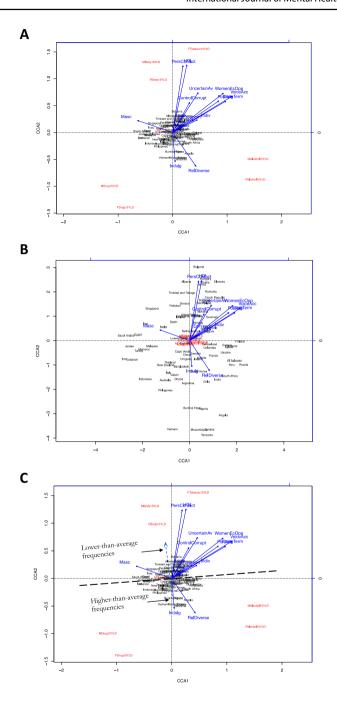
Political Impact on Length of Disability due to Addiction

Political stability, voice and accountability, and control of corruption were positively correlated with alcohol, female tobacco, and food behaviors, but negatively correlated with the use of drugs. Alcohol, BMI, and female alcohol YLD were higher in countries that allow free elections and allow their citizens to express their will, associate with one another, have access to free media, and have more stable governments. Drug YLD was lower in these countries. These political features are often associated with well-established democracies.

Economic Impact on Length of Disability due to Addiction

Three economic factors were correlated to the same addictive behaviors as the political factors. Economic freedom, women economic opportunity, and Human Development Index pertain mostly to access to goods, the first two via private opportunities, and the third

mostly via government policies. This combination of economic factors speaks to the inclusion of both national capitalism (competition) policies and government social services. We note that, in the case of BMI, this contradicts Stringhini and Bovet's (2017) findings; however, their study considered the economic status of subjects within relatively affluent

◄**Fig. 1 A, B,** and **C** Triplots of country, response, and explanatory variables from the canonical correspondence analysis (CCA). The two plots are the same, but **A** emphasizes the response variables (i.e., response variable scaling) and **B** emphasizes the country (i.e., sample scaling). Hence, plot **A** displays the major patterns in the addictive behavior with respect to the explanatory variables. For all of these triplots (i.e., **A, B,** and **C**), the length and directions of the vectors provide information about the relationships between the original explanatory variables and the derived CCA axes from a reduced model. For example, vectors that are parallel to an axis (e.g., *PersContact* and *HDI*) indicate a correlation, and the length indicates the strength of the correlation. Angles between vectors indicate the correlation among the explanatory variables. Such as, *PersContact* and *HDI* are highly correlated to each other and to axis 2, but neither is related to *Masc*, nor axis 1. Thus, Bulgaria shows increasing *PersContact* and *HDI*, whereas Vietnam shows decreasing *PersContact* and *HDI* in **B**. General Interpretation (regardless of scaling) of triplot. Locations of countries indicate their compositional similarites to each other and they tend to be dominated by the addictive behaviors that are located near them, or projected toward them in the ordination space. Locations of addictive behaviors indicate their distributional similarites to each other and they tend to be most present in the countries that are located near them, or projected toward them in the ordination space. Drawing perpendiculars through the origin from response to explanatory arrow gives approximate ranking of addictive behavioral response to that variable, and whether addictive behavior has higher-than-average or lower-than-average optimum on that explanatory variable (Table 2). For example, a perpendicular drawn through the origin of the explanatory arrow *Indug* (**C**) indicates that alcohol and drug use in males and females are higher-than-average in the direction of the vector, but lower-than-average in the opposite direction (i.e., blue dashed arrow). Detailed Results: Axis 1 ($F_1 = 51.27$, $p < 0.001$) separated the countries in the bivariate space (Fig. 1B), accounting for a variation of 64%, and was positively correlated with *Voice and Accountability* (0.51; $F_1 = 18.97$, $p < 0.001$), *Long Term Orientation* (0.46; $F_1 = 5.49$, $p = 0.005$), *Women Economic Opportunity* (0.44; $F_1 = 4.71$, $p = 0.006$), and *Political Stability* (0.40; $F_1 = 2.11$, $p = 0.12$) and negatively correlated with *Masculinity* (-0.30; $F_1 = 4.42$, $p = 0.02$). The second axis was positively correlated with *HDI* (0.59; $F_1 = 3.93$, $p = 0.02$), *Personal Contact* (0.58; $F_1 = 18.97$, $p < 0.001$), *Uncertainty Avoidance* (0.35; $F_1 = 2.94$, $p = 0.05$), *Women Economic Opportunity* (0.34; $F_1 = 4.71$, $p = 0.006$), *Voice and Accountability* (0.32), *Long Term Orientation* (0.27), *Political Stability* (0.27), and *Control of Corruption* (0.26; $F_1 = 11.01$, $p < 0.001$) and negatively correlated with *Religious Diversity* (-0.29; $F_1 = 4.15$, $p = 0.02$), and *Indulgence* (-0.26; $F_1 = 3.71$, $p = 0.02$). The variation along the second axis ($F_1 = 18.99$, $p < 0.001$) explained a further 23.7% of the variance between addictive behavior-societal. Overall, *alcohol (males)* (0.33) and *alcohol (females)* (0.32) are positively correlated with axis 1, whereas *drug (males)* (-0.24), and *Drug (Females)* (-0.18) are negatively correlated with axis 1 (Fig. 1A). In addition, *tobacco (females)* (0.20), *body (males)* (0.17), and *body (females)* (0.13) are positively correlated with axis 2, whereas *drug (females)* (-0.18), *drug (males)* (-0.13), and *alcohol (females)* (-0.11) are negatively correlated with axis 2

countries, while our study considers relative affluence among a wide range of countries. Those of relatively low economic status in affluent countries may still be more affluent than the average person in a less economically developed country. The result is that lower income individuals in affluent countries have sufficient resources to purchase high-fat, high carbohydrate foods while relatively higher income individuals in lower income countries may not be able to afford those foods.

Socio-cultural Impact on Length of Disability due to Addiction

A total of seven socio-cultural factors were correlated with addiction disability: five out of the six Hofstede dimensions (individuality, masculinity, long-term orientation, indulgence, and uncertainty avoidance); and two globalizing variables, positively impacting addiction behaviors complementarily (personal contact affecting tobacco and food consumption and religious diversity influencing alcohol and drug consumption). In contrast to the consistency of factors impacted by the governance and economic components, there was no clear pattern observed in the effects produced by socio-cultural factors. We conclude that these socio-cultural factors form a complex web of national factors, unique to each country.

Table 2 Response of behavioral variables to explanatory variables (i.e., indices)

Indices	Variable No	MAlcohol	FAlcohol	MTobacco	FTobacco	MDrug	FDrug	MBody	FBody
Governance factors									
Voice and accountability	10	*	*		*			*	*
Political stability	11	*	*		*			*	*
Control of corruption	15	*	*		*			*	*
Economic factors									
Economic freedom	18	*	*		*			*	*
Women economic opportunity	23	*	*		*			*	*
HDI	21				*			*	*
Socio-cultural factors									
Personal contact	26			*	*			*	*
Individualism	31	*	*		*			*	*
Masculinity	32			*	*	*	*	*	*
Uncertainty avoidance	33	*	*		*			*	*
Long-term orientation	34	*	*		*			*	*
Indulgence	35			*		*	*		
Religious diversity	37	*	*			*	*		

* Higher-than-average frequencies

We do note two interesting observations about these socio-cultural factors. First, while there is no clear theme connecting all of the cultural forces at play, there may be a sub-theme connecting several of them. From a social psychology standpoint, a number of these factors (i.e., collectivistic, patriarchal, traditional, indulgent, religious diversity, and personal connection) can indicate how tolerant and supportive a society is. The data suggests that the more empathetic the society, the less disability due to addiction we can observe; and, the opposite, the more individualistic (distant, patriarchal, male characteristics-dominated, pragmatic, and strict), the more people are to suffer longer from disabilities caused by addictive behaviors. This would follow Yakhnich and Michael's (2016) finding that, in trying to cope with immigration, their participants joined substance-consuming social groups for initiating addiction and joined treatment centers for abuse termination. It was the participants' loneliness (i.e., need for belonging) that triggered addiction.

Second, the indulgence factor would be suspected to be relevant to all of the study's addictive behaviors because most addictive behaviors are the direct result of over-indulgence. However, our results indicate that indulgence was not related to disabilities for tobacco use, nor for BMI. Instead, it is masculinity that positively impacts most analyzed factors (except alcohol in both sexes). While the Gender Inequality Index did not become significant in our model, it must be several subtle aspects of the masculinity index, as defined by Hofstede, that impact drug, food, and tobacco addictions, such as competitiveness, assertiveness, or material rewards for achievement.

Overall Trends in Results

Several interesting observations can be seen within the data. First, we were interested to see if any addictions were distinctive by sex. The same factors seemed to influence the addictions equally regardless of sex with one notable exception, tobacco use. All six significant governance and economic factors had a positive influence on female tobacco but not on male tobacco addiction. In addition, female tobacco use was influenced by three socio-cultural factors that did not influence male tobacco use: individualism, uncertainty avoidance, and long-term orientation. All of these factors are associated with democratic and economically advanced nations and may be related to the advancement of sex equality.

A second and somewhat unexpected trend is that there were no political or economic factors impacting disabilities resulting from drug use or male tobacco use. Those were only impacted by cultural variables. The corollary to this is that six relevant political and economic factors all impacted the same areas: alcohol, BMI, and female tobacco.

A final trend can be seen in the number of factors impacting BMI. All but two of the study's 13 significant factors influenced BMI disabilities. This suggests that obesity-related disabilities are the result of an intertwined web of factors.

Policy Implications

Because the "culture of globalization" is still undefined, it is difficult to determine whether globalization impacts the length of time that 15–49 year olds live with a disability caused by addiction. The answer to this question is a matter of degree, to which each country's norms reflect global variables. Another issue is that the level of a variable can only be established in comparison to another country's value(s).This is why the visual representations of the triplots are enlightening, allowing for simultaneous 3D visual comparisons of the 13 significant variables and offering an unprecedented glimpse into how each addictive behavior is

impacted by the unique combination of the country's variables. Winch and Thomas (2016) note that one way of addressing addiction is by influencing emotional drivers to promote behavioral changes (e.g., acceptance or disgust) needed in a sufficient quantity and quality so that the individual will react. According to our current results, different combinations of these emotional drivers need to be addressed through public education to have an adequate effect in preventing and treating addiction behaviors (Walker & Wone, 2017). Another policy measure is reevaluating local, national, and international policies and reanalyzing policy content, implications, and enforcement. This study differs from Martens et al.'s (2010), where globalization correlated with decreased mortality. However, given that our results render 13 significant variables, this study agrees with Martens' that "sustainable health cannot be addressed from a single perspective, country, or scientific discipline" (p. 12). Finally, although increased criminalization of drugs has little effect on drug consumption (Room & Reuter, 2012), a solution at the international level still remains to continue to ensure a regulated market of medical-purpose drugs, and adoption of international conventions related to addiction (such as the Convention on Narcotic Drugs and the Convention on Tobacco Control) with country-specific reservations that would adapt to the traditional and cultural practices in those countries (for example, Bolivia with cocoa leaves).

Limitations

The addition of the Hofstede dimensions to the pool of exploratory variables implies dealing with a limited sample of countries ($N = 78$) and a possibly outdated data set (2010). However, an exploratory study on the impact of globalization on addiction inequality has never been attempted before. Furthermore, because the multiple regression analysis "quantifies the relationship observed for a particular group (…) over a particular stretch of time" (Wheelan, 2014, p. 187), the same problem would arise with any year-bound data set. Berardi (2014) (p. 8) noted in 2013 that "the technical transformation implied in the process of globalization is changing the socio-cultural prospects so deeply that theoretical tools inherited from European critical theory no longer suffice for imagining the future of human evolution." If researchers were to take another "picture" today with similar sets of data, the results may look alike or different in the context of planetary changing ideologies, technological dependencies, and pedagogical value shifts that a new generation will be subjected and reactive to. This ever changing landscape may impact existing dependency relationships. For example, we may begin to see technological addictions replacing some of the addictions considered in this research. More research is needed on the effects of different forms of globalization on addiction disabilities, as updated versions of global reports become available.

Added Value of This Study

The results of this study provide insights into how a multifaceted set of national and globalization factors impact disabilities caused by addiction to tobacco, drugs, alcohol, and food over-consumption. This type of analysis has not been published to date. The multivariate triplot view simultaneously illustrates the impact of 13 significant exploratory indices on disability addiction factors by sex and thus provides novel insights into the complexity of globalization effects. Interestingly, the most affected addictions by national and globalizing factors are alcohol use for both sexes, female tobacco, and food consumption for both sexes. Higher values of democratization, development, competitiveness in society, sociability, and religious diversity are associated with more years lived with a disability in these areas.

Conclusions

Our results suggest that addiction mechanisms are as sophisticated as the individuals employing them. While this complexity may not be encouraging to policy makers, our study does provide guidance as to which factors to address. We are not suggesting that policy makers attempt to reduce addiction disabilities by reducing the feature associated with addiction. For example, high levels of personal contact are associated with obesity-related disabilities. We would not recommend lowering a country's level of personal contact as a remedy, even in the context of this pandemic. Personal contact may take different forms, such as mask-protected and social distance abiding, but also as virtual contact, when an individual can obtain the support necessary to prevent or manage an addiction. However, the results of this study suggest that prevention, treatment, and rehabilitation measures designed to prevent and change addictive behaviors such as binging and substance dependence need to be tailored to each nation based on their unique political, economic, and cultural makeup. Policy makers should recognize the factors impacting addictive behaviors and work towards appropriate solutions such as school-based or mass media education programs.

The results of this study tie in with the healthicization hypothesis in that country-level characteristics related to freedom, access to development opportunities, diversity, and certain social characteristics that reflect individual behaviors make up the social fabric and the panel of "forced choices" offered to the individual. The healthicization of addiction rests with how societal behaviors shape the individual behavior. The moral shift resulting in staying or becoming "healthy" stands not only with the individual, but also with the social opportunities of being healthy. The hierarchy of values of what it means to be healthy should be informed and shaped by community and national courses of action.

Ultimately, the authors would like to remind the audience that one of the main tenets of the World Health Organization (WHO) is everyone's right to the highest possible status of health. Gostin et al. (2016) build the argument that if the next WHO Directors will focus on this structural value (i.e., "ensuring the universal right to health") by creating a Framework Convention on Global Health, then subsequent health-related issues can also find a faster and easier solution.

Declarations

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