Health behaviours reported by adults with congenital heart disease across 15 countries

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Word Count: 4,477

Abstract

Background: Health behaviours are essential to maintain optimal health and reduce the risk of cardiovascular complications in adults with congenital heart disease (CHD). This study aimed to describe health behaviours in adults with CHD in 15 countries and to identify patient characteristics associated with optimal health behaviours in the international sample.

Design: Cross-sectional observational study.

Methods: Adults with CHD (N=4028, median age=32 years, IQR 25-42 years) completed self-report measures as part of an international study assessing patient-reported outcomes (APPROACH-IS). Participants reported on seven health behaviours using the Health Behaviors Scale-CHD. Demographic and medical characteristics were assessed via medical chart review and self-report. Multivariate path analyses with inverse sampling weights were used to investigate study aims.

Results: Health behaviour rates for the full sample were 10% binge drinking, 12% cigarette smoking, 6% recreational drug use, 72% annual dental visit, 69% twice daily tooth brushing, 27% daily dental flossing, and 43% sport participation. Pairwise comparisons indicated that rates differed between countries. Rates of substance use behaviours were higher in younger, male participants. Optimal dental health behaviours were more common among older, female participants with higher educational attainment while sports participation was more frequent among participants who were younger, male, married, employed/students, with higher educational attainment, less complex anatomical defects, and better functional status.

Conclusions: Health behaviour rates vary by country. Predictors of health behaviours may reflect larger geographic trends. Findings have implications for the development and implementation of programs for the assessment and promotion of optimal health behaviours in adults with CHD.

Clinical Trail Registration: The study protocol was registered at ClinicalTrials.gov: NCT02150603.

Abstract Word Count: 250

Keywords: Heart defects, congenital; patient reported outcome measures; health behaviour; risk factors; prevention

Introduction

Optimal health behaviours (i.e., actions individuals take to maintain or enhance their health and reduce health risks) are essential in the maintenance of good health and reduction of risk for cardiovascular complications (e.g., hypertension, stroke, infective endocarditis) in adults with congenital heart disease (CHD). Underscoring the importance of health behaviours, adults with CHD are at higher risk than the general population for cardiovascular events (1,2). Both the 2018 American College of Cardiology (ACC)/American Heart Association (AHA) Guidelines (3) and the 2010 European Society of Cardiology (ESC) guidelines (4) include general recommendations for health behaviours associated with better general and cardiovascular health. Adult CHD providers are encouraged to provide education to their patients about physical activity, oral hygiene behaviours (e.g., tooth brushing, flossing), dental follow-up, and avoidance of unsafe substance use (e.g., heavy alcohol consumption, cigarette smoking, recreational drug use) (5-6).

Despite efforts to educate adults with CHD about the importance of various health behaviours, many adults have poor knowledge about the effects of a sedentary lifestyle, inadequate oral hygiene, and substance use on their cardiovascular health (7, 8). Although adults with CHD tend to report lower rates of risky substance use relative to healthy peers, alarming rates of binge drinking (26-44%), cigarette smoking (5-28%), and recreational drug use (11.4%) have been reported (8-14). Furthermore, poor oral hygiene and lack of dental care as well as low physical activity levels have been identified in this population (8,10,12,14-17).

Data regarding health behaviour rates frequently obscure international and individual differences. Although geographic variations have been observed for health behaviours in the general population (18,19), little is known about international differences in the adult CHD population. Potential causes of differences in health behaviours as a function of nationality

include cultural beliefs and practices, access to preventative care, and socioeconomic development factors (20-22). Moreover, there is little knowledge regarding the patient-level characteristics related to health behaviours in adults with CHD. Individual demographic (e.g., age, sex, education level) and medical factors (e.g., heart defect complexity, functional status) have clear associations with behaviours that contribute to cardiovascular risk in both the general population (20) and among adults with CHD (7,11,14,21). Both geographic context and individual patient characteristics may inform providers' efforts to identify patients whose health behaviours may predispose them to increased cardiovascular risks. This knowledge may then be applied to targeted approaches to health behaviour screening and interventions.

The present study had three aims: [1] to describe health behaviours in a large international sample of adults with CHD; [2] to compare health behaviours in this sample across countries; and [3] to identify patient characteristics associated with health behaviours.

Methods

Participants and Procedures

Participants were enrolled as part of the Assessment of Patterns of Patient-Reported Outcomes in Adults with Congenital Heart disease – International Study (APPROACH-IS), which is a cross-sectional, observational study in 15 countries: Argentina, Australia, Belgium, Canada, France, India, Italy, Japan, Malta, Norway, Sweden, Switzerland, Taiwan, the Netherlands, and the United States (US). Data collection consisted of a battery of self-report questionnaires and occurred from April 2013 through March 2015. The study protocol was approved by the Institutional Review Board of the University Hospitals Leuven/KU Leuven (i.e., the coordinating centre) and additional ethical approval and/or Institutional Review Board approval was obtained by each participating centre as required. Participants provided written

informed consent at most sites, although there were some countries in which national legislation does not require written consent for survey studies. Additional study procedures have been described in full elsewhere (23). The study protocol was registered at ClinicalTrials.gov: NCT02150603.

To participate in APPROACH-IS, patients met the following eligibility criteria: [1] diagnosis of CHD; [2] 18 years of age or older; [3] diagnosis identified prior to adolescence; [4] continued follow-up at a CHD centre or participation in a national/regional registry; and [5] absence of physical, cognitive, or language barriers to completing study measures. Patients were excluded from the study if they had undergone heart transplantation or had comorbid Group 1 pulmonary hypertension, except for pulmonary arterial hypertension related to CHD.

Measures

In addition to medical chart review and completion of a demographic and medical history questionnaire, participants completed a battery of questionnaires, including the Health Behaviors Scale – Congenital Heart Disease (HBS-CHD) (24), a self-report measure assessing three domains of health (below). The HBS-CHD has been used in other CHD research and has demonstrated good-to-excellent content validity, adequate convergent validity, and good-to-excellent ability to detect clinically meaningful changes (24). The HBS-CHD was translated into other languages through a rigorous academic process (e.g., forward and backward translation, pilot testing with participants, revisions and proofreading) (24). With the exception of Dutch, psychometric data is not available for all language translations used in this study.

[1] Substance use: To assess monthly binge-drinking, participants were asked to report how often they consumed 6 drinks or more on one occasion. One item assessed whether or not participants currently smoked cigarettes. Participants also reported use of other recreational

substances, including cannabis, amphetamines ("speed"), 3,4-methylenedioxymethamphetamine (MDMA; "ecstasy"), cocaine, and psychedelic mushrooms; use of any of these drugs at least once per month was combined into one dichotomous variable indicating recreational drug use.

[2] Dental health behaviours: Participants reported whether they had visited the dentist within the past year and their average frequency of tooth brushing and flossing. Participants were considered to be following oral hygiene recommendations (7) if they had one annual dentist visit, brushed their teeth at least twice per day, and flossed at least once per day.

[3] Physical activity: Participants reported whether they regularly practiced a sport (yes/no), excluding their daily commute via walking or cycling to school or work. Data regarding moderate and vigorous physical activity in this sample have been reported elsewhere (25).

Data Analytic Plan

The seven health behaviour response variables were measured as binary outcomes. Analyses were conducted using Mplus (version 7.3) (26) in three phases to address the study aims. All analyses, with the exception of health behaviour rate comparisons between countries (i.e., Aim 2), used bootstrap resampling to obtain empirical rather than estimated standard errors, and the False Discovery Rate (FDR) (27) was used to control the Type-1 error rate. To control for the different sample sizes across countries, an inverse sampling weight was used for analyses addressing Aim 2 (28). Missing data was minimal (0.1%-9.1%) and handled via maximum likelihood estimation. Sample characteristics are presented as median[interquartile range]. A 2-tailed p-value of <0.05 indicated statistical significance.

Aim 1 (i.e., describing specific health behaviour rates in adult CHD) was investigated using descriptive statistics. Aim 2 analyses used multivariate path analysis to compare the seven health behaviours across countries. Specifically, 14 nations were dummy-coded with the US (i.e.,

the largest subsample) serving as the reference class. These 14 dummy variables served as predictors of the seven binary health behaviour response variables. A significant result indicated that the given health behaviour was reported more (or less) often versus the US sample. Italy was not included in analyses comparing binge drinking across countries because <5% Italian participants reported this behaviour. Aim 3 (identification of significant predictors of health behaviours for the overall sample) analyses involved the use of multivariate path analysis; the seven health behaviour response variables were allowed to correlate, and were regressed onto five demographic (*age, sex, marital status [married/cohabiting vs. single/divorced/widowed], education, and employment status [employed/student vs. unemployed/retired],*) and two medical (*defect complexity, NYHA class*) variables. Supplementary analysis of the associations between patient characteristics (i.e., demographic and medical variables) and the seven binary health behaviour response variables within each country was also conducted. Specifically, separate multivariate path analyses were performed for each country using multi-group analysis techniques.

Results

Participants

In total, 4,028 participants (median age 32[25-42] years, 53% women) were enrolled in APPROACH-IS. Approximately half of the sample had at least moderately complex CHD and 54% classified themselves as NYHA Functional Class I (i.e., no limitation of physical activity). See Supplementary Table 1 for additional participant demographics. Specific characteristics of the samples within each country have been provided in detail elsewhere (29).

Aim 1: Health behaviours in adults with CHD

For the total sample, 10% of patients reported binge drinking, 12% reported cigarette smoking,

and 6% reported at least monthly use of recreational drugs. Regarding oral hygiene, 72% of the patients had an annual dentist visit, 69% reported twice daily tooth brushing, and 27% confirmed daily flossing. Sport participation was reported by 43% of participants.

Aim 2: International comparisons for health behaviours

Percentages of each reported health behaviour for each country are described in Figure 1. Health behaviour rates varied widely across countries, with multiple significant differences from the US reference group for each behaviour (bold font in Figure 1). Statistics are available in Supplementary Table 2.

Patients from Australia and participating countries within Western and Northern Europe reported the highest rates of binge drinking and cigarette smoking while recreational drug use was highest in participating countries from North and South America. Patients from India and Taiwan reported the lowest rates of substance use behaviours. A more in-depth analysis of specific drugs (e.g., cannabis, MDMA, cocaine, psychedelic mushrooms, amphetamines) used in each country is reported in Figure 2. The highest rates for annual dental visits were observed in some Western and Northern European countries (81-87%), and the lowest rate in India (28%). Large disparities in daily tooth brushing and once daily flossing were observed within some countries (e.g., in France, 72% met tooth brushing criteria while 3% met flossing criteria; in India, 24% met tooth brushing criteria while 63% met flossing criteria). Regarding physical activity, patients in Asia (i.e., Taiwan, India, and Japan) and the US tended to report the lowest rates of sport participation while higher rates were observed in participating countries from Western and Northern Europe.

Aim 3: Predictors of health behaviours in adult CHD

Multivariate path analysis statistics for the entire sample are reported in Table 1.

Substance use. Significant predictors varied by health behaviour. Patients who reported at least monthly binge drinking were more likely to be younger, male, less educated, employed/students, and have less complex defects. Cigarette smoking was more likely in patients who were younger, male, less educated, and had less complex defects. Monthly drug use was associated with worse functional status, unemployment, and being unmarried.

Dental health. For all three variables, better dental health care and hygiene were associated with being older, female, and having higher educational attainment. Patients with a better functional status were also more likely to brush their teeth and follow up yearly with a dentist, while employment was associated only with annual dental follow-up.

Physical activity. Patients who were younger, male, married/cohabiting, employed/students, with greater educational attainment, less complex defects, and better functional status reported a higher likelihood of participating in sports.

Supplementary within-country analysis: In general, the relationship between specific patient characteristics and each health behaviour differed within each country. Complete statistics are provided in Supplementary Table 3.

Discussion

This large, international investigation examined the breadth and depth of health behaviours (substance use, dental care, physical activity) in adults with CHD. Results provide insight into geographic trends in the rates of health behaviours and identify predictors of health behaviours at the international level. These findings have implications for the development and implementation of programs, including structured transition services for the transfer from paediatric to adult CHD care, that target assessment and promotion of optimal health behaviours in adults with CHD. Increasing the likelihood that adults with CHD will abstain from unhealthy

substance use, engage in annual dental care and good oral hygiene, and participate in physical activity pursuits is essential for maintaining optimal cardiovascular outcomes and preventing complications in this population.

Results demonstrated wide variability in the rates of each health behaviour across participating countries. Reasons for these differences are likely multifactorial (e.g., health care organization, national economic development, cultural values and beliefs, laws and regulations pertaining to availability of some substances, geographic barriers) (20,22). In line with conclusions by Caruana and Grech (14), health behaviours of adults with CHD may largely follow demographic trends of the general population, with the presence of CHD having only a subtle impact. To maximize the likelihood of positive cardiovascular outcomes, all CHD providers, regardless of geographic location, are encouraged to screen for health behaviours and provide appropriate intervention. However, within countries, it is important to identify health behaviours that may be of particular concern to identify patients most at risk for adverse cardiovascular complications. For example, countries with lower rates of annual dental follow-up care may develop and implement a screening tool, provide targeted education about the importance of regular dental care and hygiene, and address logistical barriers (e.g., identifying local dentists, helping patients to navigate payment options).

Our findings revealed several patterns in the associations between patient characteristics and health behaviours. Consistent with previous research in both CHD and general population samples (9,11,14,30), patients who were younger and male were more likely to engage in all three substance use behaviours. These results are concerning given the established short- and long-term negative cardiovascular outcomes associated with binge drinking, cigarette smoking, and recreational drug use during young adulthood (31-33). Further, adults with less education

and less complex heart defects were also more likely to report binge drinking and cigarette use. Overall, younger male adults with CHD may be a target group for focusing efforts to assess substance use, provide education about the long-term effects of each type of substance use, and provide tailored recommendations (e.g., referral to a smoking cessation program, involvement of behavioural health providers).

Rates of dental follow-up and oral hygiene (i.e., tooth brushing, flossing) tended to be highest in patients who were older, female, better educated, or had a lower NYHA class. Indeed, prior research with healthy adults has also found that education level and female sex are positively associated with better oral hygiene behaviours (34), although sex and age were unrelated to dental follow-up in a sample of Maltese adults with CHD (14). However, it is concerning that patients with poorer functional status were less likely to follow guidelines for annual dental follow-up and tooth brushing. These patients are at greater risk for cardiovascular complications, including endocarditis (35). Given that dental problems are a primary cause of infective endocarditis (36), efforts to improve access and education regarding annual dentist visits and oral hygiene behaviours may be especially important for patients with poorer functional status.

Patients most likely to engage in sports tended to be younger, male, married or cohabiting with a partner, better educated, employed or in school, and have simpler defects and better functional status. These findings are largely consistent with previous research examining physical activity rates in adults with CHD (9,11,16,17,25,37). Of note, while physicians historically tended to restrict physical activity for patients with more complex CHD, there has been increasing awareness about the benefits of appropriate exercise and cardiac rehabilitation programs for patients with severe defects (e.g., single ventricle physiology, tricuspid atresia)

(38). In general, CHD providers are encouraged to provide education about physical activity (e.g., why it is important for long-term cardiovascular health, patient-specific limitations) and engage patients in promoting physical activity. Based on our results, extra attention on this topic may be needed for patients who are older or female and those with more complex CHD and poorer functional status.

Taken together, our results suggest that efforts to maximize optimal health behaviours require global evidence-based educational and behavioural approaches adapted to each region's specific characteristics and needs. CHD providers may aim to improve their identification of patients in need of support for changing health behaviours. Referral to behavioural health specialists (e.g., psychologists, clinical social workers, counsellors) who have expertise in evidence-based interventions for promoting health behaviour changes should also be considered. Other multidisciplinary professionals, including physical therapists and dietitians, may also be instrumental in promoting optimal health behaviours. Structured programs designed to facilitate the transition from pediatric to adult CHD services may provide a unique and valuable opportunities to educate adolescent and young adult patients about optimal health behaviours and assist them in maintaining healthy lifestyles (6, 8).

In addition to patient characteristics, it is also critical for CHD providers to consider the unique geographic, cultural, economic, and socio-political factors that may affect their patients' ability or willingness to engage in optimal health behaviours (22). Patients may face varying obstacles (e.g., availability, ease of travel, cost of services, social stigma) in accessing appropriate dental care, substance abuse services, and physical activity programs. Furthermore, health literacy should be considered since this has been found to be associated with health behaviours (39). Further research is needed within each country to determine other country-level

factors that may need to be considered when developing screening and intervention methods to increase optimal health behaviours.

Despite the relative strengths of this study (e.g., large international sample, rigorous analytic plan, type 1 error control), the results of this study must be considered with respect to several limitations. First, health behaviours were assessed via self-report, which may introduce recall and social desirability biases and provide overly positive estimates of health behaviours (37). Future studies may benefit from incorporating multiple reporters (e.g., significant others), more objective measures (e.g., pedometers, dental follow-up records, toxicology testing), and ecological momentary assessment methods. Second, data were cross-sectional, thereby precluding the ability to identify causal associations, and were limited to the years 2013-2015; longitudinal research will serve an important role in determining the direction of the effects and tracking changes in health behaviour rates over time. Future studies may also establish associations between health behaviours and clinically meaningfully CHD outcomes (e.g., hospital admissions, cardiovascular indices, quality of life). Third, the binary health behaviour outcomes utilised in the study do not allow for more nuanced insights regarding each health behaviour. Additional studies are needed to fully examine each health behaviour (e.g., for adults who endorse cigarette smoking, additional investigation into the frequency, amount, age at first cigarette, attempts to quit, etc.). Similarly, although internationally recognised operationalisations of health behaviours for decreasing cardiovascular risk were used, we acknowledge that definitions, language translations, and applications may vary depending on geographic region. For example, in contrast to the definition of binge drinking used in this study, binge drinking is defined in the US as at least four drinks for women or five drinks for men consumed within approximately two hours (40). Also, when translated into some Indian

languages, the term for dental flossing may also apply to traditional or indigenous dental hygiene methods that may differ from current Western flossing practices. Fourth, we acknowledge that this study did not investigate all health behaviours considered vital to optimal cardiovascular health. Additional health behaviours to study in the future include dietary choices, tattoo safety, prophylactic antibiotic use, vaccinations, and stress management practices. Other patient characteristics, such as anxiety, depressive symptoms, and health beliefs, are also important to examine as potential predictors. Fifth, it is acknowledged that there was variability in the number of participating sites per country (e.g., India–1 site, US–6 sites) that did not reflect each country's population size. Certainly, within-country variability must be considered when interpreting these results and designing future studies.

In conclusion, although many adults with CHD maintain healthy lifestyles, there remains a sizable portion of the population engaging in recreational substance use, lacking adequate dental care and oral hygiene, and not participating in sports. Patients are more likely to engage in particular health behaviours depending on the country in which they live. This investigation may encourage CHD providers to adapt screening, promotion, and intervention efforts aimed at improving optimal health behaviours to the specific needs of the countries in which they practice as well as to the patient characteristics that are uniquely related to health behaviours within each country.

Funding Sources: The Research Fund – KU Leuven (OT/11/033), the Swedish Heart-Lung Foundation (20130607), the University of Gothenburg Centre for Person-centred Care, Cardiac Children's Foundation Taiwan (CCF2013_02), and the National Institutes of Health (T32HD068223).

Conflict of Interest: None of the authors have a conflict of interest

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Figure Legends

Figure 1. Descriptive statistics and pairwise comparisons of health behaviour rates for the entire sample and by country. Bold values indicate those that are significantly different than the reference country (US) at $P<0.05$.

Figure 2. Usage rates (%) of specific types of recreational drugs by country.

Table 1. Multivariate path analysis results demonstrating associations between patient characteristics and health behaviours for the entire sample.

	Binge Drinking			Cigarette Smoking			Recreational Drug Use			Annual Dentist Visit		
Predictor	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age	**0.99**	**0.98;1.00**	**.001**	**0.99**	**0.98;1.00**	**.022**	**0.96**	**0.94;0.98**	**<.001**	**1.02**	**1.01;1.03**	**<.001**
Defect Complexity	**0.72**	**0.62;0.85**	**<.001**	**0.71**	**0.62;0.81**	**<.001**	0.98	0.81;1.18	.829	1.08	0.97;1.21	.152
Sex (Female)	**0.23**	**0.18;0.28**	**<.001**	**0.72**	**0.59;0.89**	**.002**	**0.42**	**0.31;0.57**	**<.001**	**1.46**	**1.25;1.70**	**<.001**
Married/Cohabiting	**0.80**	**0.65;0.99**	**.042**	0.95	0.76;1.18	.639	0.79	0.57;1.10	.165	1.10	0.93;1.29	.259
Education	**0.87**	**0.77;0.99**	**.032**	**0.74**	**0.66;0.82**	**<.001**	0.94	0.81;1.08	.372	**1.14**	**1.06;1.23**	**.001**
Employed/Student	**1.62**	**1.15;2.27**	**.006**	0.96	0.74;1.24	.758	0.94	0.64;1.36	.729	**1.51**	**1.26;1.81**	**<.001**
NYHA Class	0.85	0.72;1.01	.058	1.01	0.89;1.16	.839	1.14	0.95;1.37	.165	**0.81**	**0.73;0.90**	**<.001**

	Brush Teeth 2x/Day			Floss 1x/Day			Sport Participation		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age	**1.01**	**1.01;1.02**	**<.001**	**1.03**	**1.02;1.04**	**<.001**	**0.99**	**0.98;1.00**	**.007**
Defect Complexity	1.05	0.94;1.16	.398	1.11	0.98;1.25	.091	**0.88**	**0.79;0.99**	**.029**
Sex (Female)	**1.99**	**1.72;2.29**	**<.001**	**1.62**	**1.39;1.88**	**<.001**	**0.77**	**0.68;0.88**	**<.001**
Married/Cohabiting	1.01	0.84;1.21	.951	0.86	0.70;1.05	.127	**1.23**	**1.07;1.40**	**.003**
Education	**1.27**	**1.17;1.38**	**<.001**	**1.30**	**1.19;1.42**	**<.001**	**1.25**	**1.17;1.34**	**<.001**
Employed/Student	1.23	0.98;1.55	.074	0.91	0.70;1.18	.474	**1.46**	**1.21;1.77**	**<.001**
NYHA Class	**0.83**	**0.75;0.91**	**<.001**	1.01	0.91;1.12	.848	**0.62**	**0.56;0.69**	**<.001**

Note: NYHA, New York Heart Association. OR, Odds Ratio. CI, Confidence Interval. Defect complexity was coded using a 3-point scale (i.e., 1=simple, 2=moderate, 3=complex). Education was coded using a 4-point scale (e.g., 1=Less than high school; 4=University degree). Bold font indicates significance at P<.05.

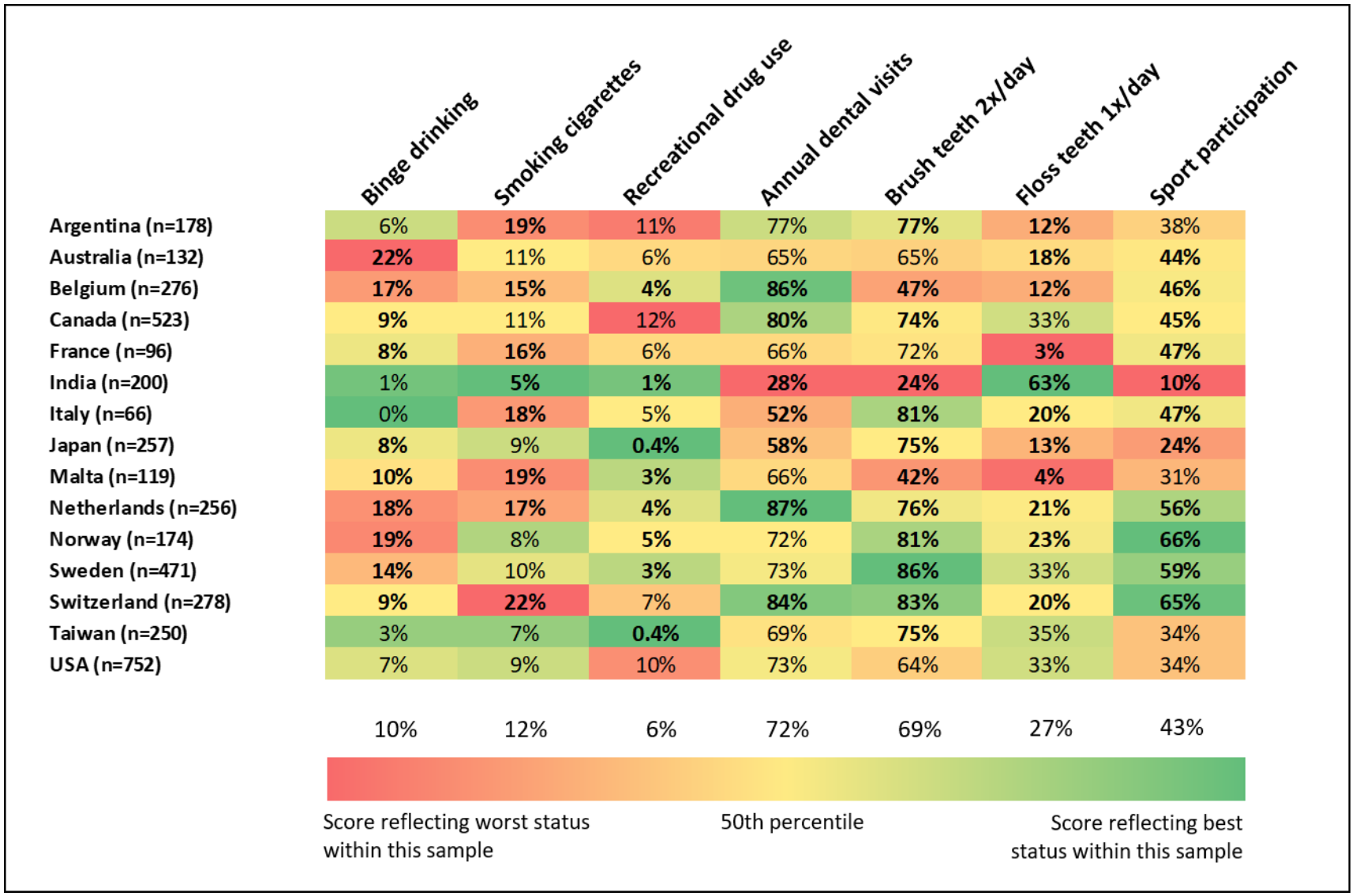
Binge drinking
Smoking cigarettes
Recreational drug use
Annual dental visits
Brush teeth 2x/day
Floss teeth 1x/day
Sport participation
Argentina (n=178) 6% 19% 11% 77% 77% 12% 38%
Australia (n=132) 22% 11% 6% 65% 65% 18% 44%
Belgium (n=276) 17% 15% 4% 86% 47% 12% 46%
Canada (n=523) 9% 11% 12% 80% 74% 33% 45%
France (n=96) 8% 16% 6% 66% 72% 3% 47%
India (n=200) 1% 5% 1% 28% 24% 63% 10%
Italy (n=66) 0% 18% 5% 52% 81% 20% 47%
Japan (n=257) 8% 9% 0.4% 58% 75% 13% 24%
Malta (n=119) 10% 19% 3% 66% 42% 4% 31%
Netherlands (n=256) 18% 17% 4% 87% 76% 21% 56%
Norway (n=174) 19% 8% 5% 72% 81% 23% 66%
Sweden (n=471) 14% 10% 3% 73% 86% 33% 59%
Switzerland (n=278) 9% 22% 7% 84% 83% 20% 65%
Taiwan (n=250) 3% 7% 0.4% 69% 75% 35% 34%
USA (n=752) 7% 9% 10% 73% 64% 33% 34%
10% 12% 6% 72% 69% 27% 43%
Score reflecting worst status within this sample
50th percentile
Score reflecting best status within this sample

Figure 1.

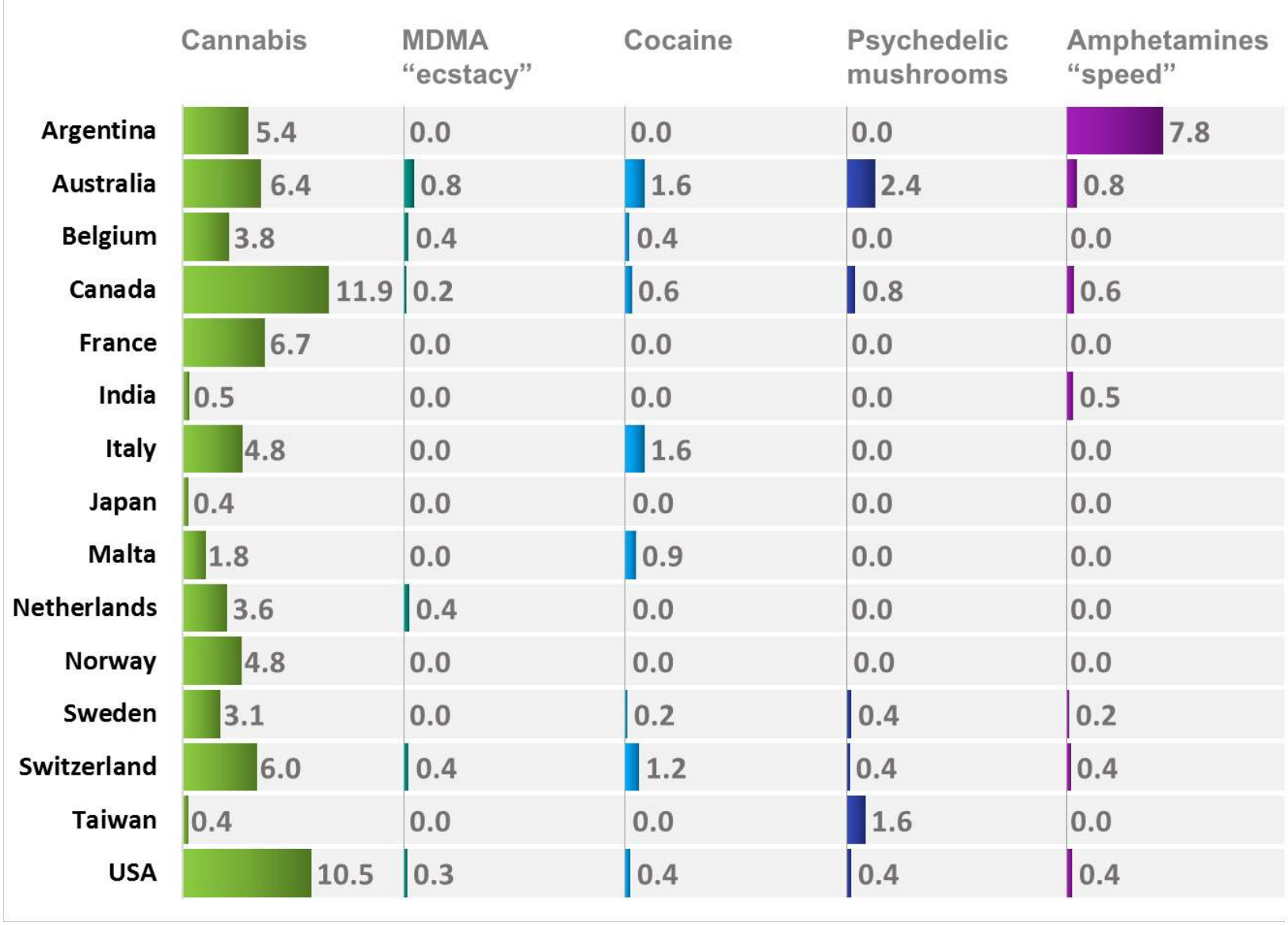
Cannabis
MDMA "ecstacy"
Cocaine
Psychedelic mushrooms
Amphetamines "speed"
Argentina 5.4 0.0 0.0 0.0 7.8
Australia 6.4 0.8 1.6 2.4 0.8
Belgium 3.8 0.4 0.4 0.0 0.0
Canada 11.9 0.2 0.6 0.8 0.6
France 6.7 0.0 0.0 0.0 0.0
India 0.5 0.0 0.0 0.0 0.5
Italy 4.8 0.0 1.6 0.0 0.0
Japan 0.4 0.0 0.0 0.0 0.0
Malta 1.8 0.0 0.9 0.0 0.0
Netherlands 3.6 0.4 0.0 0.0 0.0
Norway 4.8 0.0 0.0 0.0 0.0
Sweden 3.1 0.0 0.2 0.4 0.2
Switzerland 6.0 0.4 1.2 0.4 0.4
Taiwan 0.4 0.0 0.0 1.6 0.0
USA 10.5 0.3 0.4 0.4 0.4

Figure 2.

Supplementary Table 1. Demographic and medical background variables in 4028 adults with congenital heart disease

Variables	**n (%)**
Sex: women (n=4,012)	2,115 (52.7)
Median age in years (n=4,021)	32.0 (IQR 25-42)
Background (n=3,944)	
White or Caucasian	2,908 (73.7)
Asian	781 (19.8)
Hispanic or Latino	131 (3.3)
Middle-Eastern or Arabic	52 (1.3)
Black or African-American	41 (1.0)
Other	31 (0.8)
Educational level (n=3,989)	
Less than high school	223 (5.6)
High school	1,715 (43.0)
College degree	846 (21.2)
University degree	1,205 (30.2)
Employment status (n=4,005)	
Part-time or full-time work	2,554 (63.7)
Job seeking, unemployed, or disability	515 (12.9)
Homemaker or retired	331 (8.3)
Full-time student	327 (8.2)
Other	278 (6.9)
Marital status (n=4,008)	
Married or living with partner	2,045 (51.0)
Never married	1,753 (43.7)
Divorced or widowed	204 (5.1)
Other	6 (0.2)
Children: yes (n=4,004)	1,584 (39.6)
Patient-reported New York Heart Association assessment (n=3,927)	
Class I	2,109 (53.7)
Class II	1,375 (35.0)
Class III	287 (7.3)
Class IV	156 (4.0)
Complexity of heart defect (n=4,028)	
Simple	1,040 (25.8)
Moderate	1,957 (48.6)
Complex	1,031 (25.6)

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Supplementary Table 2. Rates of seven health behaviours across countries and comparison with US reference group.

Binge Drinking				
	Frequency		Comparison to US Reference Group	
Country	n	%	*p*	OR
Argentina	11	6.29	.087	1.81
Australia	29	22.48	**<.001**	**7.83**
Belgium	47	17.15	**<.001**	**5.59**
Canada	46	8.95	**<.001**	**2.65**
France	8	8.33	**.025**	**2.45**
India	2	1.00	.074	0.27
Italy	0	0.00	*N/A*	0.00
Japan	21	8.27	**.001**	**2.43**
Malta	12	10.08	**.001**	**3.03**
The Netherlands	45	17.65	**<.001**	**5.17**
Norway	33	19.19	**<.001**	**6.41**
Sweden	65	13.95	**<.001**	**4.38**
Switzerland	24	8.66	**<.001**	**2.56**
Taiwan	7	2.82	.555	0.78
United States	53	7.13	--	--
Total Sample	403	10.11		

Cigarette Smoking				
	Frequency		Comparison to US Reference Group	
Country	n	%	*p*	OR
Argentina	33	19.08	**<.001**	**2.34**
Australia	15	11.36	.422	1.28
Belgium	42	15.33	**.005**	**1.80**
Canada	57	10.98	.281	1.23
France	15	15.96	**.040**	**1.89**
India	9	4.55	**.040**	**0.47**
Italy	11	18.03	**.028**	**2.19**
Japan	22	8.70	.831	0.95
Malta	22	18.49	**.002**	**2.26**
The Netherlands	44	17.25	**.008**	**1.86**
Norway	14	8.14	.679	0.88
Sweden	47	10.13	.569	1.12
Switzerland	60	21.74	**<.001**	**2.76**
Taiwan	17	6.85	.267	0.73
United States	68	9.14	--	--
Total Sample	476	11.96		

Recreational Drug Use				
	Frequency		Comparison to US Reference Group	
Country	n	%	*p*	OR
Argentina	20	11.24	.614	1.14
Australia	8	6.06	.149	0.57
Belgium	11	3.99	**.002**	**0.37**
Canada	63	12.05	.352	1.18
France	6	6.25	.253	0.61
India	2	1.00	**.001**	**0.09**
Italy	3	4.55	.155	0.42
Japan	1	0.39	**.001**	**0.04**
Malta	3	2.52	**.014**	**0.23**
The Netherlands	9	3.52	**.001**	**0.29**
Norway	8	4.60	**.023**	**0.42**
Sweden	15	3.18	**<.001**	**0.29**
Switzerland	19	6.83	.105	0.65
Taiwan	1	0.40	**.001**	**0.03**
United States	77	10.24	--	--
Total Sample	246	6.11		

Annual Dentist Visit				
	Frequency		Comparison to US Reference Group	
Country	n	%	*p*	OR
Argentina	134	76.57	.392	1.18
Australia	86	65.15	.052	0.68
Belgium	238	86.23	**<.001**	**2.27**
Canada	411	79.50	**.013**	**1.40**
France	63	66.32	.146	0.71
India	55	27.50	**<.001**	**0.14**
Italy	31	56.67	**<.001**	**0.39**
Japan	146	57.48	**<.001**	**0.49**
Malta	79	66.39	.112	0.72
The Netherlands	221	87.01	**<.001**	**2.70**
Norway	125	72.25	.756	0.94
Sweden	343	72.82	.821	0.97
Switzerland	232	83.45	**.001**	**1.83**
Taiwan	172	69.08	.186	0.81
United States	544	73.41	--	--
Total Sample	2880	72.11		

Brush Teeth 2x/Day				
	Frequency		Comparison to US Reference Group	
Country	n	%	*p*	OR
Argentina	133	76.88	**.001**	**1.89**
Australia	85	65.38	.682	1.09
Belgium	119	46.85	**<.001**	**0.50**
Canada	376	73.73	**<.001**	**1.59**
France	68	72.34	.104	1.49
India	46	23.83	**<.001**	**0.18**
Italy	52	81.25	**.006**	**2.46**
Japan	189	75.00	**.001**	**1.70**
Malta	50	42.02	**<.001**	**0.41**
The Netherlands	181	75.73	.526	1.24
Norway	140	80.92	**<.001**	**2.41**
Sweden	392	85.78	**<.001**	**3.42**
Switzerland	226	82.48	**<.001**	**2.67**
Taiwan	187	75.00	**.001**	**1.71**
United States	465	63.79	--	--
Total Sample	2709	69.28		

Floss Teeth 1x/Day				
	Frequency		Comparison to US Reference Group	
Country	n	%	*p*	OR
Argentina	21	12.21	**<.001**	**0.29**
Australia	24	18.18	**.001**	**0.46**
Belgium	31	12.16	**<.001**	**0.29**
Canada	171	33.20	.799	1.03
France	3	3.23	**<.001**	**0.07**
India	115	63.19	**<.001**	**3.56**
Italy	13	20.00	**.040**	**0.52**
Japan	34	13.39	**<.001**	**0.32**
Malta	5	4.31	**<.001**	**0.09**
The Netherlands	49	20.68	.585	0.81
Norway	40	22.99	**.015**	**0.62**
Sweden	151	32.54	.993	1.00
Switzerland	55	20.00	**<.001**	**0.52**
Taiwan	86	34.54	.558	1.10
United States	239	32.52	--	--
Total Sample	1037	26.47		

Sport Participation				
	Frequency		Comparison to US Reference Group	
Country	n	%	*p*	OR
Argentina	66	37.93	.275	1.21
Australia	58	44.27	**.019**	**1.57**
Belgium	126	45.82	**<.001**	**1.67**
Canada	231	45.03	**<.001**	**1.62**
France	45	47.37	**.009**	**1.78**
India	19	9.55	**<.001**	**0.21**
Italy	29	46.77	**.038**	**1.74**
Japan	58	23.67	**.004**	**0.61**
Malta	36	30.51	.514	0.87
The Netherlands	141	56.18	**<.001**	**2.98**
Norway	113	65.70	**<.001**	**3.79**
Sweden	274	59.05	**<.001**	**2.86**
Switzerland	176	64.71	**<.001**	**3.63**
Taiwan	84	33.87	.929	1.01
United States	247	33.56	--	--
Total Sample	1703	43.06		

Note: US, United States. For binge drinking, Italian sample was not included in analyses due to 0 participants endorsing the behaviour and associated violations to the assumptions of logistic regression. The probability of binge drinking for Italian patients is essentially equal to 0. Bold font indicates significant differences (P<.05) between the given country and the US.

Supplementary Table 3. *Path analysis associations between patient characteristics and health behaviours within each country.*

Argentina								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.077	1.07	.579	1.01	.070	0.96	.258	0.98
Defect Complexity	**.034**	**0.45**	.139	0.61	.056	0.46	.130	0.63
Sex (Female)	**.005**	**0.14**	.555	0.77	.140	0.43	.569	0.79
Married/Cohabiting	.158	0.05	.417	1.49	.069	0.26	.778	0.89
Education	.077	0.36	.369	1.24	.603	0.88	.667	1.09
Employed/Student	.146	3.77	.685	0.83	.649	0.76	.083	0.45
NYHA Class	.706	1.15	.451	0.83	.122	0.57	.221	0.74

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.094	0.97	.081	1.03	**.011**	**0.96**
Defect Complexity	.149	1.63	.073	0.50	.084	0.61
Sex (Female)	**.001**	**4.11**	.161	2.32	.147	0.59
Married/Cohabiting	.118	2.13	.433	0.64	.065	2.04
Education	.377	1.19	.533	1.23	.332	1.19
Employed/Student	.303	1.57	.959	1.03	.234	1.63
NYHA Class	.660	0.89	.349	1.33	**.031**	**0.61**

Australia								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	**.042**	**0.91**	.611	0.98	.914	1.01	.641	1.02
Defect Complexity	.555	0.82	.280	1.52	**.019**	**0.25**	.711	0.90
Sex (Female)	**.002**	**0.18**	.778	1.20	**.037**	**0.08**	**.006**	**3.08**
Married/Cohabiting	.153	2.17	.282	2.06	.703	1.45	.731	1.17
Education	.954	1.02	.267	0.59	.154	2.04	.711	1.09
Employed/Student	.057	4.75	.767	0.80	.088	0.26	.533	1.33
NYHA Class	.917	1.04	.857	1.07	.135	1.71	.456	0.85

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.748	0.99	**.028**	**1.08**	.152	0.96
Defect Complexity	.368	0.77	.082	0.55	.421	0.78
Sex (Female)	.221	1.65	.726	0.82	.068	0.48
Married/Cohabiting	.754	1.15	.666	0.79	.243	1.66
Education	.119	1.48	.270	1.36	.140	1.37
Employed/Student	.847	1.10	**.030**	**0.27**	.844	1.10
NYHA Class	.400	0.82	**.042**	**0.49**	.051	0.52

Belgium								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.587	0.99	.652	0.99	*No results reported due to*		.398	1.02
Defect Complexity	.532	1.21	.372	0.80	*less than 5% of sample*		**.008**	**2.03**
Sex (Female)	**<.001**	**0.14**	.519	0.79	*reporting this behaviour*		.124	1.78
Married/Cohabiting	.265	0.65	.504	0.78			.867	1.07
Education	.437	1.17	.098	0.69			.065	1.55
Employed/Student	.755	1.26	.326	2.05			.671	1.29
NYHA Class	**.013**	**0.35**	.405	0.78			.597	0.87

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.838	1.00	**.005**	**1.06**	-0.03	.061
Defect Complexity	.825	1.05	.452	1.24	-0.22	.298
Sex (Female)	.074	1.61	.511	1.31	-0.39	.162
Married/Cohabiting	.932	1.03	.882	1.08	-0.50	.095
Education	.573	1.10	.649	0.88	**0.84**	**<.001**
Employed/Student	.246	1.68	.582	1.42	0.71	.139
NYHA Class	.052	0.65	.723	0.90	-0.30	.238

Canada								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.167	0.98	.601	0.99	**.001**	**0.94**	.174	1.02
Defect Complexity	**.017**	**0.52**	.970	0.99	.782	1.07	.363	1.19
Sex (Female)	**<.001**	**0.22**	.057	0.54	**<.001**	**0.14**	**.039**	**1.63**
Married/Cohabiting	.336	0.71	.437	0.78	.409	0.77	.849	1.05
Education	.501	0.88	**<.001**	**0.50**	**.001**	**0.55**	**<.001**	**2.44**
Employed/Student	.054	3.40	.644	1.22	.146	0.51	.756	0.90
NYHA Class	.837	1.06	.652	1.09	.335	1.23	.859	0.97

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.101	1.02	**.001**	**1.03**	**.017**	**0.98**
Defect Complexity	.119	1.31	.899	1.02	.315	0.86
Sex (Female)	**.018**	**1.69**	**<.001**	**2.08**	.872	0.97
Married/Cohabiting	.413	0.83	.261	0.79	.565	1.12
Education	**<.001**	**1.71**	**.003**	**1.45**	**.002**	**1.43**
Employed/Student	.160	1.50	.981	1.01	.467	1.22
NYHA Class	.153	0.79	**.019**	**0.67**	**<.001**	**0.57**

France								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.439	0.96	**.046**	**0.94**	.379	0.91	.496	1.03
Defect Complexity	**.027**	**0.16**	.547	0.79	.137	0.30	.621	1.18
Sex (Female)	**.038**	**0.09**	.224	0.53	.119	0.32	.408	0.68
Married/Cohabiting	.050	0.11	.312	1.93	.365	0.31	.993	1.00
Education	.279	0.56	.819	1.07	.940	0.96	.747	1.08
Employed/Student	.061	13.08	.271	0.48	.948	1.08	**.040**	**0.25**
NYHA Class	.224	0.60	.898	1.05	.244	0.56	.800	0.92

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.448	1.02	*No results reported due to*		.703	1.01
Defect Complexity	**.039**	**2.32**	*less than 5% of sample*		.072	1.90
Sex (Female)	.161	2.10	*reporting this behaviour*		**.004**	**0.25**
Married/Cohabiting	.889	1.08			.057	2.82
Education	.052	1.60			.078	1.54
Employed/Student	.193	2.18			.824	0.87
NYHA Class	.705	0.88			.083	0.52

India								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	*No results reported due to*		*No results reported due to*		*No results reported due to*		.212	0.97
Defect Complexity	*less than 5% of sample*		*less than 5% of sample*		*less than 5% of sample*		.458	1.18
Sex (Female)	*reporting this behaviour*		*reporting this behaviour*		*reporting this behaviour*		.270	1.49
Married/Cohabiting							.137	2.07
Education							.503	1.12
Employed/Student							.742	0.88
NYHA Class							.634	0.91

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.256	0.97	.281	1.03	**.007**	**0.86**
Defect Complexity	.089	0.69	.402	0.83	.614	0.85
Sex (Female)	.892	1.05	.842	0.93	.148	0.39
Married/Cohabiting	.210	1.99	.075	0.45	.802	1.18
Education	.494	1.14	.780	0.96	.134	1.52
Employed/Student	.271	1.54	.171	0.57	.999	1.00
NYHA Class	.792	1.06	.846	0.97	.761	0.93

Italy								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	*No results reported due to*		.418	1.03	*No results reported due to*		.450	1.02
Defect Complexity	*less than 5% of sample*		.154	0.27	*less than 5% of sample*		.170	1.68
Sex (Female)	*reporting this behaviour*		**.020**	**8.39**	*reporting this behaviour*		.742	0.81
Married/Cohabiting			.184	0.21			.389	0.51
Education			.909	0.95			.543	0.83
Employed/Student			**.028**	**0.09**			.142	3.32
NYHA Class			.314	1.94			.689	0.82

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.996	1.00	.819	0.99	.729	0.99
Defect Complexity	.497	1.40	.088	2.36	.440	0.73
Sex (Female)	.099	4.38	**.041**	**10.47**	**.033**	**0.26**
Married/Cohabiting	.831	0.80	.451	0.50	**.014**	**0.16**
Education	.675	1.16	**.030**	**0.30**	.721	1.13
Employed/Student	.179	3.64	**.040**	**17.16**	.401	0.55
NYHA Class	.729	1.25	**.035**	**0.10**	.186	0.43

Japan								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.088	0.96	.513	0.99	*No results reported due to*		.329	1.01
Defect Complexity	**.004**	**0.25**	**<.001**	**0.31**	*less than 5% of sample*		.279	1.24
Sex (Female)	**<.001**	**0.11**	**<.001**	**0.14**	*reporting this behaviour*		**.002**	**2.35**
Married/Cohabiting	**.042**	**3.75**	.812	1.14			.610	0.84
Education	.276	1.36	.154	0.64			.072	1.33
Employed/Student	.367	1.92	.298	2.22			.450	1.28
NYHA Class	.880	1.06	.269	1.39			.223	0.81

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.660	1.01	.105	1.03	.541	1.01
Defect Complexity	.382	1.24	.941	1.02	.305	0.76
Sex (Female)	**<.001**	**5.02**	.331	1.48	.188	0.65
Married/Cohabiting	.373	1.41	.387	1.43	.986	0.99
Education	.238	1.25	.931	0.98	.236	1.24
Employed/Student	**.030**	**2.28**	.774	1.13	.569	1.25
NYHA Class	.334	0.81	.391	1.24	**.046**	**0.60**

Malta								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.145	1.06	.678	1.01	*No results reported due to*		.172	1.03
Defect Complexity	.326	0.68	.069	0.44	*less than 5% of sample*		.769	0.91
Sex (Female)	.953	0.97	.809	0.88	*reporting this behaviour*		.284	1.59
Married/Cohabiting	.369	0.49	.268	0.52			.941	0.96
Education	.468	0.81	.304	1.28			.621	1.13
Employed/Student	**.038**	**13.01**	.633	1.74			**.001**	**7.99**
NYHA Class	.812	0.83	.824	0.88			.536	0.79

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.502	1.01	*No results reported due to*		.397	0.97
Defect Complexity	.772	0.92	*less than 5% of sample*		.704	0.82
Sex (Female)	.062	2.17	*reporting this behaviour*		.242	0.62
Married/Cohabiting	.632	1.27			.972	1.01
Education	**.003**	**1.84**			.044	1.60
Employed/Student	.723	0.81			*N/A*	
NYHA Class	.933	0.97			.290	0.61

The Netherlands								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.738	1.01	.970	1.00	*No results reported due to*		.420	0.99
Defect Complexity	.417	0.78	.647	0.87	*less than 5% of sample*		.324	0.71
Sex (Female)	**<.001**	**0.13**	.234	0.66	*reporting this behaviour*		.760	1.13
Married/Cohabiting	.090	0.54	.748	0.90			.541	1.39
Education	.979	0.99	.775	1.08			.118	1.75
Employed/Student	.247	1.64	.674	0.87			.544	1.49
NYHA Class	**.044**	**0.48**	.231	0.74			.944	0.98

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.712	1.00	**.023**	**1.03**	.475	0.99
Defect Complexity	.348	0.79	.324	0.75	.985	1.00
Sex (Female)	**.045**	**1.89**	**.044**	**1.99**	.560	0.95
Married/Cohabiting	.970	1.01	.736	1.12	.444	1.20
Education	.171	1.44	.713	1.10	.078	1.42
Employed/Student	.132	0.58	.365	1.41	.472	1.21
NYHA Class	**.046**	**0.65**	.140	1.42	.360	0.85

Norway								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.101	0.95	.621	1.01	*No results reported due to*		.069	1.04
Defect Complexity	.275	0.67	.599	0.78	*less than 5% of sample*		.379	1.27
Sex (Female)	**<.001**	**0.12**	.457	0.66	*reporting this behaviour*		.050	2.11
Married/Cohabiting	.466	0.69	.616	0.71			.710	0.86
Education	.493	0.80	.199	0.67			.411	0.84
Employed/Student	**.040**	**3.88**	.908	1.09			.639	1.26
NYHA Class	.213	1.53	.467	0.79			.709	1.10

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.807	1.00	.419	1.02	.625	0.99
Defect Complexity	.476	1.25	.982	0.99	.694	1.13
Sex (Female)	**.027**	**2.53**	.132	1.83	.191	1.60
Married/Cohabiting	.903	0.94	.882	0.95	.751	1.13
Education	**.037**	**1.76**	.113	1.43	.244	1.29
Employed/Student	.692	1.27	.461	0.69	**.036**	**2.47**
NYHA Class	.544	1.21	.980	1.01	.074	0.64

Sweden								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	**.001**	**0.96**	**<.001**	**0.95**	*No results reported due to*		**<.001**	**1.04**
Defect Complexity	.100	0.72	.332	0.80	*less than 5% of sample*		.909	0.98
Sex (Female)	**<.001**	**0.23**	.979	1.01	*reporting this behaviour*		.183	1.34
Married/Cohabiting	.400	0.78	.706	0.87			.425	0.82
Education	.659	0.94	**.003**	**0.63**			.900	0.99
Employed/Student	.801	0.90	**.048**	**0.46**			**.003**	**2.29**
NYHA Class	.240	1.31	.660	1.11			.992	1.00

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	**.040**	**1.02**	**<.001**	**1.05**	.067	0.99
Defect Complexity	.282	1.28	.645	1.08	.586	0.92
Sex (Female)	**<.001**	**3.78**	**<.001**	**2.28**	.253	1.27
Married/Cohabiting	.293	0.73	.314	0.79	.778	1.06
Education	**.002**	**1.54**	**.042**	**1.24**	**<.001**	**1.48**
Employed/Student	.988	0.99	.491	0.83	**.025**	**1.80**
NYHA Class	**.012**	**0.56**	.914	1.02	**.009**	**0.61**

Switzerland								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.178	0.97	.287	0.99	.195	0.96	.071	1.03
Defect Complexity	.521	0.81	.122	0.72	.661	1.14	.185	1.36
Sex (Female)	**.014**	**0.24**	.293	0.72	**.041**	**0.24**	.759	1.11
Married/Cohabiting	.267	0.47	.443	0.75	.275	0.39	.674	0.83
Education	.849	1.05	.551	0.90	**.026**	**2.09**	.903	1.03
Employed/Student	.855	1.17	.593	0.80	.522	0.62	**.004**	**3.17**
NYHA Class	.895	0.95	.651	1.10	.562	0.79	.765	1.06

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.202	0.98	**<.001**	**1.05**	**.013**	**0.97**
Defect Complexity	.061	1.54	.669	1.10	.870	0.97
Sex (Female)	**.023**	**2.26**	**.019**	**2.14**	.967	0.99
Married/Cohabiting	.859	1.07	.977	0.99	.873	1.05
Education	.362	1.23	**.050**	**1.48**	.054	1.43
Employed/Student	.965	1.02	.988	1.01	.241	1.56
NYHA Class	.404	1.24	.143	0.70	**.013**	**0.59**

Taiwan								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	*No results reported due to*		.987	1.00	*No results reported due to*		.209	1.03
Defect Complexity	*less than 5% of sample*		.059	0.48	*less than 5% of sample*		.845	0.96
Sex (Female)	*reporting this behaviour*		**.013**	**0.25**	*reporting this behaviour*		.739	1.10
Married/Cohabiting			.643	0.66			.344	0.69
Education			.182	0.72			**.008**	**1.47**
Employed/Student			.470	1.93			.113	1.81
NYHA Class			.634	1.20			.819	0.95

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.581	1.01	**.022**	**1.05**	.549	0.99
Defect Complexity	.899	1.03	.818	0.96	.803	0.95
Sex (Female)	.343	1.35	**.022**	**2.02**	**<.001**	**0.35**
Married/Cohabiting	.071	2.25	.866	1.06	.765	0.89
Education	.864	1.03	.142	1.25	.954	0.99
Employed/Student	.178	1.70	.878	1.06	.728	0.87
NYHA Class	.455	1.18	.841	1.05	**.011**	**0.54**

United States of America								
	Binge Drinking		Cigarette Smoking		Recreational Drug Use		Annual Dentist Visit	
Predictor	p	OR	p	OR	p	OR	p	OR
Age	.064	0.97	.055	0.98	**.014**	**0.97**	.712	1.00
Defect Complexity	.749	0.93	**.032**	**0.67**	.678	0.93	.535	1.08
Sex (Female)	**.012**	**0.47**	.317	1.34	.863	0.96	.092	1.35
Married/Cohabiting	**.017**	**0.45**	.511	0.82	.116	0.65	.469	1.15
Education	.242	1.25	**.027**	**0.68**	.295	1.17	**.003**	**1.40**
Employed/Student	.173	1.69	.620	0.86	.760	1.10	.218	1.32
NYHA Class	.326	1.19	**.043**	**1.38**	.075	1.32	**.002**	**0.73**

	Brush Teeth 2x/Day		Floss 1x/Day		Sport Participation	
	p	OR	p	OR	p	OR
Age	.198	0.99	**<.001**	**1.03**	**.010**	**0.98**
Defect Complexity	.567	0.94	.875	1.02	.123	0.83
Sex (Female)	**<.001**	**1.94**	.092	1.33	**.005**	**0.63**
Married/Cohabiting	.540	1.11	.249	0.82	.648	0.92
Education	**<.001**	**1.46**	**.049**	**1.22**	**<.001**	**1.61**
Employed/Student	.808	1.05	.430	0.84	.494	1.18
NYHA Class	.141	0.87	.433	1.08	**.001**	**0.68**

Note: NYHA, New York Heart Association. Results not reported for health behaviours with prevalence rates less than 5%. Defect complexity was coded using a 3-point scale (i.e., 1=simple, 2=moderate, 3=complex). Education was coded using a 4-point scale (e.g., 1=Less than high school;

4=University degree). Bold font indicates significance at P<.05. N/A indicates not available due to either low variability on the outcome, predictor, or both. Bold font identifies statistically significant findings (p<.05) after false discovery rate corrections for type-1 errors.