The Need for Effective Alcohol Health Warning Regulations in Taiwan

I. Introduction

Alcohol has been widely consumed in many cultures around the world for centuries ("Global Status Report on Alcohol and Health" 2). According to the World Health Organization (WHO), in 2010, worldwide consumption of alcohol was equivalent to approximately 6.2 liters of pure alcohol for every person over the age of 15 (29). This number is only expected to rise, especially in East Asia, where the WHO projects an increase in per capita consumption of 1.5 liters of pure alcohol by 2025 (42). Yet, the harmful use of alcohol is one of the top five risk factors for disease, disability, and death throughout the world (2). In 2012, about 3.3 million (5.9%) of all global deaths and 139,000 (5.1%) of all diseases and injuries were attributable to alcohol (46). Clearly, the harmful consumption of alcohol creates a significant health, social, and economic burden in societies (2).

According to the American Society of Clinical Oncology, between 5-6% of new cases of cancer and cancer deaths globally are directly attributable to alcohol consumption, corresponding to about 769,000 new cases and 477,000 deaths (Praud, et al. 1382; LoConte, et al. 83). The consumption of alcohol has been linked to an increased risk of developing various cancers, including cancer in the oral cavity and pharynx, larynx, esophagus, liver, colon, and rectum (IARC). Depending on the frequency and quantity of alcohol consumed, one may be up to 5.13 times more likely to develop oral and pharyngeal cancer, 2.65 times more likely to develop laryngeal cancer, and 4.95 times more likely to develop esophageal cancer (Bagnardi, et al.). The risk of developing liver cancer also was found to increase between 1.1-5.2 times, depending on

the amount of alcohol consumption (Chuang, et al.). As such, it is evident that alcohol consumption greatly increases cancer risks, among other detrimental health effects.

Alcohol may increase the risk of cancer through a variety of ways (Seitz and Becker 38). By generating toxins, which have the potential to damage DNA, proteins, and lipids, alcohol may cause damage to body tissues (39). Furthermore, as a result of contamination during the fermentation and production processes of alcohol beverages, alcohol beverages may also contain various other carcinogenic substances, such as nitrosamines, mycotoxins, ethyl carbamate, and pesticides ("Alcohol Consumption and Ethyl Carbamate" 1267). However, one of the main causes of this increased risk for developing cancer due to alcohol is the production of acetaldehyde, a substance which, associated with the consumption of alcoholic beverages, is classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC) ("List of Classifications"). Acetaldehyde has been found to exert toxic effects as well as damage DNA, leading to the development of various forms of cancer ("Alcohol Consumption and Ethyl Carbamate" 1277). Acetaldehyde is an intermediate product in the metabolism of alcohol and is broken down, largely by aldehyde dehydrogenases (ALDH) (1276).

There are 19 different ALDHs produced in the human body; however, the most efficient ALDH in the breakdown of acetaldehyde is aldehyde dehydrogenase-2 (ALDH2) (Gross, et al 109.). However, about 8% of the global population is ALDH2 deficient, and in East Asia, this number rises to 36% (Brooks, et al. 258). Yet, Taiwan, with 44-55% of the population being ALDH2 deficient, has the greatest ALDH2 deficient population in the world (Novoradovsky, et al. 1107; Eng, et al.24; Luo, et al. 99). Since ALDH2 deficiency results in a marked decrease in the rate of acetaldehyde metabolism, ALDH2 deficiency has been linked to a heightened risk of esophageal and head and neck cancers, even beyond the increased risks in such cancers caused

by alcohol consumption alone (Brooks, et al. 261; Huang, et al. 7). After compiling data from several studies, we found that the risk of developing esophageal cancer and head and neck cancer increase up to 11.72 and 8.30 times, respectively, compared to alcohol drinkers without the enzyme deficiency (Table 1).

Table 1. Odds Ratios of Developing Esophageal and Head & Neck Cancer for Various Drinking Quantities for Individuals with ALDH2 Deficiency[a]

Drinking (Quantity)[b]	**Esophageal Cancer (OR, 95% CI)[c]**	**Head & Neck Cancer (OR, 95% CI)[d]**
None/Light	3.00 (2.43-3.70)	1.94 (1.19-3.16)
Moderate	---	3.14 (1.74-5.64)
Heavy	11.72 (8.34-16.47)	8.30 (6.02-11.43)
Any	3.80 (3.32-4.34)	2.25 (1.88-2.68)

[a]ALDH2, alcohol dehydrogenase-2; OR, odds ratio; CI, confidence interval

[b]Drinking quantities are defined in standard drinks, with one standard drink containing 14.0 grams of ethanol. None/Light = 0-1 drinks, Moderate = 1-4 drinks, Heavy = 4+ drinks.

[c]Odds ratios for developing esophageal cancer calculated using data from studies shown in Table A1.

[d]Odds ratios for developing head and neck cancer calculated using data from studies shown in Table A2.

With the abundance of studies revealing the many dangers of the excessive consumption of alcohol in regards to health, it is clear that alcohol consumption in Taiwan, taken together with the large ALDH2 deficient population, is an issue carrying serious health and societal implications. Yet, the problems attributable to alcohol are preventable, and can be reduced through action taken on both individual and governmental levels. Hence, more steps should be taken in order to inform and protect citizens from the health risks caused by the excessive consumption of alcohol.

II. A Comparison Between Alcohol and Tobacco Regulations

In Taiwan and around the world, alcohol and tobacco use rank among the top causes of preventable diseases and deaths ("The World Health Report 2002" 7). The health hazards of tobacco have been well established for decades. Hence, many campaigns have advocated for greater legislative efforts to develop stricter regulations on tobacco products in order to reduce health risks. However, similar restrictions for alcohol, such as on public use and advertisement, have not been imposed to the same degree.

There are two main arguments used to justify the use of warning labels on tobacco but not alcohol (Stockwell 7). The first argument is that there is far greater harm associated with the use of tobacco than alcohol. However, in 2000, tobacco was estimated to contribute to 4.1% of the total burden of premature death or disability, while alcohol was found to contribute a comparable 4% ("The Global Burden"; Room, Babor, and Rehm 519). Furthermore, the World Health Organization found their 2009 report that while tobacco use causes more deaths compared to alcohol use worldwide, alcohol use accounts for a greater burden of disease ("Global Health Risks" 12). The second argument is that any level of tobacco consumption poses health risks, while only excessive consumption of alcohol poses health risks. Yet, there is no known safe level of alcohol consumption in relation to cancer risk, especially for those with ALDH2 deficiency (Chikritzhs, et al.).

Given the plethora of studies identifying alcohol as a factor for cancer, coupled with Taiwan's large ALDH2 deficient population, it is clear that alcohol, like tobacco, poses detrimental health risks in Taiwanese society. Accordingly, stricter regulations governing alcohol products should also be created in order to better inform consumers of, as well as mitigate, the long-term health effects of alcohol consumption. One effect of anti-tobacco campaigns was the

development of strict and clear-cut regulations regarding the labeling of tobacco products, especially to communicate the health risks of tobacco. Hence, there is a disparity between the requirements for health warnings on labels placed on alcohol and tobacco products, especially in (1) the content of the health warnings and (2) the size requirements for the warning labels themselves.

A. Content of Health Warning Labels

According to Article 6 of the Tobacco Hazards Prevention Act, labels on tobacco products must contain warning texts and images describing the harmful effects of tobacco use, as well as relevant information for quitting smoking (Min. of Health and Welfare). By Article 3 of Regulations for the Testing of Yields of Nicotine and Tar Contained in Tobacco Products and the Labeling of Cigarette Containers, such warning graphics and texts are prescribed by the government in sets, while every graphic and text combinations, or forms, of the same set of the prescribed health warnings must be used in rotation "on each single variant of tobacco products manufactured in the same year" (Min. of Health and Welfare). Furthermore, such labels may not use misleading words or marks "implicating that smoking has no or minor harmful effects on health" (Min. of Health and Welfare). Such regulations have a clear emphasis on health risks and informing tobacco users of the health effects of tobacco. On the other hand, by the Regulations Governing the Labeling of the Alcohol Products, warning labels on alcoholic beverages may be any one of the five following warning texts, or "other warnings approved by the central competent authority":

i. "Excessive consumption of alcohol is harmful to health."

ii. “To be safe, don’t drink and drive.”

iii. “Excessive drinking is harmful to you and others.”

iv. “Drinking is prohibited if under 18 years old.”

v. “Large quantity intake of alcohol product in a short period of time is lethal.” (Min. of Finance)

Such warnings, while relating to health, do little to inform the general population of alcohol’s long-term health risks. For example, a warning label reminding consumers that drinking is prohibited for those under the age of eighteen merely describes who may legally consume the product rather than how alcohol consumption may affect one’s health. Thus, while health warning regulations on tobacco products provide for warnings discussing the harmful health effects of tobacco for all consumers, alcohol products lack such all-encompassing warnings. Given the significant health risks posed by excessive alcohol consumption and ALDH2 deficiency, informative labels focusing on the health effects of alcohol would be beneficial in reducing the negative effects of alcohol consumption on both individuals and society at large.

B. Size Requirements for Health Warning Labels

In regards to the size requirements of warning labels, Article 6 of the Tobacco Hazards Prevention Act also provides that health warning labels must, on the largest and most conspicuous surfaces on the front and back of cigarette containers, occupy at least 35% of such labeling surfaces (Min. of Health and Welfare). On the other hand, while warning texts on alcohol products must also be placed in a conspicuous place on the container’s largest external surface, the warning texts are only required to be a minimum

of 2.65 mm in font size (Min. of Finance). Thus, such warnings on alcoholic beverages may not only be less applicable to all consumers due to the content of the warning labels, but less noticeable as well due to the small size requirement.

III. Policy Proposals

Clearly, much could still be done to improve upon the current state of alcohol labeling regulations. In their study on the effectiveness of cigarette warning labels in informing smokers about the risks of smoking, Hammond, et al. found that cigarette warning labels that are graphic, larger, and more comprehensive in content are more effective in informing consumers of the dangers and health risks of smoking, with consumers being significantly more likely to understand the aforementioned health risks (Hammond, et al. 24). As labeling regulations on tobacco products require large graphic labels that describe the health risks of tobacco consumption, it is likely that regulations on tobacco products in Taiwan facilitate greater effectiveness of health labels in comparison to current alcohol regulations. Given the myriad of detrimental effects caused by alcohol consumption, which are only furthered by ALDH2 deficiency, alcohol regulations should seek to imitate tobacco regulations in effectiveness and clarity, in order to better inform alcohol users of the harms of excessive alcohol consumption. Currently, while regulations concerning the implementation of health warnings on alcohol products are in place, the given options allow alcohol manufacturers a large amount of freedom to choose messages which, while beneficial, may be less effective in informing consumers of the harmful effects of alcohol on health (Stockwell 4). Since companies may only create warning labels that satisfy the minimum labeling requirements on their products, the minimum standards for health warning labels should be raised instead. Yet, a set of comprehensive regulations to

provide that alcohol warning labels are on par with or even beyond the standards of tobacco labeling regulations is well within our reach. Hence, we propose a three step plan to improve the effectiveness of alcohol warning labels in informing consumers of the risks of alcohol consumption.

1) The first step to be taken should ensure the communication of health risks to all alcohol consumers. Hence, the message, “Excessive consumption of alcohol is harmful to health”, should be made a mandatory warning label, while alcohol manufacturers may choose another warning label among the four remaining suggested warning messages in accordance to the Regulations Governing the Labeling of the Alcohol Products. While an informative and effective health-oriented warning label is the ultimate goal, drastic changes to labeling policies may take longer to implement. Thus, this one new regulation simply adding a mandatory warning label already approved by the central competent authority would serve as a first step to creating comprehensive and effective labels to communicate the health risks of such products.
2) Once providing that all warning labels entail a statement regarding health risks, the next step should be to improve the visibility of health warning labels. Sizes of alcohol containers vary greatly depending on the type of alcohol. Thus, rather than specifying the font size for these warnings, label size should be a minimum percentage of the alcohol container. Such labels would be more noticeable on the containers, no matter the size of the containers themselves.
3) Next, given that graphic labels have found to be more effective than simple text warnings, a further step in enabling the effective communication of the health risks of alcohol consumption could be through the placement of graphic warning labels on the

containers of alcohol products (Hammond, et al.). Just as tobacco products contain graphic displays of tobacco's health and societal harms, including images of lung cancer, birth abnormalities, tooth decay, and others, alcohol products could also contain such graphic displays of the health hazards posed by excessive alcohol consumption, for example, with images of tumors in the esophagus or head and neck. Following graphic warnings, the general health warning labels could be replaced with specific factual text warning labels associated with the graphic images in order to better inform consumers of the particular health risks associated with alcohol consumption.

With steps toward developing more comprehensive warning labels, such health warnings would be directly informative of the specific health risks posed by alcohol consumption. Given the various health and societal detriments caused by alcohol, these improvements in the clarity and rigidity of warning label regulations would greatly benefit not only the ALDH2 population and heavy drinkers, but all citizens in Taiwanese society.

Appendix

Table A1. Description of the Studies Included in the Meta-Analysis of the Association between ALDH2 Deficiency and Esophageal Cancer[a]

Study	Standard drinks/day	Drinking[b]	Cases with ALDH2 Deficiency	Cases with Normal ALDH2	Control with ALDH2 Deficiency	Controls with Normal ALDH2
Chao 2000	> 4	heavy	37	22	36	186
Yang 2007	> 0.4	any	54	57	29	41
	< 0.4	none	47	33	61	67
Yokoyama 2001	> 8.5	heavy	62	50	50	476
Matsuo 2001	> 4	heavy	46	22	4	22
Cui 2009	< 0.98	none/light	289	117	862	1169
	> 0.98	any	272	138	176	554

[a]ALDH2, alcohol dehydrogenase-2

[b]Drinking quantities are defined in standard drinks, with one standard drink containing 14.0 grams of ethanol. None/Light = 0-1 drinks, Moderate = 1-4 drinks, Heavy = 4+ drinks.

Table A2. Description of the Studies Included in the Meta-Analysis of the Association between ALDH2 Deficiency and Head and Neck Cancer[a]

Study	Standard drinks/day	Drinking[b]	Cases with ALDH2 Deficiency	Cases with Normal ALDH2	Control with ALDH2 Deficiency	Controls with Normal ALDH2
Huang 2017	0-1	light	53	49	67	120
	1-3	moderate	55	54	25	77
	>3	heavy	148	121	36	93
Yokoyama 2001	> 8.5	heavy	20	13	50	476

[a]ALDH2, alcohol dehydrogenase-2

[b]Drinking quantities are defined in standard drinks, with one standard drink containing 14.0 grams of ethanol. None/Light = 0-1 drinks, Moderate = 1-4 drinks, Heavy = 4+ drinks.

Works Cited

American Cancer Society. *Alcohol Use and Cancer*. 5 April 2017. <https://www.cancer.org/cancer/cancer-causes/diet-physical-activity/alcohol-use-and-cancer.html>.

Bagnardi, Vincenzo, et al. "Alcohol Consumption and Site-Specific Cancer risk: A Comprehensive Dose-Response Meta-Analysis." *British Journal of Cancer* 112 (2015): 580-593.

Brooks, Philip J, et al. "The Alcohol Flushing Response: An Unrecognized Risk Factor for Esophageal Cancer from Alcohol Consumption." *PLOS Medicine* 6.3 (2009): 258-263.

Chang, Jeffrey S., Jenn-Ren Hsiao and Che-Hong Chen. "ALDH2 Polymorphism and Alcohol-Related Cancers in Asians: A Public Health Perspective." *Journal of Biomedical Science* 24 (2017).

Chao, You-Chen, et al. "Chinese Alcoholic Patients with Esophageal Cancer are Genetically Different from Alcoholics with Acute Pancreatitis and Liver Cirrhosis." *American Journal of Gastroenterology* 95.10 (2000): 2958-2964.

Chikritzhs, Tanya and Tim Stockwell. "The Impact of Later Trading Hours for Australian Public Houses (Hotels) on Levels of Violence." *Journal of Studies on Alcohol* 63.5 (2002): 591-599.

Chuang, Shu-Chun, et al. "Alcohol Consumption and Liver Cancer Risk: A Meta-Analysis." *Cancer Causes & Control* 26.9 (2015): 1205-1231.

Cui, Ri, et al. "Functional Variants in ADH1B and ALDH2 Coupled with Alcohol and Smoking Synergistically Enhance Esophageal Cancer Risk." *Gastroenterology* 137 (2009): 1768-1775. 1768-1775.

Eng, Mimy Y., Susan E. Luczak and Tamara L. Wall. "ALDH2, ADH1B, and ADH1C Genotypes in Asians: A Literature Review." *Alcohol Research & Health* 30.1 (2007): 22-27.

Gross, Eric R., et al. "A Personalized Medicine Approach for Asian Americans with the Aldehyde Dehydrogenase 2*2 Variant." *Annual Review of Pharmacology and Toxicology* 55 (2015): 107-127.

Hammond, D., et al. "Effectiveness of cigarette warning labels in informing smokers about the risks of smoking: findings from the International Tobacco Control (ITC) Four Country Survey." *Tobacco Control* 15 (2006): 19-25.

Huang, Cheng-Chih, et al. "Investigating the Association between Alcohol and Risk of Head and Neck Cancer in Taiwan." *Scientific Reports* 7 (2017): 1-13.

—. "Investigating the Association Between Alcohol and Risk of Head and Neck Cancer in Taiwan." *Scientific Reports* (2017): 1-13.

International Agency for Research on Cancer. "Alcohol Consumption and Ethyl Carbamate." *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans* 96 (2010).

—. *List of Classifications, Volumes 1-121*. 18 April 2018. <http://monographs.iarc.fr/ENG/Classification/latest_classif.php>.

LoConte, Noelle K., et al. "Alcohol and Cancer: A Statement of the American Society of Clinical Oncology." *Journal of Clinical Oncology* 36.1 (2017): 83-93.

Luo, Huai-Rong, et al. "Origin and Disperal of Atypical Aldehyde Dehydrogenase ALDH2*487Lys." *Gene* 435.1-2 (2009): 96-103.

Matsuo, K., et al. "Gene-Environment Interaction between an Aledhyde Dehydrogenase-2 (ALDH2) Polymorphism and Alcohol Consumption for the Risk of Esophageal cancer." *Carcinogenesis* 22.6 (2001): 913-916.

McClain, Craig J. and Le-Chu Su. "Zinc Deficiency in the Alcoholic: A Review." *Alcoholism: Clinical and Experimental Research* 7.1 (1983).

Ministry of Finance. "Regulations Governing the Labeling of the Alcohol Products." 5 January 2015. <https://www.nta.gov.tw/web/Announce/uptAnnounceEng.aspx?c0=316&p0=7190>.

Ministry of Health and Welfare. "Regulations for the Testing of Yields of Nicotine and Tar Contained in Tobacco Products and the Labeling of Cigarette Containers." 20 August 2013. <https://law.moj.gov.tw/Eng/LawClass/LawAll.aspx?PCode=L0070031>.

—. "Tobacco Hazards Prevention Act." 23 January 2009. <https://law.moj.gov.tw/Eng/LawClass/LawAll.aspx?PCode=L0070021>.

National Cancer Institute. *Alcohol and Cancer Risk*. 24 June 2013. <https://www.cancer.gov/about-cancer/causes-prevention/risk/alcohol/alcohol-fact-sheet#q1>.

Noelle, K. LoConte, et al. "Alcohol and Cancer: A Statement of the American Society of Clinical Oncology." *Journal of Clinical Oncology* 36.1 (2017): 83-93.

Novoradovsky, A., et al. "Mitochondrial Aldehyde Dehydrogenase Polymorphism in Asian and American Indian Populations: Detection of New ALDH2 Alleles." *Alcoholism: Clinical and Experimental Research* 19.5 (1995): 1105-1110.

Praud, Delphine, et al. "Cancer Incidence and Mortality Attributable to Alcohol Consumption." *International Journal of Cancer* (2015): 1380-1387.

Room, Robin, Thomas Babor and Jurgen Rehm. "Alcohol and Public Health." *Lancet* 365 (2005): 519-530.

Seitz, Helmut K. and Peter Becker. "Alcohol Metabolism and Cancer Risk." *Alcohol Research Current Reviews* 30.1 (2007): 38-47.

Stockwell, Tim. "A Review of Research into the Impacts of Alcohol Warning Labels on Attitudes and Behavior." University of Victoria, 2006. <http://hdl.handle.net/1828/4785>.

World Health Organization. *Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks*. Geneva: WHO Press, 2009. <http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf>.

—. *Global Status Report on Alcohol and Health 2014*. Geneva: WHO Press, 2014.

—. *The Global Burden*. n.d. <http://www.who.int/substance_abuse/facts/global_burden/en/>.

—. "The World Health Report 2002: Reducing Risks, Promoting Healthy Life." 2002.

Yang, Shu-Juan, et al. "Genetic Polymorphisms of ADH2 and ALDH2 Associated with Esophageal Cancer Risk in Southwest China." *World Journal of Gastroenterology* 13.43 (2007): 5760-5764.

Yokoyama, Akira, et al. "Alcohol and Aldehyde Dehydrogenase Gene Polymorphisms and Oropharyngolaryngeal, Esophageal and Stomach Cancers in Japanese Alcoholics." *Carcinogenesis* 22.3 (2001): 433-439.