IJADR International Journal of Alcohol and Drug Research

The Official Journal of the Kettil Bruun Society for Social and Epidemiological Research on Alcohol

https://doi.org/10.7895/ijadr.437 IJADR, 2024, 12(S1), xx–xx ISSN: 1925-7066

Alcohol use, economic development, and health burden: A conceptual framework

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Abstract

Economic development has been identified as an important contributor to life expectancy: wealthier countries with better living conditions generally have different causes of death and show overall lower all-cause mortality rates. Economic development also impacts on alcohol consumption: upper-middle and high-income countries, on average, have higher levels of consumption and less abstention. Thus, there are two influencing factors on alcohol-attributable mortality, acting in opposite directions. This often leads to a paradoxical situation whereby, for some low- and middle-income countries (LMICs), increases in alcohol consumption may be associated with decreases in alcohol-attributable mortality rates due to the impact of improved living conditions outweighing the impact of higher alcohol consumption. Without any change in alcohol consumption, both alcohol-attributable and all-cause mortality are substantially improved with economic development—but an increase in consumption diminishes these benefits. Thus, increases in consumption diminish the potential benefits of economic development. Two case examples from Thailand and Vietnam are presented to illustrate this phenomenon, where failure to implement alcohol control policies in Vietnam led to marked increases of alcohol attributable mortality despite an overall decreasing rate of all-cause mortality.

Angus Deaton sketched out a historical trajectory of current high-income countries, where economic development led to overall healthier and wealthier populations, but also risked creating inequalities within societies, as well as between societies globally (Deaton, 2013). Alcohol does not play a large role in his account: as the exception to this, "excess alcohol consumption" is mentioned as one of the reasons why the Soviet Union had a lower life expectancy for men and women than would have been expected from its economic strength (Leon, 2011)

Alcoholic beverages became important industrialized commodities in the 19th and 20th centuries, with tax income constituting an important part of many countries' incomes, especially in the most powerful European empires at the time. Alcoholic beverages and other psychoactive substances have even been labelled as the "glue of empires"

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Financial support: BS and JR were supported by a grant from the Canadian Institutes of Health Research via the Ontario Canadian Research Initiative Node Team (OCRINT) CRISM Phase II (FRN 477887); KDS and JR were supported by the WHO via their support of the WHO Collaborating Centre (contract #: 2022/1273495-1).
Declaration of interest: None
Keywords: alcohol per capita consumption, economic transition, mortality, alcohol-attributable fraction, low- and middle-income countries

in the second European colonial expansion period (Courtwright, 2001; Room, 2020). As a consequence, alcoholic beverages started to play a more important role in the colonized countries as well.

Alcohol production and consumption are associated with economic development. In general, the wealthier a country is—up to a certain level—the higher the alcohol consumption. For example, based on 2008 data, Shield and colleagues found a very high correlation between adult alcohol *per capita* consumption (APC) and gross domestic product *per capita* based on purchasing power parity (GDP-PPP) up to a threshold of international $15,000 per year (Shield et al., 2011). Similar correlations can be found in earlier data for the year 2002 (Schmidt et al., 2010), and in more recent data (World Health Organization, 2018), albeit with lower thresholds for the years before 2008 and higher thresholds thereafter. Additional analyses have shown that abstinence plays a large part in the association between economic development and the level of alcohol use: the less wealthy a country, the higher the rate of abstainers (Probst et al., 2017; Schmidt et al., 2010). Religion—in particular the percentage of the population which identifies as Muslim—is the only other large impacting factor on level of alcohol consumption on a global level (Manthey et al., 2019; Probst et al., 2019).

The high correlation between GDP-PPP and alcohol use in economic development can be explained by the fact that alcohol use is by no means a necessity of life, and the poorer a country the more likely it is that the overwhelming majority will abstain from alcohol for economic reasons. However, with economic transition, more disposable income is available to purchase alcohol and the country becomes attractive for global industry as a market, with subsequent marketing efforts aimed at normalizing alcohol use and equating it to success and integration into a modern Western-oriented way of life (Babor et al., 2023). As indicated above, there is a threshold for this relationship since for changes in GDP-PPP within high-income countries, the relationship is much weaker.

This contribution explores the dynamics between economic development and alcohol use today, with an emphasis on alcohol-attributable health consequences and mortality.

Economic Development, Level of Alcohol Consumption, and Mortality

The most recent Comparative Risk Assessment for alcohol, for the year 2019, observed a clear gradient between the wealth of nations based on GDP-PPP *per capita* by the World Bank and alcohol consumption: on average, low-income countries consumed less than one third of the *per capita* alcohol consumption than high-income countries consumed (for detailed numbers, see Table 1 below and [WHO, 2023d] based on [WHO, 2023a]).

However, the alcohol-attributable mortality burden per litre of pure alcohol is much higher in low-income countries. *Harm per litre* denotes the harm, in our case the number of deaths caused by one litre of pure alcohol (Room & Rehm, 2023). It can be simply calculated by dividing all alcohol-attributable deaths in a country by the APC, which denotes the average consumption of each inhabitant. This calculation for 2019 shows that each litre of pure alcohol consumed is linked to more than four times the mortality burden in low-income countries as compared to high-income countries. As we will show below, the reason for this difference is that in high-income countries some causes of death are no longer present or are quite small, while in low-income countries some of the risk factors interacting with alcohol use, such as crowding, poverty, lack of medical services, or tobacco use are much more prevalent. As countries transition economically towards more wealth, this burden per litre is reduced. Does this mean that the health consequences of alcohol use decrease with economic development? Figure 1 summarizes the relationships between economic development, alcohol consumption, and all-cause mortality

Table 1

Economic Wealth, Alcohol Consumption, and Mortality Harm per Litre

World Bank Income Group	Adult alcohol *per capita* consumption APC (litres/year)	Mortality harm per litre (alcohol-attributable deaths per 100,000 per litre APC	
		Point estimate	[95% CI]
Low	2.86	13.00	[9.36, 17.10]
Lower-middle	3.72	9.77	[7.00, 13.99]
Upper-middle	6.06	5.33	[4.04, 7.09]
High	9.23	2.85	[2.42, 3.37]
Global	5.45	5.93	[4.83, 7.09]

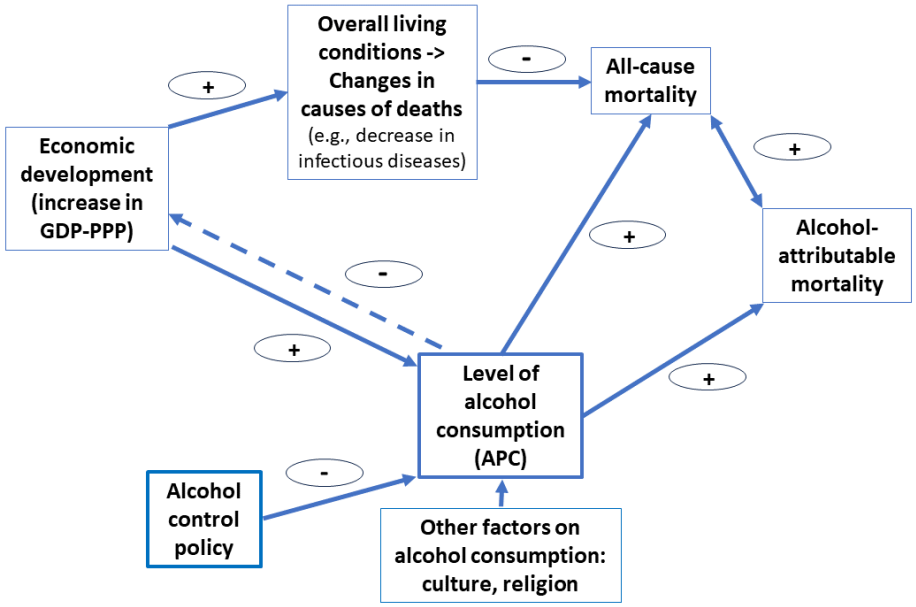
[a] CI: confidence interval; APC adult alcohol *per capita* consumption
Note: Our own calculations based on WHO data (mortality [World Health Organization, 2023a]; alcohol exposure [World Health Organization, 2023c] and the recent Comparative Risk Analysis for alcohol [see Shield et al., 2020; World Health Organization, 2023a, in press] for further details).

Economic development is of importance for both the level of consumption and the attributable health burden, such as mortality. When countries get richer, living conditions improve (Deaton, 2013), and causes of death which predominantly affect people younger in age, such as tuberculosis or other infectious diseases, become less important or disappear altogether (McKeown, 2009; Omram, 2001), leading to overall lower mortality rates and higher life expectancies.

In terms of alcohol-attributable mortality, as alcohol is a causal factor for infectious disease as well (Morojele et al., 2021; Rehm et al., 2017), this portion of mortality decreases. In addition, the improved living conditions of economic development are associated with reductions of some risk factors with which alcohol interact (e.g., crowding, poverty, lack of available health services; in some countries, e.g., the Philippines, tobacco smoking [Kaiser et al., 2016]; for more detailed reasoning, see also Shield and Rehm [2021]), and thus alcohol's mortality burden is reduced.

Figure 1

A Conceptual Model on Economic Development, Alcohol Consumption, All-Cause and Alcohol-Attributable Mortality



Note: + denotes a positive impact (e.g., higher GDP-PPP leads *ceteris paribus* to higher APC), - denotes a negative impact (more comprehensive alcohol control policies lead *ceteris paribus* to a lower level of consumption).

There are two more arrows concerning APC which require an explanation. The first one involves the dotted arrow showing that APC has a negative impact on economic transition. The Organisation for Economic Co-operation and Development (OECD) found in their last models on the impact of alcohol use that at a macroeconomic level, GDP in OECD countries is 1.6% lower due to diseases caused by alcohol consumption above the 1/1.5 drinks per day cap for females/males (OECD, 2021). In a recent review which has not yet been peer-reviewed, a meta-analysis also found a negative effect from the level of consumption on GDP (Mahesarajah & Pazoki, 2022).

Finally, as for the explanation of the last arrow involving level of alcohol consumption, the effect of APC on all-cause mortality is clear: higher levels of consumption will be associated with higher levels of all-cause mortality. The overwhelming majority of alcohol's impact on health are detrimental (Rehm et al., 2017), and every comparative risk assessment has come to this conclusion (Rehm & Imtiaz, 2016; WHO, in press).

To further answer the question about the impact of economic development on the health impact of alcohol use, Table 2 presents key data on all-cause and alcohol-attributable mortality by economic development for the year 2019. Alcohol-attributable mortality is defined as all deaths which would not have occurred in a counterfactual scenario of no alcohol use (Rehm et al., 2001), and was derived utilizing an alcohol-attributable fraction methodology (Rehm et al., 2010; Shield et al., 2020). The rates in the table were derived using the standard population of the World Health Organization (Ahmad et al., 2001).

As Table 2 demonstrates, all-cause mortality, and thus life expectancy, are highly linked to wealth. In high-income countries, the all-cause death rate is, on average, reduced by more than 60% compared to low-income countries. By extension, if economic transition is linked to substantial reductions in mortality rates, this will also be associated with reductions in alcohol-attributable mortality. However, for alcohol-attributable deaths, the proportional reduction is much smaller; in 2019, the proportional reduction amounted to about 30%. Another indication of this relationship is the increase in the alcohol-attributable fraction with increasing development. How can the difference in reductions of all-cause vs. alcohol-attributable mortality be explained? One main reason has been mentioned before: the level of alcohol consumption is strongly related to economic development for low- and middle-income countries (LMICs; Shield et al., 2011): *ceteris paribus*, the higher the GDP-PPP, the higher the alcohol consumption (with the main exceptions being related to religion).

Looking at the relationships from another angle, alcohol use slows down the mortality gains of economic development. Tuberculosis is a good example to illustrate that the reduction of its incidence in the economic transition from low- to upper-middle income countries is slowed down by some factors associated with development. The bacillus is spread more easily in crowded conditions associated with urbanization, and in situations where people's immune systems are not functioning optimally. Heavy-drinking occasions are an important factor here: both the innate and acquired immune systems are weakened (for more detailed mechanisms, see Morojele et al., 2021; Rehm et al., 2009),

thereby causally contributing to the persistence of tuberculosis and slowing down its eradication (see Target 3.3 of the Sustainable Development Goals [United Nations, 2016]).

Table 2

Economic Wealth, All-Cause Mortality, and Alcohol-Attributable Mortality

World Bank Income Group	Deaths per 100,000 people[a]	Alcohol-attributable deaths per 100,000 people[a]		Alcohol-attributable fractions[b]	
		Point estimate	[95% CI]	Point estimate	[95% CI]
Low	1082	37.1	[31.4, 46.7]	3.1%	[2.6%, 3.9%]
Lower-middle	857	36.3	[30.4, 43.9]	4.5%	[3.7%, 5.4%]
Upper-middle	584	32.3	[27.5, 38.8]	5.4%	[4.6%, 6.5%]
High	398	26.3	[22.8, 30.0]	4.8%	[4.0%, 5.8%]
Global	663	32.3	[28.2, 37.8]	4.7%	[4.1%, 5.6%]

CI: confidence interval

Note: Our own calculations based on WHO data (mortality [World Health Organization, 2023a]; alcohol exposure [World Health Organization, 2023c] and the recent Comparative Risk Analysis for alcohol [see Shield et al., 2020; World Health Organization, 2023a, in press for further details]).

[a] Rates were age-standardized using the WHO age standard (Ahmad et al., 2001).

[b] Alcohol-attributable fractions denote the proportion of all deaths which were caused by alcohol (for underlying formulas see (Rehm et al., 2010). They can be interpreted as the proportion of deaths which would disappear if no alcohol were consumed.

Alcohol use is also linked to non-communicable diseases and injuries, and reductions of the latter play an important role in the health improvements associated with economic development. Again, increased alcohol use slows down the reduction of injuries (WHO, 2023b). Indeed, the reductions of injury mortality in South Africa during the weeks of the COVID-19 pandemic when alcohol sales were prohibited are a powerful demonstration of the possibilities for a world with reduced alcohol use (Barron et al., 2022). This also has economic implications, as injury deaths tend to happen relatively early in life and, as a result, alcohol is the most important contributing risk factor for deaths in early adulthood (GBD 2020 Alcohol Collaborators, 2022; Shield & Rehm, 2015).

Consequences of the Interactions between Economic Development, Alcohol *Per Capita* Consumption and Alcohol-Attributable Burden

One result of economic development contributing to an elevated APC is that while overall mortality rates decline, the alcohol-attributable mortality rates may decrease at a rate comparatively less than that observed for all causes, or they might remain static, or in some instances, even increase (see also Room et al., 2022). This change in alcohol-attributable mortality will depend on the increase in APC and the improvement in other factors affecting the risk of mortality, which are reflected in the all-cause mortality rate. In this respect, Deaton's contention is correct that 'excess' alcohol use in Russia was a crucial factor in it not attaining its full potential given the economic transition (Deaton, 2013). The statement may be generalized so that it is not only true for excess alcohol use, but for regular alcohol use as well.

The example of South Africa during the COVID time of temporary prohibition provides a strong reminder that alcohol use can be impacted by political action. The South African government chose to limit alcohol due to its effect on socializing and weakening the immune system, in a situation where social distancing and high immune responses were necessary at the population level (Matzopoulos et al., 2020). LMICs can implement alcohol control policies to reduce alcohol-attributable mortality (Babor et al., 2023) and achieve the full benefits of economic transition.

Room and colleagues argue that alcohol control policies are often enacted whenever harms from alcohol reach unacceptable levels creating "long waves of consumption" (Room et al., 2022); however, such a view may be too pessimistic. A transition to becoming a high-income country does not necessarily mean that such a country will reach the current levels of APC of other high-income countries (see Table 1), resulting in a situation with an alcohol-attributable fraction of about 5%, where, on average, every 20th death is caused by alcohol use and could in principle be avoided with better alcohol control policies (see Table 2). However, mitigating alcohol-related harms during economic development depends on how much alcohol-attributable harm civil societies and their political leaders are willing to tolerate before initiating change.

Two Exemplary Developments

Thus far we have examined the developments based on cross-sectional data, as if the real development from a low-income to a high-income country over time would be accurately reflected by analyzing countries from these categories in 2019.

A trend analysis of two countries from the Association of Southeast Asian Nations (ASEAN), a region we selected because of its relatively fast economic growth (World Bank, 2023b), allows us to study the consequences of such growth during short time intervals. Both countries, Thailand and Vietnam, are middle-income countries; Thailand has been an

upper middle-income country since 2010, and Vietnam was a lower-middle income country during that same time period (World Bank, 2023a).

Table 3 provides an overview of the key indicators examined here. Both countries exemplify the finding that with economic growth (measured in GDP-PPP *per capita*), standardized to 2023 international dollars [World Bank, 2023c]), the all-cause age-standardized death rates decreased. However, APC also increased in Vietnam during this time period, so despite the marked decrease in overall mortality rates, the alcohol-attributable mortality rates actually increased. In contrast, while Thailand decreased the all-cause standardized mortality rates, it also decreased the alcohol-attributable mortality rates. This difference can be partially attributed to the implementation of stronger alcohol control policies in Thailand since its enactment of the *Alcoholic Beverages Control Act* in 2008 (Sornpaisarn & Rehm, 2020); for an overview of policies until 2016 in both countries, see Sornpaisarn et al. (2020).

Table 3

Economic Growth, Alcohol Use, and Mortality in Thailand and Vietnam

	Thailand					Vietnam				
Year	**GDP-PPP[a]**	**APC[b]**	**Death rate[c]**	**AA death rate[c]**	**AAF**	**GDP-PPP[a]**	**APC[b]**	**Death rate[c]**	**AA death rate[c]**	**AAF**
2010	12,989	7.57	554.8	44.1	8.3%	5,391	7.37	753.4	51.0	6.7%
2013	15,090	8.16	517.4	44.3	8.5%	6,725	8.28	740.4	52.1	7.0%
2016	16,231	8.28	512.6	44.9	8.3%	8,278	9.17	724.2	54.4	7.5%
2019	18,760	7.85	500.7	42.9	7.7%	10,687	9.34	704.8	54.4	7.6%
Proportional difference 2010-2019	44.4%	3.7%	-9.8%	-2.7%	-7.4%	98.2%	26.8%	-6.5%	6.5%	13.6%

[a] GDP PPP: gross domestic product *per capita* based on purchasing power parity (GDP PPP), standardized to 2023 international $ taken from the World Bank (World Bank, 2023c).
[b] APC: adult alcohol *per capita* consumption 3-year averages (World Health Organization, 2023c).
[c] Rates per 100,000 were age-standardized using the WHO age standard (Ahmad et al., 2001).
Abbreviations used: AA: alcohol-attributable; AAF: alcohol-attributable fraction (explanation of the concept see Table 2 above).

Appendix Table 1 provides an overview of alcohol control policies employed in Thailand and Vietnam from 2010 to 2023. Thailand implemented stronger alcohol control policies, launched them earlier than Vietnam, and continuously implemented additional alcohol control policies. This seems most evident with taxation: whereas Vietnam has adopted *ad valorem* alcohol excise taxation, which does not sufficiently control for levels of consumption (Sornpaisarn et al., 2017), Thailand imposed alcohol excise taxation using a combination of taxation methods (applying both specific taxation, tax based on alcohol content, and *ad valorem* taxation), and increased tax rates intermittently (Sornpaisarn & Kaewmungkun, 2014; Sornpaisarn et al., 2012; Tawichsri, 2019), leading to an overall higher proportion of taxes in the final price (e.g., for spirits: 31% for Thailand and 10% for Vietnam), while emphasizing the impact of such taxes on alcohol content (0.26 US$ per standard drink for Thailand and 0.12 US$ per standard drink for Vietnam [Wall et al., 2018]).

In addition to taxation laws, Thailand has a higher minimum legal purchasing age (MLPA) and more measures addressing the control of alcohol availability, such as limits on the hours and days of alcohol sale in off-premise outlets, and the country launched a new online sales prohibition in 2020 (Prime Minister's Office, 2020).

In a lengthy process with notable interference from the alcohol industry, Vietnam implemented its own control act in 2020, called *The Law on Prevention and Control of Harmful Effects of Alcoholic Beverages* (Casswell, 2022; Chung & Phuong, 2020). This Act introduced alcohol control measures aimed at driving under the influence of alcohol, alcohol sponsorship, and alcohol sales promotions. While this Act is an important step in the right direction, more needs to be done in Vietnam to reduce alcohol consumption and its attributable harms, including a revision of the alcohol taxation system and better control of availability—including the availability of unrecorded alcohol, which is particularly high in this country (63% in 2019; WHO, in press). Some of these measures had actually been proposed to be included in the current Act, but were not included due to the prominent role industry played in the deliberations (Casswell, 2022).

Limitations

This paper is a first step in conceptualizing the relationships between economic development, alcohol use, and mortality. To illustrate our concepts we used mainly relatively recent data from a recent WHO report (WHO, in press). Thus, we used cross-sectional data to illustrate an argument about economic development over time. Very clearly, cross-sectional data cannot be used to draw definitive conclusions about any causal relation, or developments over time (Morgenstern, 1998). However, first analyses on temporal developments over time showed that all countries in the Western Pacific Region of the WHO which transitioned upwards in the last 20 years from low- to lower-middle income countries, or from lower-middle income to upper-

middle income (for all transitions, see World Bank, 2023d), experienced stark increases in APC (WHO, 2023c). We illustrated this by pointing to longitudinal analyses comparing alcohol control policies and their effects in Thailand and Vietnam. However, there are other factors impacting on mortality than alcohol control policies. More detailed analyses, controlling for more factors and temporal trends in neighboring countries (for the methodology, see Rehm et al., 2023) are necessary to provide more evidence on the causal diagram suggested. We strongly encourage more research into these hypotheses in order to draw a much clearer picture on the interrelationships between economic transition, alcohol use, and mortality. More economic analyses are also necessary on the impact of level of consumption on GDP-PPP. This is an important question—one which is regularly debated in many Parliaments when it comes to alcohol control laws—and the standard position of the alcohol industry is that alcohol production and the hospitality industry contribute positively to a country's economic strength. This argument is usually accepted without further questioning or comparing this positive impact with the detrimental ones (Manthey et al., 2021). As the literature is sparse on this topic, we only used a dotted line in **Figure 1** above to illustrate the relationship.

Conclusions

Economic development is, in most cases, associated with gains in health, as indicated by lower mortality rates and higher life expectancies. However, in the absence of increased alcohol control measures it is also related to increases in alcohol consumption. The resulting health consequences of higher alcohol consumption diminish the benefits of economic development. The implementation of alcohol control policies—in particular increases in taxation, restrictions in marketing, and reductions in availability which have been shown to be cost-effective—can, for LMICs, diminish the increases in alcohol use and thus in the rates of alcohol-related harm that otherwise accompany economic development (Chisholm et al., 2018).

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