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Alcohol and global health

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SUMMARY

The Sustainable Development Goals are powerful indicators of a global commitment to social justice. A prerequisite to enjoying fair and equitable treatment is good health, and attaining good health has been enshrined as a universal human right in the World Health Organization´s Constitution since 1946.

Sustainable Development Goal 3 aims for good health in the broadest and most equitable sense. Within this goal, targets 3.4 and 3.5 involve reduced mortality from non-communicable diseases and suicide, improved mental health and well-being, a reduction in harmful alcohol use, and increased treatment coverage for alcohol use disorders.

This report reviews the current evidence regarding alcohol's impact on these two targets. Differential burdens of both alcohol use and harm are a pattern throughout. Through engagement with the alcohol-harm paradox – the phenomenon of "more harm per litre" for disadvantaged populations, even at equal levels of consumption – we highlight the groups that are disproportionately harmed.

Alcohol is a barrier to achieving both good and equitable health, on a global scale. Targets 3.4 and 3.5 of the third Sustainable Development Goal will not be achieved without addressing alcohol use.

LIST OF ABBREVIATIONS

AUD: Alcohol use disorder | DALY: disability-adjusted life year | GBD: Global Burden of Diseases, Injuries, and Risk Factors Study | NCD: non-communicable disease | WHO: World Health Organization | SDG: Sustainable Development Goals.

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SUSTAINABLE DEVELOPMENT GOAL 3

ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL, AT ALL AGES

1. INTRODUCTION

1.1 GLOBAL HEALTH AND TODAY'S CHALLENGES

Activities to strengthen global health are those that **improve health** and **improve health equity** of the world's population. Commitment to global health is predicated on a recognition of shared challenges and shared responsibilities, and emphasizes a mutual flow of knowledge, resources, and experiences between societies, including from low- to high-income countries.

Seen as a whole, good health is spreading. People are living longer and entire populations are ageing, and with more healthy years. Infant mortality has decreased by 37% since 2000, early childhood mortality by 44%, and new HIV cases by 35% [2].

Yet improved health is not being enjoyed universally or equally: health inequities are indeed increasing, both within and across countries. The proportion of early childhood deaths that occur in Sub-Saharan Africa and Southern Asia – already four out of every five – is increasing [3]. In one third of low-income countries, the poorest groups are reporting worse health and lower health services coverage than twenty years ago [4]. And among European and American youth, socioeconomic status predicts increasingly divergent health outcomes. The larger the income inequality within a country, the greater the health divergence over time between socioeconomic groups [5].

Health inequities are generally the result of unfair distribution of power and resources at all levels, from the global and national to the local and family. These social determinants shape the conditions in which individuals are born, grow, live, work, and age, and are for the most part beyond the reach of a single individual to correct. Neoliberal reforms emphasizing individual responsibility for health, de-regulation, and reliance on the private market rather than the welfare state to provide appropriate health services to all, have all weakened states' abilities to address social determinants of health.

1.2 ALCOHOL AS A GLOBAL HEALTH PRIORITY

Alcohol is a prime example of a cross-cutting risk factor to global health that can be regulated to a greater extent, in order to dramatically reduce health risks. Alcohol is an intoxicant, a toxin, an immunosuppressant, carcinogenic, and dependence-producing. In some societies and entire regions of the world today, alcohol use is decried. The wide consensus that children and youth's consumption should be limited, if not prevented, reflects the common understanding that consumption requires a mature level of risk assessment. Alcohol consumption before neurodevelopment is completed also sets the stage for cognitive problems and functional impairments that can last throughout adulthood.

At the same time, humans have a long history with alcohol, precisely because of its intoxicant properties. Nearly all human societies in the past 6,000 years have carved out social roles for alcohol: to demarcate childhood from adulthood, to celebrate, to mourn, to relax, for enjoyment, and to promote sociability and enhance social bonding. These are important psychosocial functions that cannot be disregarded when implementing evidence-based alcohol policies and initiatives.

The focus of this report is on alcohol's health-related effects. Alcohol consumed at infrequently, in low quantities, and in non-harmful patterns is unlikely to have acute negative effects. But a recent phenomenon is the increasing availability of commercial alcohol, both via lower costs and higher disposable incomes, and the associated spread of "leisure drinking" across settings and subpopulations. As a result, only in the past three decades have international organizations such as the World Health Organization recognized alcohol's impact on global health. In 2010, all WHO member states negotiated the Global Strategy to Reduce the Harmful Use of Alcohol. In the most recent update on actions taken, the 2018 Global Status Report on Alcohol and Health, the WHO reported there remains "a public health imperative to address effectively the harmful use of alcohol and the need to reduce alcohol-related harm worldwide" [6].

This statement seems bold, yet it gives priority only to the reduction of harmful alcohol use as target. In fact, the authors of the Global Burden of Diseases study (described in section 3.1), who provided the data used in the Global Status Report, concluded that the only amount of alcohol that will reduce alcohol related health harms to zero is zero alcohol consumption [7].

1.3 AIM AND METHODS

This report assesses alcohol's impact on selected health outcomes that are increasingly relevant to a globalizing and ageing world, using the United Nations' Sustainable Development Goals (SDGs) as a framework. In 2015, all 193 member states agreed to try to achieve the SDGs by 2030 [8]. An underlying theme is the moral imperative of reducing health inequities. These goals build off of and enhance the scope of the Millennium Development Goals; they apply to all countries, and with a specific focus on meeting the needs of the most disadvantaged groups.

The 17 SDGs and their 169 included targets are interconnected, and progress toward one will also contribute to achieving the others. SDG 3 and two of its targets are the focus of this report: **"Ensure healthy lives and promote well-being for all at all ages."** The equity focus within this goal is clear: all people, at all ages. Targets 3.4 and 3.5, involving non-communicable disease, mental health, and substance use, are explored in particular.

The current evidence base for the data for this report are drawn from the most recent, high-quality systematic reviews, meta-analyses, and international studies available, unless otherwise specified. Much of the data on global alcohol use and consequences are sourced from the Global Burden of Diseases, Injuries, and Risk Factors (GBD) Study, with 195 contributing countries and nearly 700 data sources.

Alcohol is not consumed equally.

2. GLOBAL CONSUMPTION OF ALCOHOL

In 2016, one-third of the world consumed alcohol at least once in the past year, corresponding to 2.4 billion persons [7].

Yet alcohol is not consumed equally. Consumption depends first on physical and financial availability within a given environment, which in turn is shaped by legal regulation, religious practice, and cultural norms. More than half of adults in the WHO's European, American, and Western Pacific Regions (stretching from China to Australia) consume or have consumed alcohol, compared to 5% of the Eastern Mediterranean

Region (including Egypt, Morocco, and other northern African countries). 40% of adults in the African region currently consume or have consumed alcohol. See *Figure 1*.

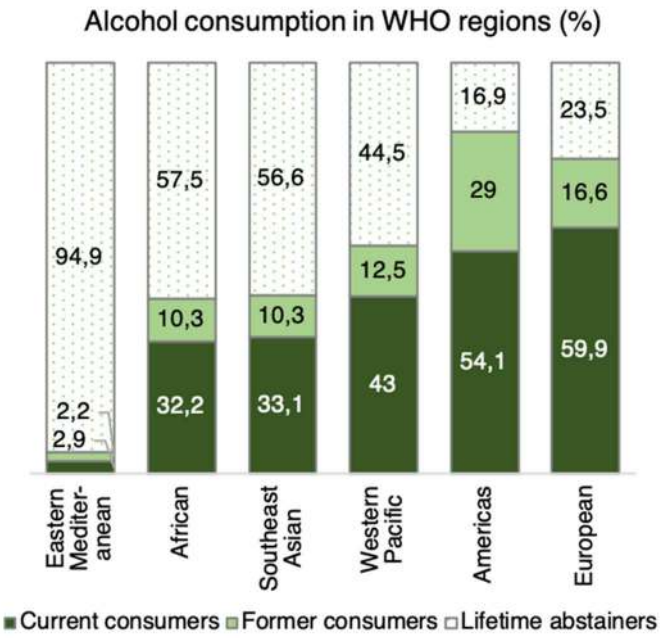

Figure 1 Most of the world does not consume alcohol

Parsing by wealth rather than region reveals further gradients: in high-income countries, 72% of women and 83% of men are current drinkers as of 2016, with mean standard drinks of 1.9 and 2.9 per day, respectively. In comparison, in low- and middle-income, 8.9% of women and 20% of men are current drinkers, and their averages are 0.3 and 1.4 standard drinks.

That consumption also depends on socioeconomic status is logical, considering commercial alcohol is a commodity that costs money, and people in low- and middle-income countries have fewer resources to spend on alcohol. Unsurprisingly, therefore, a similar gradient is also seen within countries – poorer people drink less often, and have lower total consumption, than richer people.

Within the same socioeconomic strata, people with lower social standing drink less than those with higher social standing, dependent on how large these social differences are. Women in high-income countries with lower gender-based income drink more like men, and the gender gap in consumption is lower than in low-income countries. Consumption patterns are also linked to race, ethnicity, and age, all of which intersect to influence socioeconomic status and social standing.

The alcohol industry has capitalized on differential consumption, and has a vested interest in establishing alcohol as a status symbol: companies can then create and market products specifically to groups with lower consumption by promising the attainment of status. To the alcohol industry, prevalence maps such as that in *Figure 1* represent regions to enter and expand in, as evidenced by industry activity in Africa in particular. Similarly, subpopulations with lower consumption are also seen as potential emerging markets. For example, sugared, pink-colored products have successful increased consumption among young women in high-income countries, as has outdoor advertising to racial minorities in the urban United States.

2.1 MEASURING (HARMFUL) ALCOHOL USE

The negative consequences of alcohol increase along with consumption. In health research related to alcohol, both axes are important to measure.

Figure 2

Consumption measures typically combine quantity (e.g. units of alcohol per drinking session) and frequency (e.g. amount of drinking sessions per week, or amount of high-volume drinking sessions per year) to arrive at graduated estimations of volume, as displayed on the left side of *Figure 2*. Graduated estimations do not capture in detail certain consumption patterns such as binge-drinking, which may occur infrequently but are particularly high-risk, and these patterns are often reported separately.

The second axis that must be evaluated is the severity of harm arising from consumption patterns; the right side of *Figure 2*. The WHO writes,

> "The concept of the harmful use of alcohol is broad and encompasses the drinking that causes detrimental health and social consequences for the drinker, the people around the drinker and society at large, as well as the patterns of drinking that are associated with increased risk of adverse health outcomes." [6]

Once harms overtly attributable to alcohol are observed, yet consumption persists, an individual's use graduates from risky use to abuse. Dependence arises when the individual is no longer able to stop such consumption due to physiological and biological adaptations to alcohol. In research utilizing the

American DSM-V diagnostic criteria, the term “alcohol use disorder” refers to a continuum, rather than the categories dependence and abuse.

This report will use the term *harmful use* when reporting findings of studies that measure alcohol abuse, misuse, dependence, or alcohol use disorder, as these categories and diagnoses all refer to patterns of consumption with health, social, or legal harms. *Alcohol use* will be applied when describing consumption/volume that has not been specified as harmful.

2.2 THE ALCOHOL-HARM PARADOX

Global and even national inequalities in alcohol use are conversely reflected in the burden of harms, disability, and life-years lost due to alcohol. While people who are already disadvantaged – through lower socioeconomic status; ethnic, cultural, or religious minority status; lower education; or female gender – drink less, they experience more harms from drinking, in what has been called the ***alcohol-harm paradox*** (Figure 3). These harms include loss of earnings, violence, stigmatization, and family disruption [9], which are outside of the scope of this report. Instead, this report will focus on health harms such as morbidity, mortality, and healthy years of life, described in section 3.1. The research reviewed is relevant primarily to the individual who consumes alcohol, but a brief section about health harms to others is included at the end.

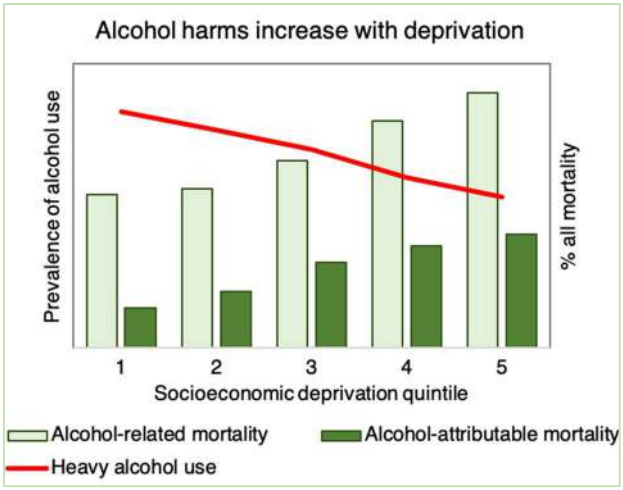

Figure 3 Adapted from the Alcohol Research Group 2015 [10]

The alcohol-harm paradox would be easily explained if people in low socioeconomic strata consumed alcohol in more harmful patterns than those in higher socioeconomic strata. In some settings, this is true, but the multiplicative and intersecting effects of relative deprivation are likely more influential [9].

Low socioeconomic status itself appears to increase vulnerability to alcohol-related health harms, with numerous possible mechanisms: clustering of other risk factors for non-communicable diseases, particularly smoking; reduced access to and quality of health care; higher availability of lower quality alcohol, such as home-brewed; drinking context, such as where and with whom drinking occurs; and other aspects of neighbourhood deprivation [10, 11]. Discrimination and stigma are also common features of poverty and distinct sources of stress, and alcohol consumption may be an attempt to cope with these stressors [12, 13]. Resilience factors such as exercise and a good diet – without which, individuals are often blamed for their own poor health outcomes – are not enough to explain or correct the alcohol-harm paradox [10]. In total, persons from lower socioeconomic strata will as a group experience more alcohol related-health harm per unit of alcohol consumed, than those in higher socioeconomic strata.

Alcohol does not harm equally.

3. GLOBAL HEALTH CONSEQUENCES

This section describes the most common techniques of measuring health harms, then discusses specific groups of harms identified in SDG targets 3.4 and 3.5 that are caused by alcohol directly, indirectly, and multiplicatively: non-communicable diseases, impaired mental health and well-being, suicides, and alcohol and other substance use disorders.

3.1 MEASURING HEALTH HARMS

In order to quantify and estimate health harms from a factor such as alcohol, the burden of disease concept has been developed. The burden of disease is the gap between current health status and the ideal situation of everyone living to old age, without disease or disability. This gap is created through premature death, disability, and risks that lead to illness and injury.

Measuring alcohol-related harm using GBD concepts
Years of life lost 1 YLL = 1 year of life lost prematurely, i.e. before the standard life expectancy.
Years lost due to disability 1 YLD = 1 year of life spent in ill health. A weighted measure of years lived in which years lived with ill health count less than years lived in full health.
Disability-adjusted life years 1 DALY = 1 year of healthy life "lost" (YLL + YLD). The sum of years of life lost due to dying prematurely and years of life spent with ill health.
Alcohol-related death The number of deaths in which alcohol was a contributing factor.
Alcohol-attributable deaths The number of deaths caused by alcohol use, which would not have happened without alcohol.

The above table explains common GBD measurements of health harms. No matter how harm is measured – through the crude measures of mortality and morbidity, or through specific measures such as age-adjusted alcohol-attributable DALYs – alcohol is a causal factor.

In 2016, 2.8 million **deaths** were attributable to alcohol use globally, corresponding to 6.8% of age-standardized deaths among men and 2.2% among women [7]. These deaths are disproportionately among younger people, as displayed in *Figure 4.* Twice the amount of premature deaths are attributable to alcohol among adults under 40 (13%) compared to those under 70 (7%). In Africa, this proportion is nearly doubled: one of every four deaths under 40 is alcohol-attributable [6].

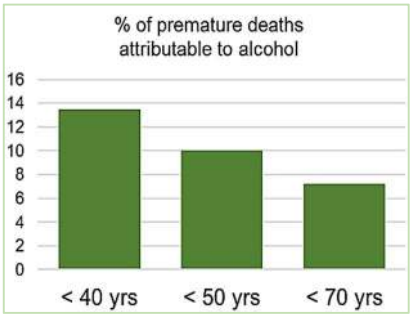

Figure 4

When looking at additional life **years lost to disability**, alcohol is the seventh leading risk factor globally. Among adults under 50, alcohol is the leading risk factor, causing 9% of DALYs for men and 2% for women.

Why does alcohol consumption increase both the risk of death and disability?

> "Alcohol use as a risk factor is unique in that it leads to an increased risk of death and disability from many different causes, with the harms caused by alcohol across these diseases, conditions and injuries cumulatively summing to a relatively large burden of disease. Specifically, alcohol is causally related to more than 200 International Classification of Disease three-digit codes, including infectious diseases, noncommunicable diseases, and injuries." [14]

Much has been written about the increased risk from alcohol on the transmission, infection, and mortality of many of the most harmful communicable diseases, such as HIV, tuberculous, viral hepatitis, and pneumonia [6]. Such classifications are inherently underreported, as many diagnoses given in everyday clinical practice are not necessarily including the "alcohol-related" aspect. Similarly, alcohol use has a recognized causal relationship with numerous intentional and unintentional injuries, such as traffic accidents, drownings, and interpersonal violence [15].

This report will primarily focus on alcohol's effects on non-communicable diseases, mental health and well-being, and alcohol and other substance use disorders. As the world's population ages, these chronic conditions are accounting for an ever-increasing proportion of the global burden of disease. Alcohol use is a modifiable risk factor that, if reduced, could substantially reduce their prevalence and mortality rates.

SDG Target 3.4 (part 1)

BY 2030, REDUCE BY ONE THIRD PREMATURE MORTALITY FROM NONCOMMUNICABLE DISEASES THROUGH PREVENTION AND TREATMENT

3.2 NON-COMMUNICABLE DISEASES

Non-communicable diseases (NCD), or chronic diseases, are the direct cause of more than two-thirds of deaths globally [16]. NCDs were historically identified as diseases of affluence; while inhabitants of low- and middle-income countries died of infectious diseases such as tuberculosis at young ages, while those in high-income countries died of cancers, diabetes, and cardiovascular diseases – after suffering them for many years. As the epidemiological transition continues, NCDs are now identified as diseases of poverty, and 86% of premature deaths due to NCDs now occur in low- and middle-income countries, where the majority of the global population live.

Rather than being transmitted through easily identifiable vectors, NCDs develop as environmental, genetic, and behavioral risk factors interact, and rarely can a NCD be prevented through removing a single risk factor. The current strategy of the WHO is therefore to reduce the risk factors associated with NCDs. The Global Action Plan for the Prevention and Control of NCDs identifies alcohol as one of the top four most important modifiable and preventable risk factors, along with tobacco use, an unhealthy diet, and physical inactivity [17].

Alcohol is a major risk factor due to its causal relationship to several major categories of NCDs: ***cardiovascular diseases, cancers, chronic respiratory diseases,*** and ***gastrointestinal disorders***. In total, nearly 82 million NCD DALYs each year are attributable to alcohol [14].

Cardiovascular diseases such as hypertensive diseases, stroke, and atrial fibrillation are responsible for most NCD deaths each year. Eighty-five percent of premature cardiovascular deaths occur in low- and middle-income countries. 0.6 million cardiovascular diseases deaths and 13 million DALYs are attributable to alcohol, due to increased blood clotting tendency and blood pressure elevation and reduced threshold for ventricular fibrillation. Alcohol is the largest contributor to cardiovascular disease deaths and DALYs in Europe (causing 11% of both) [6].

Cancer is the second leading cause of death worldwide, and 70% of cancer deaths – 6.7 million – are in low- and middle-income countries. Alcohol as a chemical compound damages DNA strands, prevents DNA repair, and promotes tumor growth, and 0.4 million cancer deaths and 10.3 million cancer DALYs are attributable to alcohol. Many cancer risks appear to increase cumulatively as alcohol is consumed, with the female breast a particularly susceptible organ: every additional drink consumed daily increases breast cancer risk by 7-10%. Heavier daily consumption, for example 4-5 drinks, increases the risk of oral cavity, pharynx, larynx, and esophagael cancers by 200-300%, and of colorectal and rectum cancers by more than 100% [18]. Proportionally, more cancers, cancer deaths, and cancer DALYs are caused by alcohol in Europe and the Americas than in other regions, as mean alcohol consumption has been highest in these regions for decades.

Chronic respiratory diseases such as chronic obstructive pulmonary disease, asthma, and pulmonary hypertension are experienced by hundreds of millions of people worldwide. Chronic obstructive pulmonary disease alone is the third most common cause of death globally, and the eighth leading cause of DALYs. These conditions are caused primarily by tobacco smoking and second-hand smoke (a bigger risk factor in high- and middle-income countries) and household air pollution from biomass fuels (a bigger risk factor in low-income countries), while poor nutrition, low birth weight, and other poverty indicators exacerbate these risks [19]. Heavy alcohol consumption over time has only recently been suggested as a potential risk factor for these diseases, likely through inhibiting general and lung-specific immune responses and increasing susceptibility to a variety of respiratory infections and

viruses that in turn increase the risk of chronic respiratory diseases [14, 20, 21].

Gastrointestinal disorder is an umbrella term for diseases effecting the digestive system, such as liver disease and pancreatitis. Alcohol's metabolism into acetaldehyde damages liver cells, and the volume of alcohol consumed has an exponential relationship to liver cirrhosis risk. Alcohol causes at least half of the 0.6 million deaths and 22 million DALYs from liver cirrhosis, which the WHO notes is a likely underestimation due to disease coding procedures. The age-standardized burden of alcohol-attributable digestive diseases deaths and DALYs were both highest in Africa (nearly 17 deaths per 100,000, and 602 DALYs). However, the proportion of these diseases' deaths and DALYs was highest in Europe; about one third.

Figure 5 displays what we know so far about the strength of the relationship between two ways of measuring alcohol consumption, and selected disease categories for which alcohol is a causal factor. Cancer risk increases as the average amount/volume of alcohol consumed increases, while ischaemic disease risk increases as a function of heavy drinking sessions.

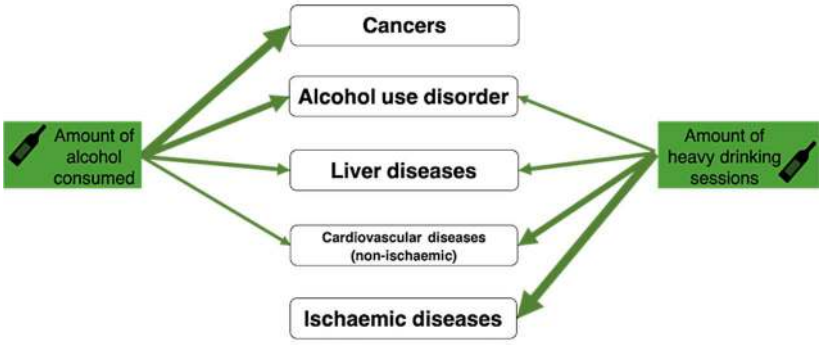

Figure 5 Adapted from Rehm et al. 2017 [1]. The width of each arrow indicates the strength of the risk.

The most recent GBD analysis has cast doubt on the traditional claim that low to moderate amounts of alcohol use could be beneficial for some conditions. Currently, the only protective effects of alcohol were found in a very specific sub-group: among women over 60 years living in high-income countries, alcohol was slightly protective of the development of ischaemic heart disease. Diabetes mellitus risk was only decreased for the lowest level of drinkers – one drink per day, compared to no drinks – and again only for women. The GBD study concluded that alcohol's harmful effects on other organs, particularly through the development of cancers and

liver diseases, far outweigh these small protective effects, and that alcohol has no overall benefit.

Alcohol's synergistic effects with other major risk factors also implicate it in the rising proportion of NCDs. The strongest relationship is between alcohol and smoking [22]. Alcohol acts as a solvent for tobacco carcinogens and smoking increasing the risk for some alcohol-related cancers described above - and their combined harms are greater than either independently [14]. That alcohol, smoking, poor nutrition, and physical activity are often clustered in some combination together means that the presence of one risk factor increases the likelihood *and* multiplies the consequences of additional risk factors. If alcohol is not addressed, health interventions which seek to change these other risk factors are unlikely to succeed [23].

High-income countries tend to have higher alcohol-attributable NCD burdens, while low-income countries have higher alcohol-attributable infectious disease burdens [15]. This does not mean alcohol is irrelevant to low-income countries' NCD burdens; on the contrary, the WHO's Package of Essential NCD Interventions for Primary Health Care in Low-Resource Settings identifies alcohol as barrier to NCD prevention and treatment in low-income countries. One reason is that some infectious diseases increase susceptibility to NCDs, such as tuberculosis, of which alcohol is a major contributor, to cardiovascular disease [24]. In low- and middle-income countries already burdened by infectious diseases and with urbanizing and ageing populations, alcohol will likely hasten the convergence of infectious and NCD burdens in low- and middle-income countries. This trend is most pronounced in the African region, where infectious diseases such as tuberculosis and HIV/AIDS remain widespread, and NCDs are rapidly increasing. Many low-and middle-income countries therefore experience a double-burden of alcohol related harm, as they are in the middle of the epidemiological and demographic transitions.

SDG Target 3.4 (part 2)

PROMOTE MENTAL HEALTH AND WELL-BEING

3.3 POORER MENTAL HEALTH

Mental health is relevant to two targets within SDG 3, first generally in target 3.4 and then relating to alcohol use disorders in target 3.5 (section 3.6).

While some mental disorders are directly fatal, such as anorexia, most contribute more to the global burden of disease through years of healthy life lost. Among all of the alcohol-attributable years spent with a disability, 98% were due to mental disorders.

The GBD methodology underestimates lives lost to mental disorders, as excess deaths among people with mental disorders are coded to their direct physical causes, and suicides (discussed later on) and self-harm are coded to injuries [25] [26]. Even with this underestimation, a clear inequity in mortality is visible: people with mental disorders die a median of 10 years earlier than people without mental disorders [27].

The WHO has identified harmful alcohol use as one of the key risk factors in the development of mental disorders [6]. (In contrast to the much of the research conducted on NCDs, which measures volume of alcohol use and seeks to uncover dose-response relationships, research on mental disorders has been mainly conducted on cohorts of patients with alcohol use disorder diagnoses, which can be interpreted as harmful use). Harmful alcohol use is strongly associated with many of the most common mental disorders and problems, to the extent that comorbidity of alcohol use disorder and another mental disorder is the rule, rather than the exception. In the following two sections, we review alcohol's impact on ***depression, anxiety, bipolar disorder, personality disorders, psychotic episodes***, and ***suicide***.

Defined according to its chemical targets in the brain, alcohol is both a depressant and a stimulant. Depressant effects such as reduced inhibitions, impaired memory and cognition, reduced impulse control, and higher depressive symptoms, are experienced in concert to stimulant effects such as aggression, increased heart rate, and dopamine release, the latter of which also makes alcohol rewarding.

The strongest evidence of a causal link between alcohol use and a specific mental disorder exists for **depression** [28, 29]. A range of potential mechanisms have been identified, from alcohol altering neurotransmitter or metabolic function in ways that increase vulnerability to depression, alcohol's social consequences such as unemployment and legal problems, and

alcohol's resulting physical health problems such as the diseases described above. Among people with alcohol use disorders (AUDs), a higher volume of alcohol predicts more severe symptoms of depression in the future [30], and in total, people with AUDs have 2.4 higher odds of also having a major depression diagnosis [31]. There is also strong evidence that people suffering from depression are more likely to eventually develop an AUD than non-depressed people [30, 32].

The relationships between alcohol and other mental disorders have been harder to disentangle, and fewer longitudinal analyses have been able to determine causality.

Anxiety disorders have a relatively early onset, that is, often before alcohol is available. This may explain why some studies report anxiety developed first, while others report AUD came first [33]. Nevertheless, both are risk factors for each other: people with AUDs have double the risk of also having an anxiety disorder compared to those without any AUD [31]. People with a pre-existing AUD are also more likely to subsequently develop anxiety disorders than people without AUD, and people with anxiety disorders are more likely to develop AUD than those without anxiety disorders.

Similar patterns of shared risk are seen in other common mental disorders and problems. People with AUD have a fourfold risk of also having **bipolar disorder** compared to those without AUD [34]. **Personality disorders**, which by definition tend to present before age 18, are also over-represented among people with AUD: about half of each patient group has the other diagnosis [35]. Multiple measurements of alcohol use (lifetime use as well as AUDs) also increase the odds of future **psychotic episodes** by about 1.5, while previous experience with psychosis increases one's risk for subsequent alcohol use or AUD, again with an odds ratio of 1.3 – 1.5 [36].

In the most conservative interpretation of the current research, harmful alcohol use contributes to the development of depression, but not to remaining mental disorders or syndromes such as anxiety, bipolar disorder, or psychotic episodes. Yet the strong associations between alcohol use and these remaining disorders mean that many who struggle with alcohol also bear multiple psychiatric burdens.

This leads to diagnostic and treatment confusion, with severe consequences for the most vulnerable. Alcohol intoxication can mask underlying disorders, and even when these disorders are recognized, people are sometimes denied treatment

for them until their alcohol use is “under control”. Alcohol interferes with most psychiatric prescriptions, necessitating detoxification before beginning in pharmacological treatment for other mental disorders, and it is rare that psychiatric and alcohol treatment are integrated. Alcohol use destabilizes mental health treatment and decreases people’s odds of remaining and succeeding in such treatment. Conversely, mental health problems also greatly reduce one’s chance of remaining in treatment for alcohol or other substance use.

No global analysis has been conducted of the social inequalities of alcohol-triggered mental health problems. However, social exclusion, unemployment, and other measures of lower socioeconomic status or social standing have long been reported to increase vulnerability for mental health problems in general, and for depression, anxiety, and psychosis individually. Gender is also an important and intersecting component. In another analysis of global GBD data, twice as many women as men suffer from depression in all regions of the world [37]. As gender inequality per region rises, measured through indicators such as domestic violence, sexual abuse, unpaid caring work, and lack of reproductive rights, the gap between women’s and men’s depression rates increases.

There is no reason to believe alcohol-related mental health problems are immune from social inequalities. Untreated mental health is a particularly under-appreciated and under-resourced problem in low- and middle-income countries. In the United Kingdom, social inequalities in mental health problems have been reported to both develop early and widen throughout the life-course, with higher education and occupational grade appearing to protect from the worsening of existing problems and the development of new problems [38, 39].

3.4 SUICIDE

800,000 people die by suicide each year, and for each of these deaths, there are twenty additional people who attempt suicide. Up to one of every five suicides and attempts are attributable to alcohol [6]: if alcohol were removed, 3.4 million suicides and attempts would be prevented yearly. People with harmful alcohol use have a 4 times greater risk of death by suicide compared to those without [30].

When examining the larger population of alcohol consumers, not only people with diagnoses, we see an alarming dose-re-

sponse relationship between drinking and subsequent attempts to commit suicide. Low levels of drinking, measured variously as a blood alcohol content of <0.1 or fewer than three drinks for women and four for men in one occasion, lead to a 3 times greater subsequent risk of suicide attempt compared to no drinking. Higher levels of drinking lead to a 37 times greater risk of suicide attempt [40].

Certain disadvantaged groups could particularly benefit from reductions in alcohol availability as a suicide prevention measure. Cross-country data on risk factors of suicide is not yet comparable, but one review of 22 studies reported various indicators of social inequality, such as unemployment and living in an area with high income inequality [41]. Suicide also disproportionately affects sexual minority youth, who have 3.5 times the risk of attempting suicide compared to their heterosexual peers, according to a recent meta-analysis [42]. American research has explicitly identified alcohol abuse as an important risk factor for sexual minority youth's suicide [43].

3.5 IMPAIRED WELL-BEING

Well-being is included in the WHO's definition of good health. While lacking a formal definition, well-being is generally understood to be a positive holistic state that can be evaluated only by individuals themselves, rather than being diagnosed. The factors that influence individuals' well-being are inherently subjective, and therefore vary widely between individuals and between their societies. Nevertheless, broad patterns appear when people describe what contributes to their well-being: good physical and mental health are important components, as are economic security, social connectedness, productivity or meaningful activities, and a general satisfaction with life.

The recognition that high volume and harmful use of alcohol significantly impair many, if not all, of the domains comprising well-being is reflected in several diagnostic criteria for AUD: persistent alcohol use despite physical or psychological problems, social or interpersonal problems, giving up or missing important social, occupational, or recreational activities, and overtly harmful consequences. People with AUD overwhelmingly report lower quality of life than people without AUD [44]. Improved well-being is therefore an explicit outcome of treatment for AUD and a marker of recovery.

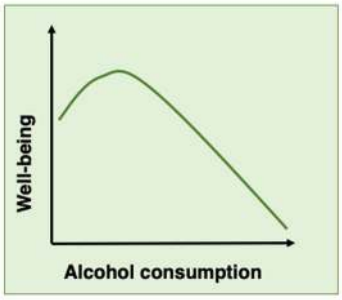

Figure 6

However, alcohol consumed in socially acceptable and expected patterns, and in volumes that do not deprive vital resources or require acquisitive criminal activity, may not immediately reduce well-being, and in fact may increase well-being. Increased well-being is likely the basis for alcohol's traditional social uses. Many large studies of general populations point towards an inverted U-shape relationship between alcohol and well-being, as seen in *Figure 6*. Drinking "some" alcohol (typically defined as a few times a week, but less than daily) may correlate with higher well-being compared to no alcohol, potentially because consumption indicates purchasing power, social status, social network, and sufficient self-rated health, any one of which abstainers may lack [45]. But as soon as volumes reach the threshold of harmful use, or when binge drinking is present, well-being begins to decrease, and often linearly [46-48].

This positive relationship well-being and low levels of consumption will likely not be seen in settings with low tolerance for alcohol use. In these settings, even low levels of consumption could indicate, result in, or exacerbate social exclusion, in total reducing well-being.

SDG Target 3.5

STRENGTHEN THE PREVENTION AND TREATMENT OF SUBSTANCE USE, INCLUDING NARCOTIC DRUG ABUSE AND HARMFUL USE OF ALCOHOL.

3.6 ALCOHOL AND OTHER SUBSTANCE USE DISORDERS

Alcohol is dependence-producing, if exposure is long-term and of some magnitude. For two of every ten male consumers in the course of their lifetime, and one of every ten female consumers, alcohol consumption will continue despite impaired functioning and problems in one's health, social, and legal areas of life. As described in section 2.1, when these problems accumulate along with cravings and other bio-psycho-social adaptations to persistent alcohol use, diagnostic categories such as abuse, misuse, dependence, and alcohol use disorder (AUD) begin to apply.

AUDs and other substance use disorders are mental disorders that are often chronic, and therefore could be included under SDG target 3.4. Their inclusion as a separate target in 3.5 is significant, as it recognizes the unique global health burden they impose.

283 million individuals currently have an AUD, including 46 million women and 237 million men. AUDs are most prevalent in high-income countries, with the highest prevalence rates in Europe (4% of women and 15% of men) and the Americas

(5% of women and 12% of men) [6]. In high-income countries, AUDs are responsible for a higher proportion of the alcohol-related disease burden than in low- and middle-income countries, which suffer more from alcohol-related injuries, accidents, and infectious diseases [15].

AUDs and sub-clinical harmful use can be prevented. Unlike NCDs and some other mental disorders, which often have a constellation of component causes, removing alcohol will completely remove the possibility of harmful use. For this reason, population-based efforts to restrict alcohol availability are the underlying tactic to reduce harmful use. A reduction of harmful use by only 15% would achieve the first indicator in target 3.5, and a 10% reduction would meet the earlier Global Action Plan for NCDs. Removing (or more realistically reducing) alcohol use will reduce the associated harm from alcohol, and may also help an individual in reducing other substance use, particularly tobacco.

Globally, 93% of those who need treatment for AUDs and other substance use disorders do not have access to evidence-based treatment, which is the second indicator of target 3.5. Treatment coverage corresponds to the resources of a country: in low-income countries, treatment coverage rates are 1%; in high-income countries, they are typically around 10% [49]. Similarly, best practices to reduce harmful alcohol use are through prevention; that is through reducing accessibility – e.g. through taxation and price regulation, restricting outlets of sale and their opening hours, allowing the monopolization of production, distribution, or sales, and setting age limits for sales – are also used most by high-income countries and least by low-income countries [6].

Another result of AUDs is stigma and subsequent marginalization. New evidence suggests that such stigma may contribute to atypical stress responses – a risk factor for further substance use [50]. Alcohol-related stigma is also a barrier to seeking other medical care, can result in lower quality care provision, and negatively affects access to education and employment opportunities. Stigma has been reported to last even after treatment completion, creating a catch-22 in which ever having an AUD can marginalize people enough to create and perpetuate social and health disadvantages, and even where they may not have existed before [9].

3.7 HEALTH HARMS TO OTHERS

So far, we have exclusively discussed alcohol's direct or indirect harms on the person drinking. However, consequences to others is an important dimension of the health harms of alcohol.

Some groups are more vulnerable to being harmed by others' alcohol use. The clearest example is the consequence of a pregnant woman's alcohol consumption to the fetus. Alcohol is teratogenic to a fetus, and when the developing central nervous system is exposed, a range of irreversible cognitive impairments and growth abnormalities can occur that are collected under the umbrella term **fetal alcohol spectrum disorder (FASD).** FASD itself is potentially a strong risk factor for the later development of mental and behavioural disorders and disabilities, particularly intellectual disabilities, ADHD, conduct disorders, learning disabilities, psychotic disorders, anxiety, and depression [51]. Children in certain already vulnerable groups have extremely elevated odds of FASD compared to the general population, in particular indigenous communities, children in foster care and orphanages, correctional populations, and children to mothers with low socioeconomic status [52]. Remarkably, the prevalence of FASD on the group level does not reflect who drinks while pregnant: an estimated one of every thirteen pregnant woman who drink will deliver a baby with FASD [53]. More women with higher socioeconomic status drink while pregnant than women with lower socioeconomic status, yet it is in the latter group that FASD and it's subsequent disorders are seen the most.

Parental alcohol use postnatally can also harm children throughout the life course in the disease categories which this report has examined. The most commonly measured outcome in studies examining such health harms is the child's future alcohol use, typically as an adolescent. In three-fourths of studies reviewed, parental alcohol use was related with statistical significance to subsequent adolescent drinking [54]. In one of the only long-term follow-up studies examining paternal drinking and child mortality, 46,000 Swedish men were followed up with from ages 18-57. Their risks for alcohol-related mortality increased along with their fathers' consumption of alcohol (from a scale of "never" to "often", and up to harmful use) even after accounting for likely covariates such as the sons' own problematic alcohol use [55]. Most studies of parental drinking's harms to children have been conducted in high-income countries, and these results remain to be confirmed in low- and middle-income countries.

Adults also report a variety of mental health problems and impaired well-being that they attribute to their partners', spouses', or other family members' alcohol use, not limited to harmful use or even intoxication [56] . In an American study of nearly 6,000 adults, the more harmful their partner or other family member's alcohol use was, the higher the odds of respondents reporting anxiety or depression – even accounting for variables that may have increased respondents' pre-existing vulnerability to depression, such as their own alcohol use [57]. Women reported more family difficulties resulting from their partners' alcohol use than men, and younger age groups – particularly 18-29 years – reported more than older groups. While non-harm health such as violence and traffic accidents are outside the scope of this report, it is important to note that women are also far more likely than men to be victimized by others' drinking, particularly women who have consumed alcohol themselves [58].

4. INDUSTRY, DEVELOPMENT, AND HEALTH

Many low-income countries have traditional alcohol consumption patterns dominated by general abstention, with episodic high-volume drinking. The alcohol industry is intentionally targeting low-income countries by promising jobs and economic growth, creating larger markets for their products because these countries have far less regulation, taxation, and consumption [15]. Rapidly changing consumption patterns are particularly visible in Africa, where the alcohol industry itself has authored WHO-recommended national alcohol strategies in at least four countries [59]. This means that alcohol is becoming more available and more affordable to entire populations residing in settings in which, if they develop an AUD, they have a 99% chance of not receiving treatment.

Industry efforts are successfully counteracting documented commitments of these countries to regulate alcohol, simply because they lack the resources and infrastructure for implementation. The most recent progress report on the WHO's Global Strategy to Reduce Harmful Use of Alcohol states:

> "While the scope and intensity of national efforts to address alcohol-related harm have increased, resources have not, particularly in low- and middle-income countries where alcohol consumption and related harm are likely to be rising most rapidly. Not a single low-income country reported increases in resources devoted to alcohol policy implementation since 2010.

> "Progress has been skewed towards wealthier countries, with low- and middle-income countries having a tendency to experience increased challenges with alcohol consumption and alcohol control." [60]

This pattern loosely mirrors the alcohol industry's actions in middle- and high-income countries. In the United States, for example, targeted advertising has successfully increased rates of harmful alcohol use among teenagers and racial minorities [12].

The health harms described in this report develop on the individual-level over time, likely over several decades. The measureable consequences in low-income countries currently subjected to intense industry action will likely be fully visible only after many years. We are therefore awaiting large future burdens in countries with health systems ill-equipped to manage them.

6. CONCLUSION

Sustainable Development Goal 3 aims for good health for all, at all ages. Targets 3.4 and 3.5 call for the reduction of mortality due to non-communicable diseases, improved good mental health and well-being, reduction of suicide mortality and harmful alcohol use, and increased treatment coverage for alcohol use disorders.

As this report has reviewed, alcohol is a risk factor both independently and multiplicatively for most of the major non-communicable diseases, and particularly for cardiovascular disease, cancer, and gastrointestinal diseases. Alcohol likely facilitates the development of major depression and potentially stimulates other mental problems, and drinking even low amounts triples the risk of suicide attempts. Even in the most resourced countries, the treatment gap for those with harmful alcohol use is 90%.

Alcohol is clearly a barrier to global health improvement, but it is also a gendered barrier to health equity. The countries with the least resources to provide treatment for alcohol's health harms are those in which the alcohol industry is currently expanding the most aggressively, intentionally taking advantage of low regulations and public health protections. And through-

out the world, many alcohol-related burdens fall disproportionately on the shoulders of certain age groups, genders, ethnic and racial minorities, and people in the lowest socioeconomic strata, as well as on entire countries and regions with the least resources. People who are most vulnerable are also the most susceptible to health harms resulting from other's alcohol use.

In a somewhat tautological definition, harmful alcohol use is indicated by its harms. Yet alcohol's negative health consequences are sometimes visible even after consumption of amounts typically considered non-harmful. According to the SDG targets 3.4 and 3.5, there does not appear to be a level of alcohol consumption that is totally without harm to global health.

Alcohol harm prevention should utilize evidence-based measures effected on the population level. The WHO has developed "best buys" of effective, cost-effective prevention techniques proven in low- and middle-income countries, including taxation, advertising bans, and regulations of sales outlets and hours. Developing (and making widely accessible) screening and treatment services for those who do develop alcohol use is also essential. Best buys are also particularly impactful in low- and middle-income countries compared to high-income countries, because inhabitants of the former are more sensitive to incremental price increases.

Such techniques are imperative to implement now in settings with lower consumption regions, such as Africa. We have windows of opportunity to resist the influence of the alcohol industry by maintaining traditional practices that discourage consumption, whether via civil societies, governments, or families.

In order to secure improved health and health equity for all in the future, the most obvious and modifiable risk factors for non-communicable diseases, poor mental health, and alcohol use disorders must be addressed. Harmful alcohol consumption is clearly a risk factor, and addressing total alcohol use on the population level will reduce harmful alcohol use and other risks described in this report. It may take several decades before the alcohol prevention efforts are reflected in the targets of SDG 3.4 and 3.5, and actions now are investments for future generations.

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