Published in final edited form as:

Am J Addict. 2011 ; 20(1): 30–39. doi:10.1111/j.1521-0391.2010.00099.x.

A Web-Based Study of Gamma Hydroxybutyrate (GHB): Patterns, Experiences, and Functions of Use

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Abstract

GHB (gamma hydroxybutyrate) was developed as a general anesthetic. Due to dosing difficulty and side effects, regular use was discontinued. Medical uses include treating sleep and alcohol disorders. In the 1990s, it was promoted as a supplement and taken to improve mood and sex. GHB and its analogs (gamma butyrolactone and butanediol) were widely available until federal regulations were put into effect with mounting evidence of adverse events. This survey (N = 61) study was conducted to assess patterns, experiences, and functions of use. Much of what is understood regarding GHB treatment is based on hospital case studies for overdose and withdrawal. Not enough is known about prevention, reducing use and associated problems, or relapse. We know little about specific drug effect expectancies, triggers, coping skills, and consequences of use (positive/negative). While the drug treatment literature has a wealth of information to draw upon, GHB-specific information may greatly assist relapse prevention.

INTRODUCTION

Gamma hydroxybutyrate (GHB), also known as fantasy, liquid ecstasy, and G, was initially introduced as a general anesthetic.¹ It was also used as a nutritional supplement for sleep inducement and to increase muscle mass,² however, its use as a “club drug” and “date rape drug” led to U.S. federal regulation of GHB.² GHB analogs³ such as GBL (gamma-butyrolactone), BD (1,4-butanediol), GHV (gamma-hydroxyvalerate), and GVL (gamma-valerolactone), which are found legitimately in industrial solvents and paint strippers, are used for illicit consumption⁴ in an effort to produce effects similar to GHB.

GHB is often used to increase feelings of euphoria, relaxation, sociability, and sexuality and to explore altered states of consciousness.^{5,6} However, consequences of use include loss of consciousness, overdose, amnesia, emotionality, loss of motor control, withdrawal, hospital admittance, sexual assault victimization, and engaging in risky behaviors, such as driving while under the influence and polysubstance use.^{1,2,4,5} Despite possible adverse effects, GHB has been used to treat sleep and addictive disorders including alcohol withdrawal.^{2,7}

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Declaration of Interest The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

Similar to Sumnall et al.,⁶ the current study utilized a web-based survey to assess GHB users. As compared to other survey techniques, web-based surveys are more cost and time-effective, accessible, and accurate and provide more tailored feedback to participants without compromising the validity and reliability of the data.^{8,9}

Whereas previous studies have provided survey data on GHB users, the present study provides more in-depth analyses of how important drug use concepts relate with respect to GHB and analog use. Specifically, there is a dearth of research on specific GHB/analog effect expectancies, triggers, coping skills, and consequences of use (positive and negative). Thus, the purpose of the current study is to address these gaps in the literature on GHB/analog and assist in identifying factors that can assist in the assessment and treatment of GHB/analog users.

METHODS

Participants

The sample was recruited via the Internet. A brief advertisement was sent out to various websites for posting. The ad indicated that a link to the study survey was located on “<http://center.butler.brown.edu/ATTC-NE/>”. The ad was sent to websites that had been previously identified as containing information about GHB (pro-use, anti-use, or neutral). A link was also posted on the “Project GHB” web-site. After locating the study website, potential participants were provided an introduction to the study describing the procedures, anonymous nature of responses, and that the researchers had no stated view point that GHB should be legal or illegal. Following this, the consent form was provided, and if respondents agreed to the consent procedures, they indicated so by clicking, “Yes, I have read the above and agree to participate.”

The study included anyone reporting knowledge of GHB use (either personal or via exposure to others’ use). No exclusions were attempted during recruitment since respondents could easily misreport certain exclusion criteria, such as age or citizenship in order to participate in any event. Therefore, age and citizenship were simply tracked as part of data collection for those persons who eventually elected to participate. It was felt that this would provide the broadest, best, and most representative pool of potential participants. All information obtained was anonymous, identifying information was not collected, answers were never linked to identity, and the best web security available was used. Persons who desired assistance or more information related to GHB use were recommended to seek information from reputable websites, such as Project GHB or their healthcare provider. The study received Institutional Review Board approval.

In order to track whether persons completed the questionnaire more than once, participants were directed to create a unique code consisting of parts of their mother’s name and their social security number. Sixty-one respondents participated in the study over 5 months. Fluctuations in the sample size are noted in the Results section, and are a result of some respondents leaving some items blank. Items may be left blank due to refusal to answer, or because the question applies to only someone who used GHB/analog (as compared to having only been exposed to others’ use).

The sample ($N = 61$) characteristics are noted in Table 1. A majority of respondents ($N = 56$) completed 75% or more of the study questions (no significant differences were found on basic demographics between those who completed 75% or more and those who completed less than 75%). Of the 61 respondents, 53 did not know anyone else in the study (86.9%).

Procedures

Assessment—Questionnaires took between 1 and 1.5 hours to complete. Most answers consisted of two to several fixed choices that respondents endorsed. Some questions required respondents to type in a number. Participants could stop at any time, and sign in again later to complete the questionnaires. No one utilized this option.

Measures

GAN (GHB/Analog Names)—This is a pop-up screen of chemical names to which participants could refer.

GAGI (GHB/Analog General Information Form)—Basic, relevant data were gathered primarily for descriptive purposes. These included age, gender, education, and racial background.

CLGA (Contemplation Ladder for GHB/Analog)—This is an adapted version of the contemplation ladder,¹⁰ the marijuana ladder,¹¹ and the alcohol ladder.¹² A visual analogue is presented to participants. It is a ladder with 10 rungs; each rung has a number and corresponds with a statement representing where a person might be in relation to changing GHB/analog use: 1 = I enjoy using GHB/analog and have decided never to change use to 10 = I have changed my GHB/analog use and will never go back to the way I used before. Respondents are asked to choose the number that best matches where they are now with respect to GHB/analog use. The 10 rungs can be condensed into the five stages of change (see Refs. 11 and 13).

GAUP (GHB/Analog Use Patterns)—This is a 32-item questionnaire. Response options for frequency of use are based, in part, on the Treatment Outcome Prospective Study (TOPS^{14,15}). After reviewing scientific reports as well as Internet testimonials of use patterns, additional relevant use patterns (including frequency and duration of use) were identified and added. Consistent with assessment of other illicit substances, the content of this questionnaire does not focus on amounts of substances, but rather on frequency.¹⁶ Based on the work of Sobell and colleagues,¹⁷ GHB/analog users should be able to provide information on the type of substance used (GHB, GBL, or BD) and the frequency of use. To assist with this, participants had access to the GAN (see above). This questionnaire assessed a variety of use patterns including most frequent use ever, usual frequency of use in the last 12 months, duration of most frequent use ever, and chemical usually used (GHB, GBL, or BD). With respect to most frequent use ever, response options may range from “less than once per month” to “sipped throughout day.” Response options for duration of most frequent use ever range from “1 week” to “36 months or more.” Methods of accessing GHB/analog are also assessed on this questionnaire. For example, respondents were asked if they had ever obtained the substance from a friend (Y/N) and how frequently they had done so in the past 12 months (0 = Never to 3 = Frequently). Use of GHB/analog within the respondent’s social network is also assessed, and an index was calculated by dividing the number of GHB/analog users in the respondent’s social network by the total number of persons in the respondent’s social network.

GAOK (GHB/Analog Opinions and Knowledge)—This questionnaire has 30 items assessing opinions and knowledge of GHB/analog dangers. Most items are rated on two 5-point Likert scales (Disagree strongly = 1 to Agree strongly = 5; vs. Do not know = 0, Entirely harmless = 1 to Very dangerous = 4). Areas assessed include general opinions about GHB/analog (“GHB should be entirely legal”), knowledge regarding dangers of mixing GHB/analog with other substances, and knowledge regarding taking GHB/analog with certain medical conditions. In addition, a series of nine items addressed when respondents

began taking GHB/analogs and whether or not there were government warnings about these substances when they began use. Four scales (including internal consistencies) are obtained from this questionnaire: Dangerous with Medical Conditions (.85), Legalization/Free Access (.47), Dangerous with Alcohol and Other Drugs (.78), and Use Carefully/Under Medical Supervision (.63).

RUGA (Reasons for Using GHB/Analogs)—This 14-item questionnaire assesses the reasons participants initially began using these substances (eg, to “reduce aging effects” or “improve sex”). Response options use a 4-point Likert scale (Disagree strongly = 1 to Agree strongly = 4). It was developed after reviewing information covering thousands of pages from both scientific case studies and anecdotal Internet reports. Three scales (including internal consistencies) are obtained from this questionnaire: Psychological/Health Benefits (.83), Enhance Party Experience (.74), and Assist Sleep/Medical Opinion (.64).

GAEQ (GHB/Analog Expectancy Questionnaire)—This 38-item questionnaire is modeled after the Alcohol Expectancy, Marijuana Effect Expectancy, and Cocaine Effect Expectancy Questionnaires (AEQ,¹⁹ MEEQ, and CEEQ²⁰). Items specific to GHB/analog use were taken from published scientific reports and from testimonials found on the Internet over the course of 14 months. Participants rate how much they agree/disagree with statements such as “GHB/analogs increase muscle and reduce fat.” Response options are comprised of a 5-point Likert scale (Disagree strongly = 1 to Agree strongly = 5). Four scales (including internal consistencies) are obtained from this questionnaire: Negative Psychological/Somatic Effects (.85), Psychomotor Retardation (.83), Energy/Improved Health (.75), and Improved Sociability (.76).

IPA-GA (Important People and Activities for GHB/Analogs)—This is a brief version (11 items) of the instrument developed by Clifford and Longabaugh²¹ and has shown to be valid and reliable in other studies.^{22,23} It assesses the social influence of GHB/analog users and nonusers in participants’ lives. It asks questions such as how often important persons in the respondent’s life use GHB/analogs (7 = Daily to 0 = Not in the past 6 months), percent of important persons who do not use or have stopped use (0–100%, increments of 10%), whether various persons have been accepting or rejecting of use (asked separately for family, friends, and work colleagues), how many persons (asked separately for family, friends, colleagues) use GHB/analogs (1 = None to 4 = All), and importance of family, friends, colleagues (asked separately) as rated on a 5-point Likert scale (1 = Not at all to 5 = Extremely). No formal scoring is applied.

SADGA (Substance Abuse/Dependence for GHB/Analogs)—A 13-item checklist was created based on the DSM-IV to develop 12-month and life time abuse and dependence diagnoses for GHB/analogs.

WDLTE-GA (Withdrawal/Long-Term Effects for GHB/Analogs)—These 27 items are based in part on the nonalcohol withdrawal symptoms for Structured Clinical Interview for DSM-IV (SCID-I/24), the Clinical Institute Withdrawal Assessment for Alcohol Based on DSM-III-R (CIWA-AD25), and Internet reports. Respondents were asked to consider symptoms as a result of reducing/stopping use, as compared to symptoms due to some other disorder (eg, having anxiety, taking GHB to relieve anxiety, and then having anxiety re-emerge when GHB is stopped). Respondents endorse the time period over which the symptom lasted (< 1 day, 1–6 days, 1–3 weeks, 1–4 months, 5–11 months, ≥ 1 year, and did not occur), whether or not GHB/analogs were taken again to relieve the symptoms, and if two or more symptoms adversely impacted important aspects of social/work life (Yes, No, Not Applicable [NA]—effects did not occur). These items are based on scientific reports

regarding possible long-term effects and Internet testimonials indicating effects lasting over 2 weeks. Three scales (including internal consistencies) are obtained from this questionnaire: 18: General Malaise/Cognitive Symptoms (.86), Restlessness/Agitation (.82), and Fatigue/Somatic Symptoms (.79).

BSCQ-GA (Brief Situational Confidence Questionnaire for GHB/Analogues)—This eight-item questionnaire is based on the 100-item Situational Confidence Questionnaire (SCQ26·27) and reflects self-efficacy for not using GHB/analogues. The eight items of the BSCQ correspond to the eight scales of the original SCQ: Unpleasant emotions, physical discomfort, pleasant emotions, testing control, urges/temptations, interpersonal conflict, social pressure, and pleasant times with others. Participants rank their confidence in resisting using GHB/analogues in each of eight situations on a scale of 0 (Not at all confident) to 100 (Totally confident). Breslin and colleagues²⁸ compared the longer and shorter versions and found that the shorter version is effective and corresponds well with the longer version. Average overall confidence score is used in analyses.

CBI-GA (Coping Behaviors Inventory for GHB/Analogues)—Participants are asked to indicate on a 4-point Likert scale (0 = Usually to 3 = Never) how often they have used various methods to stop from using GHB/analogues (eg, Telephoning a friend). This measure has been shown to be valid and reliable in previous work.²⁹ Total score (ranging from 0 to 108) or average score (0–3) can be obtained across the 36 items. Alternatively, average cognitive coping (14 items), and average behavioral coping (22 items) scores can be obtained, both ranging from 0 to 3. Similarly, total cognitive coping and total behavioral coping scales can be obtained, ranging from 0–42 and 0–66, respectively. Lower scores indicate more use of coping.

AIDDBS-GA (Alcohol and Illegal Drugs Decisional Balance Scale for GHB/Analogues)—As shown in previous studies, this is a reliable and valid method of measuring the costs and benefits of use according to respondents.^{30–34} Participants are asked to indicate on a 5-point Likert scale (1 = Not at all to 5 = Extremely) how important various factors (eg, My GHB/analog use causes problems with others) are in making decisions about whether or not to use GHB/analogues. This 20-item questionnaire³⁵ provides two summary scores indicating the Pros of using (10 items) and the Cons of using (10 items), with each summary score ranging from 10 to 50. Alternatively, the average Pros and Cons can be presented (ranging from 1 to 5 on each scale).

SIP-AD-GA (Short Inventory of Problems-Alcohol/Drugs for GHB/Analogues)—This scale is composed of 15 items, five subscales (Physical, Inter-/Intrapersonal, Impulse Control, and Social Responsibility), and one total score. Previous work demonstrated that it is a valid and reliable measure of problems associated with substance use.³⁶ Respondents are asked how often events (eg, I have been unhappy because of my GHB/analog use) have happened to them over the last 12 months on a 4-point Likert scale (0 = Never to 3 = Daily/almost daily). Similarly, they are asked how much various problems (eg, I have had money problems because of my GHB/analog use) have occurred during the last 12 months on a 4-point Likert scale (0 = Not at all to 3 = Very much). Each scale's score ranges from 0 to 9, whereas the overall score ranges from 0 to 45.

CGAU (Consequences of GHB/Analog Use)—Because it is not uncommon for users to be hospitalized, enter detoxification, or be arrested for use, this instrument assesses the number of days participants may have endured such events. This is a 14-item questionnaire. Analyses involving these data may be comprised of simple totals (eg, total number of days in hospital).

GAOSU (GHB/Analog and Other Substance Use)—This 34-item questionnaire assesses alcohol and substance use (including dietary supplements and medication) in the past 12 months. Frequency of use is rated on a 5-point Likert scale (Never = 0 to Almost daily = 4). Also rated, using a 4-point Likert scale, is frequency of GHB/analog use and other substances (Never = 0 to Always = 3) within the same 8-hour period. This 8-hour period is based on the duration of clinical effects of GHB/analogs.³⁷ Total frequency of use scores may be calculated.

RESULTS

Use Patterns

Methods of acquisition are presented in Table 2. When asked how frequently respondents used when they *first* began using GHB/analogs ($N = 59$), 39% used three times per month or less; 31% used two to six times per week; 31% used once per day or more. Most maintained their initial use levels for 3 months or less (49%); 17% maintained it for 4–11 months; 34% maintained this level for over a year. Respondents reported using mostly GHB (61%) rather than analogs.

When asked regarding *most* frequent use *ever* of GHB/analogs ($N = 59$), 14% used three times per month or less; 10% used two to six times per week; 76% used once per day or more. Most maintained this use level for 3 months or less (44%); 22% maintained it for 4–11 months; 34% maintained this level for over a year. Respondents ($N = 58$) reported using mostly GHB (57%) rather than analogs.

When asked how frequently respondents *usually* used GHB/analogs during the *last 12 months* ($N = 52$), 35% used three times per month or less; 17% used two to six times per week; 48% used once per day or more. Most maintained this use level for 3 months or less (39%); 33% maintained it for 4–11 months; 29% maintained this level for over a year. Respondents reported using mostly GHB (58%) rather than analogs.

When asked regarding *most* frequent use of GHB/analogs during the *last 12 months* ($N = 55$), 29% used three times per month or less; 11% used two to six times per week; 60% used once per day or more. Most maintained this use level for 3 months or less (55%); 20% maintained it for 4–11 months; 26% maintained this level for over a year ($N = 51$). Respondents ($N = 53$) reported using mostly GHB (57%) rather than analogs.

Participants were asked about the frequency of other drug use including legal and illegal drugs, prescription and nonprescription, and dietary supplements (such as St. John's Wort, ephedra, etc.). Of respondents ($N = 54$), the top six substances used once per month or more were: Alcohol (68% of respondents), nicotine (50%), marijuana (36%), melatonin (28%), ginkgo biloba (26%), and over the counter sleep aids (26%). Respondents ($N = 52$) also indicated the substances sometimes or always taken with GHB/analogs: Nicotine (38% of respondents); speed or methamphetamine (30%); ecstasy or MDMA (26%); marijuana (24%); ketamine (12%); ginseng (12%); and prescription antidepressants (12%).

Reasons for Starting Use and Drug Effect Expectancies

Respondents ($N = 58$) indicated beginning use in order to (top seven answers presented) get high (79%), to be more sociable (78%), to improve sleep (76%), to assist with depression or anxiety (72%), to improve sex (71%), to feel more energized (67%), and to enhance dancing (64%). Although there have been anecdotal reports of GHB/analogs increasing muscle mass/reducing fat, improving cognitive ability, and reducing effects of aging, only 49%, 40%, and 35% began using for these reasons, respectively. Although GHB has been used in treating alcoholism,³⁸ only 26% indicated they began using for this reason.

Participants ($N = 57$) were asked regarding their drug effect expectancies for GHB/analogs (top five expectancies presented): 95% expected these substances to put a person in a good mood; 95% expected them to help with sleep; 88% expected them to improve sociability; 86% expected GHB/analogs to slow heart rate and breathing; and 83% expected them to improve sexual experiences. Consistent with reasons for beginning use, 71% expected GHB/analogs to decrease depression and anxiety; 66% and 70% of respondents expected these chemicals to make them feel energized and to dance more joyously, respectively. Only 56% expected that GHB could be helpful with treatment of addiction such as alcoholism. Although 21% did not expect GHB/analogs to be addictive, 80% and 71%, respectively, expected these chemicals to cause coma and uncontrollable shaking.

Knowledge and Opinions of Dangers

Of the $N = 50$ who endorsed using GHB, 80% began using after government warnings had been posted, yet 42% indicated there were no warnings. Similarly, of the $N = 29$ who endorsed using GBL, 100% began using after government warnings had been posted, yet 45% thought there were no warnings. Finally, of the $N = 12$ who endorsed using BD, 83% began using after government warnings had been posted, yet 58% thought there were no warnings.

Most respondents (about 72%; $N = 57$) answered affirmatively when asked if it was dangerous to use GHB/analogs when taking other substances, such as minor tranquilizers (eg, valium), major tranquilizers (eg, thorazine); pain killers (eg, opiates); anticonvulsants (eg, dilantin); and over the counter sleep aids. An overwhelming percentage (97% of $N = 57$) responded that it was dangerous to ingest GHB/analogs while drinking alcohol; and in contrast, only 25% indicated use with methamphetamine or MDMA as dangerous ($N = 56$, 45% responded the combination was harmless, whereas 30% were unsure). When asked how dangerous it is to use GHB/analogs with various medical conditions (eg, epilepsy, heart conditions, liver disease, addictions, hypertension) about 33%, 12%, and 55% endorsed that it was dangerous, harmless, or that they were unsure, respectively ($N = 57$).

Patterns of Dependence and Abuse

On average respondents ($N = 56$) attempted to quit using GHB/analogs 4.07 times ($SD = 0.23$) and then returned to use. Thirty percent of respondents had been previously treated for GHB/analog abuse. Participants experienced signs of tolerance in that 63% ($N = 57$) indicated their usual amount had less effect on them and 66% indicated they had to take more to get the same effect. Of respondents ($N = 61$), 59% qualified for life-time GHB/analog dependence (38%) or abuse (21%), and 41% qualified for past 12-month dependence (28%) or abuse (13%). For most participants experiencing withdrawal symptoms, the symptoms abated within 1–3 weeks. For participants who experienced anxiety after reducing use, 25% reported the anxiety persisted for over 1 year. Insomnia was the most common withdrawal effect with 54% of respondents ($N = 57$) experiencing this symptom and 61% of those having the symptom taking GHB/analogs to relieve it. Anxiety was the second most common symptom, with 52% of respondents ($N = 54$) experiencing it and 68% of those having the symptom taking the drug again to relieve it. Similar figures for depression ($N = 56$) are 48% and 50%; for irritability/anger ($N = 54$) they are 44% and 57%; and for agitation/fidgetiness ($N = 57$) they are 42% and 54%. Of persons with withdrawal effects ($N = 37$), 57% had two or more symptoms that caused significant distress or had a negative impact on their lives.

Social Patterns

Social networks of respondents consisted of about 15 persons, and of those persons, the median number who were GHB/analog users was 9 (median presented due to highly skewed

data). Of respondents, 11.5% knew someone who had died from GHB/analogs. Although 77% of the $N = 57$ respondents rated family as important or extremely important to them, family members did not accept use of GHB/analogs by respondents (25%), or did not know respondents used (51%); and 86% of family members did not use. In contrast, 84% of the $N = 57$ respondents rated friends as important or extremely important to them and 54% accepted or encouraged the respondent's use; and 75% of friends also used GHB/analogs.

Consequences of Use

When asked about problems caused by use, overall SIP score was $M = 11.44$ ($SD = 12.82$, with 31% indicating no negative events). SIP subscores are ranked as follows among the $N = 53$ respondents: Social Responsibility, $M = 1.81$ ($SD = 2.52$, 47% endorsing no difficulty with Social Responsibility); Physical, $M = 2.30$ ($SD = 2.41$, 36% endorsing no difficulty in this domain); Impulse Control, $M = 2.36$ ($SD = 2.71$, 36% endorsing no problem in this area); Intrapersonal, $M = 2.40$ ($SD = 2.96$, 43% endorsing no difficulty); and Interpersonal, $M = 2.40$ ($SD = 3.16$, 50% endorsing no problem).

Respondents were asked if a doctor had informed them that they had medical problems (liver, kidney, heart, neurological, or hormonal) associated with GHB/analog use, and only one person (out of $N = 55$) answered affirmatively. Of respondents ($N = 55$), 6% endorsed having been sexually assaulted while under the influence of GHB/analogs; 6% were the victims of crime while under the influence (not sexual assault); and 9% believed they were given GHB/analogs without their knowledge. Respondents were asked how many times they had been arrested for possession, sale, or distribution of GHB/analogs; time spent in jail or hospitalized; and amount per month spent on accessing these drugs. Table 3 shows financial costs related to such consequences. In addition, the median number of days respondents ($N = 50$) drove after using GHB/analogs was 60 (median presented because data were highly skewed).

Interest and Skills to Change Use

On the ladder, $M = 5.92$ ($SD = 3.78$; $N = 59$), indicating that on average, the sample planned to change use in the next 6 months. Specifically, 32% were not even considering change (precontemplation), 12% thought of changing use but had no plans to do so (contemplation), 7% definitely planned on changing use in the next 6 months (preparation), 21% have made changes to use and continue to work at these changes (action), and 29% have made what they felt was significant and permanent change to use (maintenance).

The scores for the sample ($N = 53$) on the Decisional Balance Questionnaire were $M = 2.57$ ($SD = 1.17$) for the pros of use and $M = 2.10$ ($SD = 1.07$) for the cons of use. The top five factors rated as not at all important were cons of use, and included being avoided when using (68% of respondents felt this was unimportant); setting a bad example for others (59% of respondents endorsed as not important); being seen as lacking character (58% rated this as unimportant); losing trust/respect of coworkers/spouse (58% rated this as unimportant); and getting into trouble when using (56% rated this as not important). The top five factors rated as very to extremely important were mostly pros of use, and included making it easier to have fun and socialize (47% of respondents endorsed this); facilitating relaxation and self-expression (40% endorsed); being more fun (36% endorsed); increasing confidence (34% endorsed this); and disappointment of others due to use (34% endorsed; this is a con of use).

Of respondents ($N = 54$), 76% were confident they could resist GHB/analogs during conflict with others; 69% if they were purposely testing their control over GHB/analogs; 64% during negative emotions; and 63% when experiencing positive emotions. In comparison, 50% of respondents were confident they could resist GHB/analog use during pleasant time with

others; only 46% were confident they could resist if they felt urges and temptations; when experiencing physical discomfort, this figure is 44%; and when experiencing social pressure, only 43% were confident they could resist. Average confidence score to resist use is $M = 65.40$ ($SD = 29.60$).

A majority of respondents reported using cognitive coping strategies to avoid using GHB/analog. Of respondents ($N = 56$), 54% said they had paused and thought the addiction cycle through (23% of respondents usually did this); 51% reported thinking positively as a strategy to not use (20% usually did this); 51% recalled how they let friends and family down with use in the past (16% usually used this strategy); 48% thought of the mess they've gotten into in the past by using (21% usually did this); and 46% reported thinking how much better off they are without using (20% usually used this strategy). Behavioral strategies were among the least employed to avoid using GHB/analog: 11% left money at home (so they could not purchase it), 20% attended Alcoholics/Narcotics Anonymous, 20% spoke with friends who quit, 23% phoned a friend, and 23% waited it out (until desire to use subsided, or methods of access were inaccessible). The total coping score was $M = 82.60$ ($SD = 28.71$). Total cognitive and total behavioral coping strategies are $M = 30.32$ ($SD = 12.95$) and 52.28 ($SD = 16.38$), respectively. Average overall coping score was $M = 2.29$, $SD = 0.80$; similar figures for average cognitive coping and average behavioral coping scales were $M = 2.17$ ($SD = 0.04$) and $M = 2.38$ ($SD = 0.03$), respectively.

Relationships among Key Constructs Related to GHB/Analog Use

All variables were checked for distributional assumptions; no transformations were needed. The relationships among the above presented constructs (coping skills; social network; scales of GAOK, GAEQ, RUGA, and WDLTE-GA; etc.) are presented in Table 4. Correlations included 23 variables; therefore alpha was set at the .001 level. Correlations were powered at the .80 level to detect a medium-large effect size with $N \sim 43$ for these analyses (see Ref. 43). In order to save space, only significant relations are presented.

DISCUSSION

This study found that most respondents who began this web-based survey completed it without incident. It is possible to obtain a relatively diverse sample of GHB/analog users via the Internet, although most were men. Results indicate that over 76% of respondents had used these substances one or more times per day, and that it is not uncommon for GHB/analog to be obtained through persons not known well to the consumer. Furthermore, results indicate that 42–58% of persons consuming these substances did not know there were government warnings regarding adverse events associated with these drugs.

The sample generally endorsed use of GHB/analog for recreational purposes, to improve health, and to assist with sleep difficulty. Respondents also generally appeared to have significant withdrawal symptoms including mood disturbance and insomnia. Although the sample reported relatively few consequences due to use, the dollar amounts associated with arrests, jail time, hospital care, and annual purchase cost of the drug are exorbitant and range from \$900–\$36,000. Of note, 50 respondents had engaged in driving under the influence (DUI). Had these 50 respondents been arrested even once for DUI, at \$10,000 per episode, 44 the costs of DUI for the entire sample would have been \$500,000 (without injury or accident costs).

A substantial proportion of participants are unmotivated to alter use. Relaxation and having fun were seen as important in making decisions to use, and similarly, not wanting to disappoint others was seen as important to making decisions to not use. A substantial proportion of participants associate with friends who encourage use, as compared to their

family members who discourage use. Although many respondents were thinking about changing use or working on changing use, they are more vulnerable to using GHB/analogs when socializing, when feeling pressured by others, when they feel an urge to use, or when they are physically uncomfortable. What's more, respondents seemed overly reliant on cognitive coping skills to avoid use, rather than on more active behavioral coping strategies.

These findings suggest that the public needs to be better informed of the potential adverse events associated with GHB/analogs. The data also suggest that efforts to reduce use might focus on increasing contacts with family members who are nonusers, and increasing efficacy and behavioral skills to cope with social pressure, urges, and physical discomfort.

Motivation to reduce use is associated with acknowledging more use-related problems, more coping skills, and fewer dependence symptoms. More withdrawal symptoms are associated with fewer coping skills, and more lifetime dependence symptoms. Most frequent use in the past 12 months is associated with more use-related problems and lower confidence to resist use; whereas having more confidence to resist is associated with fewer problems. Confidence to resist is associated with 12-month dependence symptoms, which may suggest that persons are over-confident in their ability to resist use or alternatively, that *previous* symptoms abated with recently improved confidence to resist.

As expected, most frequent use in the last 12 months is associated with most frequent lifetime use, and surprisingly, it is also related to low dependence symptom count for both 12-month and lifetime. Similarly, most frequent lifetime use was related to low 12-month and lifetime dependence symptom count. In addition, 12-month and lifetime dependence are associated with acknowledging fewer use-related problems. It is difficult to reconcile these findings, and more research is needed to see if results are spurious or if there are subsets of users with varying vulnerabilities to development of dependence symptoms.

Persons using in relation to socializing have fewer dependence symptoms, and see more benefits to use. Tentatively this suggests that there may be a portion of users who do not experience difficulties with GHB/analogs when used in the context of social settings; however more detailed studies are needed to understand if this is true and potential mediating factors. Persons using in relation to perceived health benefits employ fewer coping skills and have more 12-month dependence symptoms. The view that GHB/analogs should be legal and freely accessible is associated with perceiving fewer use-related problems, use of fewer coping skills, and more 12-month dependence symptoms. This suggests that persons more vulnerable to developing dependence symptoms begin to use for health benefits and do not believe in limiting access; however, again, more detailed studies are needed to determine if this is true as well as potential mediating factors.

Previous studies found similar results indicating (1) persons use in order to get high, relax, or reduce anxiety, improve sex, sleep, and improve sociability^{5,6}; (2) significant co-ingestion of other drugs^{4,5}; and (3) that family members often do not know the respondent is using.⁴ The present study improves on much of past research in that it is not limited to a single geographic region, and it surveyed a broad range of drug use constructs. In addition, unlike much previous research, this study examined relationships among measures specific to GHB/analog use (expectancies, reasons for beginning use; withdrawal and long-term effects, opinions and knowledge), which may inform approach to treatments and assist in better understanding the phenomenon of GHB/analog use.

Although generally, use has decreased in the United States since the late 1990s,^{2,45} it is still problematic for some individuals and may be increasing internationally (see Ref. 6). More work is needed in this area. Specifically, replication is needed since the sample size utilized in this study was small and web based. A limitation of this study is that respondents self-

selected into the study; but we note that a population-based survey would have been prohibitively large to access enough GHB/analog users for analyses. Future studies should collect larger samples and collect data from a variety of settings as well (such as hospital settings). Future studies with larger sample sizes may wish to collect prospective data to determine how behavioral constructs relate to one another over time. This may be informative for efforts involved in developing behavioral treatments. It may be that tailored intervention to alter the social network, increase coping skills, enhance self-efficacy, and provide feedback on signs of dependence may reduce use. It is noteworthy that so many persons did not know of the dangers of GHB/analog. Although GHB may be used under proper professional guidance (eg, for sleep), certainly there are risks for some. Lack of knowledge of risks speaks to the need for education so that persons can make informed decisions regarding use.

Acknowledgments

In memory of LAR Stein's sister. Special thanks to Anya, Trinkka, Deborah Zvosec, and Steve (in Texas), all found via Project GHB. Thanks also to various other websites for their interest and support, including Erowid and The New Blue Light.

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TABLE 1

Characteristics of participants ($N = 61$)

Descriptor	%	M	SD
Hispanic ethnicity*	7	-	-
Racial affiliation			
African/Black	0.0	-	-
American Indian			
Alaskan Native	2	-	-
White/European	90	-	-
Asian	3	-	-
Pacific Islander	2	-	-
Mixed race	3	-	-
Age (years)*	-	31.85	9.80
Men	80	-	-
Completed survey			
Outside of United States	18	-	-
Used GHB/analog			
In the last 12 months *	93	-	-
Used other drugs			
In the last 12 months *	82	-	-
Currently in detoxification			
For GHB/analogs *	7	-	-
GHB/analog use disorder			
In last 12 months	41	-	-
Education			
≤ High school	12	-	-
Some college	38	-	-
College degree	39	-	-
Graduate degree	12	-	-
Marital status			
Married	15	-	-
Co-habitate	13	-	-
Divorced/separated	15	-	-
Never	57	-	-
Employment			
Full-time	57	-	-
Part-time	10	-	-
Never	15	-	-
Other†	18	-	-
Mental health history * ‡	59	-	-

* $N = 60$;

[†] Student, military, or retired/disabled;

[‡] has sought professional care for emotional issues, or substance use; % = Percent; M = Mean; SD = Standard deviation.

TABLE 2

Methods of acquisition

	Ever		At least sometimes in the last 12 months	
	N*	%†	N*	%†
Friend	54	70	49	51
Web	53	59	41	46
Ordered from different country	52	46	40	45
Made it‡	53	40	39	46
Someone not known well	51	31	38	11
Chemical supply company	53	26	35	17
Health food store	52	19	34	9
Magazine	52	2	30	0
Pharmacy	52	2	31	0

* Total number of respondents;

† percent endorsing, “Yes”;

‡ “Ever” is smaller percent than last 12 months due to number of omitted responses.

TABLE 3

Financial costs of medical and legal consequences and to purchase (N = 55)

	M*	SD†	Med‡	Mode	Cost
Days in healthcare facility	6.05	22.20	8	0	\$12,896§
Times arrested due to use	8.89	64.02	3	0	\$36,162
Days in jail due to use	5.13	27.60	15	0	\$931¶
Dollars spent per month	111.00	176.92	75	0	\$900#

* M = Mean;
† SD = Standard Deviation;
‡ Med = Median;
§ based on average costs = \$1,612/day39 multiplied by Med;
|| based on average costs = \$12,054 multiplied by Med40:41;
¶ based on average costs = \$62.05/day42 multiplied by Med;
based on a 12-month period, since over 90% of the sample endorsed use in the last year.

TABLE 4

Correlation matrix relating constructs

	5 [†]	7 [‡]	9 [§]	10	11	12	13	14	15	16	17	18	19 [*]	20 [‡]
1-Ladder	x	-.46	x	x	.52	.54	-.57	-.46	x	x	x	-.70	x	x
2-Negative psychological/somatic effects [*]	x	-.47	x	x	.57	.45	x	x	x	x	x	-.55	.51	x
3-Energy/improved health [*]	.58	x	x	x	x	x	x	.45	x	x	x	.46	x	.48
4-Improved sociability [*]	x	x	x	.45	x	x	x	x	x	x	x	x	x	x
5-Psychological/health benefits [‡]	-	x	x	x	x	x	x	x	x	x	x	x	x	.50
6-Enhance party experience [‡]	x	x	x	x	x	x	x	-.46	x	x	x	x	x	x
7-Legalization/free access [‡]	R	-	x	x	-.51	-.51	x	.50	x	x	x	.55	x	x
8-General malaise/ [§] cognitive symptoms	x	x	.49	x	x	x	.52	x	x	x	x	.48	x	x
9-Restlessness/agitation [§]	R	R	-	x	x	x	.54	x	x	x	x	.45	x	x
10-AveDBP	R	R	R	-	x	x	-.57	x	x	x	x	x	x	x
11-AveDBC	R	R	R	R	-	.65	-.56	x	x	x	x	-.61	x	x
12-SIP-Tot	R	R	R	R	R	-	-.72	-.61	-.53	x	.52	-.70	x	x
13-DepSx-LT	R	R	R	R	R	R	-	.44	x	-.62	-.47	.62	x	x
14-DepSx-12M	R	R	R	R	R	R	R	-	.51	-.49	-.71	.67	x	x
15-Confidence	R	R	R	R	R	R	R	R	-	x	-.49	x	x	x
16-Freq Use-LT	R	R	R	R	R	R	R	R	R	-	.64	x	x	x

^{*} GHB/analog Expectancy Questionnaire scale;[‡] Reasons for GHB/analog Use scale;[§] GHB/analog Opinions/Knowledge scale;

[§] Long-term Withdrawal Symptoms scale; AveDBP = Average Pros-Decisional Balances; AveDBC = Average Cons-Decisional Balances; SIP-Tot = Short Inventory of Problems Total score; DepSx-LT = Dependence Symptom Count-Lifetime; DepSx-12M = Dependence Symptom Count-Last 12 Months; #15 = Brief Situational Confidence Questionnaire Score; #16 = Most Frequent Use-Lifetime; #17 = Most Frequent Use-Last 12 Months; #18 = Coping Behaviors Questionnaire-Summary score; #19 = Psychomotor Retardation; #20 = Assist Sleep/Medical Opinion; R = Repeated correlation; x = Non-significant; all correlations significant at $p \leq .001$ level; average $N = 43$.