# PSYNAPSE

PSYCHOPHARMACOLOGY
SECTION OF THE CPA
CANADIAN PSYCHOLOGICAL ASSOCIATION
SOCIÉTÉ CANADIENNE DE PSYCHOLOGIE
PSYCHOPHARMACOLOGIE
SECTION DE LA SCP

THE NEWSLETTER OF THE CPA'S PSYCHOPHARMACOLOGY SECTION

Volume 2, Issue 2
October 2020

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# A Message from the Editor

Bryan Butler, M.A.

McGill University

Dear members of the Psychopharmacology Section,

It is my pleasure to welcome Dr. Amir Sepehry as our new section chair! I would also like to thank Dr. David Nussbaum for his many years of service as the previous chair and wish him the best of luck in his future endeavors.

Please take the time to **complete the survey** *Psychologist's attitude toward the Prescriptive Authority (RxP) movement.* See page 26 for further details.

LINK TO SURVEY:

https://forms.gle/9xzTkTybyWSpgQ1U9

I hope that you are all keeping well during these challenging times.

Kind regards,

Bryan

# A Letter from the in-coming Section Chair

Amir A. Sepehry, M.Sc., Ph.D.

Adler University
Division Chair

Dear members of the CPA Psychopharmacology section,

I welcome you to the 2020 fall academic term.

As the in-coming Chair of the section (2020-21), I would like to introduce myself. I have been an active member of the CPA Psychopharmacology Section as well as other sections for over a decade. I have been involved with the Psychopharmacology Section as the newsletter editor and contributor, webmaster, and at times reviewed abstracts for the CPA annual conference.

I have been interested in psychopharmacology since completion of my undergraduate degree. During my initial training at the Simon Fraser University (SFU), I worked as a research assistant in a neuropsychology lab with a keen interest in better understanding the brain and behavior relationship with a focus on psychopharmacology. At the time, I worked on a meta-analytic project examining the effect of atypical antipsychotics on long-term memory dysfunction in schizophrenia (i.e., dementia precox), which was published in the Journal of Psychopharmacology, a SAGE journal. Subsequently, at L'Universite de Montreal while completing my Master's degree with Dr. Emmanuel Stip (Psychiatrist), I worked on several meta-analytic projects including one, which examined the effects of Selective Serotonin Reuptake Inhibitors (SSRIs) as an adjunctive therapy for negative symptoms of schizophrenia, and two projects on oral cholinesterase inhibitors for cognitive symptoms of schizophrenia.

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My doctoral training was done part at the University of Victoria (UViC) and part at the University of British Columbia (UBC), under the supervision of Dr. Claudia Jacova (cognitive neuropsychology) and in collaboration with esteemed colleagues from neurology, geriatric medicine, and experts in lifespan developmental psychology. During that time, I have completed a meta-analytic work examining the effect of SSRIs on Alzheimer's disease (AD) with comorbid depression, and wrote a letter to the editor of the Lancet, on SSRI treatment for AD. Simultaneously, in 2010, I was awarded the American Psychological Association (APA) Division 55 - American Society for the Advancement of Pharmacotherapy (ASAP) - Student advocacy award. By the time I completed my PhD, I had collaborated on several peer-reviewed projects worldwide. During my post-doctoral fellowship with Dr. Robin G.Y. Hsiung (cognitive/behavioral neurology, and genetic epidemiology) I wrote several papers including one that examined the effect of pharmacological treatment for apathy in Alzheimer's disease. Since then, I have worked on several projects and collaborated and provided consultation to a nutraceutical company. Simultaneously, I have been working on several book and encyclopedia chapters. Additionally and currently, I am teaching graduate level courses, including psychopharmacology, and completing clinical training in clinical neuropsychology, where I have also examined the effect of medication on the assessment of cognitive function within the forensic context.

I hope to continue my work and gain better understanding of the brain and behavior relationship via the lenses of neuropsychology and clinical psychopharmacology. Consequently, with the knowledge of the medical system and neuropsychology, I hope to advocate for prescriptive authority for licensed psychologists, and to provide care to patients with shattered lives. Given my extensive training, I wish to use my meta-analytic and knowledge translation skills to provide evidence-based training and treatment, where appropriate. Particularly, within the Psychopharmacology Section, I wish to advance the field, allow further collaboration and networking between colleagues and students.

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I wish to invite more students and esteemed colleagues to join the division and take part in activities we envisage for the upcoming year. I hope to continue and expand the scope of the Section founded and led previously by Dr. Nussbaum, and I will do my best to push forward with our current plans.

I hope that you are keeping safe and sound in this turbulent COVID time.

Amir A. Sepehry, MSc, PhD
CPA-Psychopharmacology Chair (2020-21)

# Why Prescriptive Authority for Licensed Psychologists is Essential

Amir A. Sepehry, M.Sc., Ph.D. (Adler University)-Division Chair

Bryan Butler, M.A. (McGill University)

David Nussbaum, Ph.D., C. Psych. (University of Toronto)

The world as we speak is changing. It is challenged by changes induced as the result of the COVID pandemic. These changes include vicissitudes in the rate of mental illnesses and medical conditions, and economic and resource limitations. How we approach these changes matters greatly. By the same token, acknowledging the considerable global burden of mental illness is imperative. Hence, we have greater needs for practitioners with suitable skills to apply the scientist-practitioner model alongside patient-centred care. Practitioners with suitable skills such as implementing prevention, rehabilitation, and treatment planning in underserviced rural and urban core areas of the world, are critical.

Current evidence shows that, with exception of psychologists, several medical non-specialists (e.g., General Practitioners: GPs) and allied health practitioners (e.g., nurse practitioners and pharmacists) are permitted to independently prescribe medications, and particularly psychotropic medications (Brijnath et al., 2017; Law et al., 2012; Mark et al., 2009; Rookhuizen et al., 2017) with significant impact (Ross, 2015). General practitioners act as gate keepers to specialists, and in shortage, nurse practitioners and other allied health experts contribute to the management of people suffering from mental illness and shattered lives. According to the Canadian Psychiatric Association, many areas of the country lack adequate psychiatric services, particularly in the rural and northern areas (https://www.cpa-apc.org: How many psychiatrist are there in Canada?) and there is approximately one psychiatrist to 8400 Canadians (https://www.cpa-apc.org: What is the recommended ratio for psychiatrist in population?).

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This shortage has a significant impact on patient care (e.g., burden on primary care physician and nurses) and mental health policy that should not be disregarded. Consequently, clinicians—general and allied health practitioners—are available there to mitigate the effects of specialist shortages (service-gap) in rural regions (Dewan et al., 2014; Merwin et al., 2003). However, GPs or nurse practitioners may not be extensively trained to assess and treat the spectrum of mental illness.

Some practitioners may select to provide alternative psychological interventions (Siriwardena, 2010). According to the American Psychological Association (APA) (https://www.apa.org/monitor/2012/06/prescribing), all too often, patients are prescribed medications that may not work or may be inappropriate for their mental health problems, which in return can be taxing on resources. Also, despite current evidence and guidance, the prescribing psychotropics such as hypnotics, anxiolytics, and antidepressants are often problematic for GPs and their patients, particularly when drugs are given for an inappropriate indication or for an excessive length of time (Siriwardena, 2010). Additionally, prescription by GPs may be affected by several medical and non-medical factors which may explain a sense of arbitrariness surrounding psychotropic drug treatment (Svensson et al., 2019), this is beyond the scope of this paper.

While writing a prescription to treat a mental illness is simple, it may not always be the safest or most effective route for patients, and at times, doctors prescribe ex juvantibus (Helmchen, 1990). That is making an extrapolation regarding the disease causativeness from a perceived response of the disease to a given treatment (e.g., pharmacotherapy), which increases the risk of being problematic if the practitioner has not received adequate training regarding the brain and behavior relationship to deal with the adverse consequences that are potentially unseen (e.g., neurobiological changes without physical signs).

In Canada, currently no institutions exist which offer training in clinical psychopharmacology for licensed psychologists, and there are no jurisdictions in which Canadian psychologists have been granted prescriptive authority.

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However, in the United States this authority has been provided by in five states: New Mexico, (2002), Louisiana (2004), Idaho, Iowa and most recently, Illinois in 2019, along with the Territory of Guam, the Department of Defense, Public Health Service and Indian Health Service. (https://en.wikipedia.org/wiki/Prescriptive_authority_for_psychologists_movement) State licensing bodies have negotiated specific regulations and scope of practice. To qualify as a "Medical Psychologist" individuals must pass the national PEP (Psychopharmacology Examination for Psychologists) examination, and undergo extensive practical experience under a prescriber licensed in that state. (https://www.asppb.net/general/custom.asp?page=PEPExam) Although not all psychologists favor Prescriptive Authority for their profession, the APA officially supports the initiative, even if their support has not always translated into robust actions. (https://www.apa.org/monitor/2012/06/prescribing )

In this advocacy process, it is interesting to note that successful states have elicited support from local General Practitioners, who often welcome Medical Psychologists taking patients with mental health issues off their hands. This is not out of a disregard for these patients, but a realistic recognition that mental health issues are not a major component of general medical training, can be very time consuming, and referrals to psychiatrists will involve lengthy waiting times. These in turn result in return visits to the General Practitioner and less specialized treatment for the mental health patient. It also reduces their availability for their patients with strictly medical needs for which they received optimal training.

Advocates for Prescriptive Authority have also allied themselves and benefitted from strategies employed by non-medical professions in obtaining their prescriptive authority. Beyond Clinical Nurse Practitioners, these groups include optometrists (who in some U.S. jurisdictions can administer not only eye-dilation drops for examinations, but also therapeutic drugs for treatment of some eye diseases), pharmacists, and podiatrists. (https://www.tdlr.texas.gov/pod/podfaq.htm) Psychologists can learn from the experiences on non-physicians to navigate successfully the political landscape to gain Prescriptive Authority for interested and qualified psychologists.

# When You Wish Upon A Star

Pat DeLeon, Ph.D., MPH, JD

Former APA President

Psychology's prescriptive authority (RxP) quest has a most interesting history and exciting future. Anthony Ragusea recently reported that at this year's virtual APA convention, the Council of Representatives voted to deem clinical psychopharmacology as the newest Specialty for professional psychology. "Specialization is important for many reasons. Specialization is another mechanism to ensure high quality treatment. Specialization helps to assuage fears expressed by some that all psychologists will eventually become prescribers. A specialization, by definition, is an activity that most psychologists will not engage in because they do not have the requisite skills. Specialization is also symbolic, it implies that the practice of psychopharmacotherapy is not something we 'tolerate' psychologists doing, but something psychologists can aspire to. The healthcare environment is changing, the profession of psychology must evolve, and prescribing psychologists show us that psychologists can both swim in water and walk on land with equal facility!"

In November 1984, U.S. Senator Daniel K. Inouye urged psychologists at the annual meeting of the Hawaii Psychological Association to seek prescriptive authority in order to improve the availability of comprehensive, quality mental health care. Around that time, Richard Samuels, President of the Division of Independent Practice, and Steve Ragusea also called for embracing this intriguing clinical authority.

In 1989, the APA Board of Professional Affairs (BPA) held a special meeting, under the chairship of Norma Simon.

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BPA strongly endorsed immediate research and study regarding its feasibility and the appropriate curricula so that psychologists might provide broader service to the public and more effectively meet the psychological and mental health needs of society. In 1990, at our Boston annual meeting, the Council of Representatives established an ad hoc Task Force on Psychopharmacology. Chaired by Michael Smyer, their 1992 report concluded that practitioners, with combined training in psychopharmacology and psychological treatments, could be viewed as a new form of health care professional, expected to bring to health care delivery the best of both psychological and pharmacological knowledge. Further, the proposed new providers had the potential to dramatically improve patient care and make important new advances in treatment. In August 1995, the Council formally endorsed RxP for appropriately trained psychologists and called for the development of model legislation and a model training curriculum. New Mexico (2002) and Louisiana (2004) enacted relevant statutes.

As Steve Ragusea has pointed out on several occasions, the real key for the RxP quest has been the graduation of Morgan Sammons (now CEO of the National Register) and John Sexton from the Department of Defense demonstration program on June 17, 1994, at the Walter Reed Army Medical Center ceremony, which was attended by APA President-elect Bob Resnick and myself. Steve frequently says: "These two dedicated colleagues proved to psychology that obtaining prescriptive authority could be done appropriately for the public good by our own profession. Despite the objections of early naysayers, there is no longer any doubt of the accomplishment. A quarter century of safe and effective prescribing by psychologists can be neither denied nor ignored."

The COVID-19 pandemic has had a major adverse impact upon our nation, not the least of which has been increased emotional and economic distress. The Kaiser Family Foundation reports that a growing number of adults are struggling with mental health issues linked to related worry and stress, increasing from 32% in March to 53% in July, 2020. Those experiencing symptoms of anxiety or depression reached 40% this summer, up from 11% a year ago.

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Fifty-nine percent of those who have lost income because of the pandemic experienced at least one adverse effect on their mental health and well-being.

One might hope that our nation's health policy leadership would respond in a positive, visionary fashion.
However, over the years, we have learned that substantive change always takes time, often far more than one would expect, and raises considerable concern among many. Economist Jeffrey Bauer estimates that by fully empowering non-physician providers our nation's health care costs could be reduced by 32%, which would result in an annual savings of $155 billion. He further makes the point that he has expressly, and unsuccessfully, sought any evidence that non-physician practitioners have clinical outcomes that are less successful than those of their physician counterparts. Yet, the historical barriers continue, often under the guise of ensuring "quality of care." Those expecting that the RxP agenda will ultimately be successful primarily because of its demonstrated cost-effectiveness and quality of care – not to mention addressing society's pressing needs -- must become personally involved in the public policy/political process if they desire this change. Successful advocates possess vision, determination, and a willingness to continue to pursue their agenda – regardless of how long that might take. We must appreciate that change can be very unsettling to our colleagues within the health care system.

In 2002, the Institute of Medicine (IOM) released its report Leadership by Example: Coordinating Government Roles in Improving Health Care Quality. Noting that the American health care sector is in need of improvement, the Committee's overall conclusion was that "the federal government must assume a stronger leadership role to address quality concerns." Approximately one-third of Americans are beneficiaries of federal health programs and the majority of health care providers participate. A critical first step in addressing the nation's serious health care safety and quality concerns was seen as the establishment of valid and reliable measurement systems that can be used to assess the degree to which care processes are consistent with the clinical knowledge base and patients are achieving desired outcomes.

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Patients should be provided with health information necessary to evaluate treatment options and to participate in care management. There was strong encouragement for the adoption of best practices through the release of public-domain comparative quality data. Finally, it was emphasized that the public programs should continue to serve as laboratories for the development of innovative 21st century care delivery models. The rhetorical questions – Over the past nearly two decades, has the objective data on psychology's prescribing patterns been appropriately attended to? Have we seen enthusiastic consideration of psychology's prescriptive authority legislation? Steve proclaims: "IN AT LEAST TEN STATES, YES!" "What your life can truly be"-(Earth, Wind & Fire).

Aloha,

Pat DeLeon

Former APA President

# Medium-Chain Triglycerides (MCTs) and Neurocognitive Function

Amir A. Sepehry, M.Sc., Ph.D. (Adler University)-Division Chair

Alireza Ghannadi, Pharm.D., Ph.D., Saied Vejdani, MD, and Karim Leilnahari, Ph.D. (CSN; Canadian Sports Nutrition)

Kristin Berrington, B.Sc. (University of Manitoba)

Claude Sara, B.Sc. (Pharm), DESS

The potential mechanism of action of non-pharmacological nutraceutical agents such as medium-chain triglyceride (MCT) has been elaborately studied (Augustin et al., 2018; Cunnane, Courchesne-Loyer, St-Pierre, et al., 2016; Murray et al., 2016). It is suggested that MCTs are broken down in the gastrointestinal tract and then absorbed directly via the gut and transferred to the liver, then rapidly metabolized such that they can be an alternative fuel in the absence or shortage of glucose. Since MCTs are capable of passing through the blood-brain barrier (Wlaz et al., 2012; Wlaz et al., 2015), the organ responsible for cognitive functioning that is predominantly dependent on glucose as source of energy and oxygen is the brain. The brain is capable of utilizing ketones - the byproduct of MCT that has been hepatically derived, as an inert source.

To this end, oral ingestion of compounds inducing a ketogenic state in a healthy human body, such as coconut oil, are proposed to enhance physical and brain energy metabolism (Croteau et al., 2018), and consequential cognitive performance (Murray et al., 2016). Subsequently, the anticipated effect of these compounds to compensate for deteriorating brain glucose uptake associated with psychiatric and neurological conditions are examined by experts (Cunnane, Courchesne-Loyer, St-Pierre, et al., 2016) with the most prominent use of the compounds being for preventing cognitive deficit due to aging, or decline due to neurodegenerative conditions, such as Alzheimer's disease (AD)(Croteau et al., 2018; Cunnane, Courchesne-Loyer, Vandenberghe, et al., 2016).

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However, findings from open-label, single arm studies on the use of MCT for cognition and memory seem unequivocal, information emerging from randomized clinical trials (RCTs) seem elusive and controversial. For instance, a prospective, open-label pilot study examining the use of MCT for the management of cognitive impairment in AD did not show global cognitive improvement in their sample consisting of sporadic, mild-to moderate AD (Ohnuma et al., 2016). Conversely, the same study has shown improvement of cognitive functioning as assessed via Mini Mental State Examination (MMSE) in a group of AD patient with ApoE4-negative and MMSE of 14 or higher at onset, suggesting that a group of AD patients benefited from the compound after 3 months intervention. A similar sample group in a different study had shown improvement on tasks of word recall and orientation after 3 months of intervention in individuals with mild- to moderate AD (n=15) with MMSE onset of 15 or higher (Kimoto et al., 2017). It is noteworthy that others have found similar results showing the association between a higher ketone value and improvement in paragraph recall with memory impaired individuals including patients with AD and mild cognitive impairment (MCI) (Reger et al., 2004), or on global cognition with differing sample sizes (Ciavardelli et al., 2016; Taylor et al., 2018).

RCTs using various methods of MCT delivery (e.g., emulsions) provide mixed results given the variation in neuropsychological testing approach both within and across studies, and type of study design (e.g., cross-over, parallel arm). For example, although A cross-sectional trial shows positive results for parts of episodic memory (e.g., free recall), and attention and processing speed (e.g., trail making-number sequencing) compared to pre- to post-treatment with active compounds, only language function, as assessed by Boston Naming Test (BNT)- total correct, showed significant difference between placebo and active compounds in individuals with MCI within an interval of 6 months (Fortier et al., 2019).

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Noteworthy that similar results have been observed by other studies (Ota et al., 2019) suggesting that while some individuals see health benefits from MCTs, based on current evidence, it is premature to conclude that MCTs are foolproof supplements for management of cognitive functions, and for slowing cognitive decline related to Alzheimer's disease. Although there is much speculation that the use of MCT can lead to a ketogenic metabolic state, recent evidence has shown that intermittent fasting plays a role in health, aging, and disease progression by triggering a metabolic switch from glucose-based to ketone-based energy (de Cabo & Mattson, 2019). Therefore, future studies may speculate the combination of MCT (e.g., total daily dosage of 17.3g)(Xu et al., 2020), with intermittent fasting for a desired effect. Current studies are not without limitations. For instance, limited information is provided by the studies on the compounds used, standards and constituents (chemical skeleton of the ingredient), which rendered further analysis impossible. An additional limitation to current studies included is the lack of clear information on the type of MCTs. For instance, what constitutes a regimen/ or drink, since the current market includes different types that are often mixed with other compounds including herbal oils (e.g., coconut oil).

Hence future studies with larger sample size are warranted. This only suggests a potential for future use of MCTs in large clinical trials, and repurposing, with varied populations, since our sample of studies included elderly individuals, with AD or MCI, Diabetics, and healthy adults.

# ▪ALCOHOL: A SCIENTIFIC ODYSSEY FROM PREHISTORIC FORESTS TO AVICENNA TO COVID-19

Danial Asadolahi, B.A., 5th Year PsyD Student, and Amir A. Sepehry, M.Sc., Ph.D.

(Adler University)

Alcohol (also called ethanol) is a ubiquitously used substance, consumed in such social contexts as the religious and the celebratory, and as part of rituals for sealing agreements (Hockings & Dunbar, 2020). The history of humans and alcohol can be traced back 10 million years ago (Hockings & Dunbar, 2020). Prehistoric forest floors were littered with fallen and fermenting fruits, which contained ethanol (Hockings & Dunbar, 2020). Evolution provided the common ancestors of the African great apes, a category which includes humans, with the metabolic capacity to transform this ethanol into energy-filled molecules that could serve as a significant calorie source (Hockings & Dunbar, 2020). The historical discovery of alcohol as a compound is attributed to the ancient Iranian physician 'Rhazes', while another prominent ancient Iranian medical figure, 'Avicenna', was the first to discuss alcohol's antiseptic properties (Ashtiyani Saeed et al., 2011; Azimzadeh Tehrani, 2014; Royal College of Physicians of Edinburgh, n. d.).

Given alcohol's ubiquity, social and medical importance, its long history, and potential adverse effects, if abused, this paper aims to deepen readers' understanding of this highly prominent substance. To this end, recent select empirical data concerning a few topics relating to alcohol are reviewed. These include A) alcohol's pharmacokinetics and pharmacodynamics, B) symptoms of alcohol intoxication, C) assessment of alcohol-related impairment (ARI) and excessive consumption, D) misuse and related personal and social problems, and E) psychological and medical treatment of alcohol-related conditions. We further provide brief discussions about the modern medical uses of alcohol and some new research developments, as well as hinting at recent additional alcohol-related findings.

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**Pharmacokinetics of Alcohol**

We will begin by examining the human body's effect on alcohol upon consumption of the substance. Blood alcohol concentration (BAC) is "…determined by the rate at which alcohol is absorbed, distributed, metabolized and excreted" (Goldin & Marshall, 2017). With regards to absorption, alcohol can easily pass into body fluids and into cells (Goldin & Marshall, 2017).
After being ingested orally, alcohol is almost totally absorbed; peak BAC occurs after 30-60 minutes (Goldin & Marshall, 2017). 80% of absorption happens in the small intestine, a relatively faster process, while 20% of absorption happens in the stomach, a relatively slower process (Goldin & Marshall, 2017). A number of different factors contribute to the alcohol absorption process (Goldin & Marshall, 2017). These include concentration of alcohol (absorption is faster at concentrations of 15-30%), carbonation of alcohol ($CO_2$ can increase absorption), and mixing alcohol with beverages (diet drinks cause greater alcohol absorption than sugar-containing beverages; Goldin & Marshall, 2017).

Such means of alcohol consumption as intravenous injection, snorting, and the use of alcohol-soaked disposable menstrual products lead to faster absorption of the substance (Mahdi & McBride, 1999). As individuals grow older, alcohol absorption changes in such a manner as to enhance the chances of interactions with medications (Stewart & McCambridge, 2019). These interactions can involve a variety of medications used to treat long-term medical conditions, "…including cardiovascular diseases, pain, depression, diabetes, musculoskeletal conditions, infections, and cancer" (Stewart & McCambridge, 2019). Additionally, even when alcohol consumption is at a lower level than what drinking guidelines describe as low-risk, the substance can exert a direct and negative influence upon a large number of medical conditions for which medications are given (Stewart & McCambridge, 2019).

Following the absorption process, "…alcohol is distributed into total body water through all body tissues and fluids in proportion to their relative water content" (Goldin & Marshall, 2017). Alcohol easily passes through the blood brain barrier (Goldin & Marshall, 2017).

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It also enters the placenta and quickly spreads through the fetal compartment (Goldin & Marshall, 2017). Alcohol can also pass into lactating mothers' breast milk (Goldin & Marshall, 2017). There are gender differences between men and women in terms of distribution of alcohol in the body; women's total body water is lower than men's as a result of women's higher body fat; "Therefore a woman will achieve a higher blood alcohol level even if they drink the same amount as a man of the same body weight…" (Goldin & Marshall, 2017).

In terms of alcohol metabolism, the primary organ involved is the liver, as this is the organ in which the relevant metabolic enzymes are most prevalent (Goldin & Marshall, 2017). Damage to the liver will thus significantly affect the human body's ability to metabolize alcohol (e.g., alcoholic liver disease reduces alcohol metabolism rate; Goldin & Marshall, 2017). Key liver enzymes involved in alcohol metabolism are alcohol dehydrogenase (ADH) and aldehyde dehydrogenase (ALDH; Wall et al., 2016). The stomach is also involved in alcohol metabolism (Goldin & Marshall, 2017). Alcohol metabolism rate varies greatly between and within individuals as a result of both genetic and environmental factors (e.g., "race, sex, age, biological rhythms and time of day, food, exercise, smoking, drugs and chronic intake of alcohol"; Goldin & Marshall, 2017). To take one example, there is evidence that women's bodies, on average, metabolize alcohol at a slower rate compared to men's (Patel & Preedy, 2017). The body does not store alcohol (Goldin & Marshall, 2017). The substance remains in total body water until eliminated; 90% of this elimination occurs via metabolism and the remainder via excretion in sweat, urine, and exhaled air (Goldin & Marshall, 2017). The excretion process serves as the basis of the breathalyzer test (Goldin & Marshall, 2017). Thus, following consumption, alcohol undergoes four major bodily processes, namely absorption, distribution, metabolism, and excretion. Having described the body's effect on alcohol, we will next turn to the substance's effect on the body.

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**Pharmacodynamics of Alcohol**

Alcohol affects multiple bodily organs and systems, "including the central nervous system (CNS), endocrine, immune, cardiovascular and GI [gastrointestinal] systems" (Goldin & Marshall, 2017). In people who drink habitually, tolerance development leads to a higher BAC being required to cause a particular effect (Goldin & Marshall, 2017). The main effect of alcohol on the human body is in the CNS, where the substance produces a depressant effect (Goldin & Marshall, 2017). Alcohol affects the CNS via both directly and indirectly influencing several different neuropeptide and neurotransmitter systems and thus impacting various brain circuits and pathways pertaining to stress, reward, habit-formation, and decision-making (Goldin & Marshall, 2017). To provide some examples, low to moderate alcohol consumption gives rise to feelings of excitation and euphoria through activation of the glutamate neurotransmitter system (Borghesani, 2018). Alcohol exposure stimulates dopamine release in the brain, which is related to alcohol's reinforcing effects (Goldin & Marshall, 2017; Volkow et al., 2017). Acute alcohol exposure enhances the function of the inhibitory neurotransmitters GABA and glycine, which contributes to such intoxication effects as sedation, ataxia, anxiolysis, and amnesia (Goldin & Marshall, 2017). Furthermore, alcohol affects 5-HT (serotonin) receptors expressed on GABA neurons, increasing GABA release (Goldin & Marshall, 2017).

Chronic alcohol exposure affects glutamate receptors, causing a hyperexcitable neuronal state that is believed to play an important role in the development of alcohol withdrawal symptoms (Goldin & Marshall, 2017). Alcohol withdrawal symptoms include sweating, high pulse rate, hand tremor, insomnia, anxiety, nausea or vomiting, among several others (APA, 2013). The CNS depressant influence of other drugs is substantially enhanced by alcohol (Goldin & Marshall, 2017).

With regards to the effect of alcohol on biological tissue, the substance's effect is a toxic one; therefore, nearly all body tissues can be harmed by the substance if it is used in excess (Goldin & Marshall, 2017). Alcohol consumption levels higher than one to two drinks in one day produce toxicity (Goldin & Marshall, 2017).

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In terms of neurotoxicity, chronic heavy alcohol drinking and binge drinking can cause irreversible brain damage; this can give rise to seizures, degeneration of the cerebellum, and cerebral cortex thinning, which is linked to dementia and motor impairment (Goldin & Marshall, 2017). The mechanisms through which these brain disorders and diseases arise include the direct toxic impact of high alcohol concentrations, formation of alcohol metabolites, and "cellular oxidative stress" (Goldin & Marshall, 2017). Alcohol overconsumption can also cause indirect damage to the brain. Alcoholism can produce thiamine deficiency through poor nutrition and decreased thiamine absorption via the GI tract; thiamine deficiency then leads to the Wernicke-Korsakoff syndrome, characterized by such symptoms as ataxia, global confusion, and memory problems (Brigadeiro et al., 2016; Goldin & Marshall, 2017; Martin et al., 2003). Indirect damage from alcohol consumption can also occur through accidents and falls caused by intoxication (Goldin & Marshall, 2017). Such events can produce head injuries and subdural hematomas (intracranial hemorrhage; Gaist et al., 2017; Goldin & Marshall, 2017).

Excessive alcohol intake can cause damage to multiple bodily systems (Goldin & Marshall, 2017). These include the endocrine, immune, respiratory, and cardiovascular systems (Goldin & Marshall, 2017). With regards to the immune system specifically, high alcohol consumption levels can produce immunosuppression, which in turn leads to increased infectious disease risk (e.g., tuberculosis, pneumonia, HIV) and increased risk of various cancers (Goldin & Marshall, 2017). In summary, while lower alcohol consumption may produce pleasant effects, higher levels can be damaging to the body and the brain. The next section examines the symptoms people generally experience following alcohol consumption.

**The Symptoms of Alcohol Consumption and Intoxication**

The particular symptoms associated with alcohol consumption are dependent on blood alcohol concentration (Goldin & Marshall, 2017). However, genetic, environmental, and cultural factors (e.g., metabolic capacity and psychosocial setting of alcohol consumption) can affect the pattern of consumption symptoms that are expressed (Goldin & Marshall, 2017).

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In socially drinking, non-abusing, and non-dependent individuals, at blood alcohol concentrations of less than 50 mg/dl, consumption symptoms can be pleasant, and include "relaxation, mood elevation, [and] decreased self-consciousness…" (Goldin & Marshall, 2017). These effects are attributed to alcohol's depressant action on the reticular activating system, which decreases the inhibitory control over the cortical region (Goldin & Marshall, 2017).

Between BACs of 50 mg/dl and 100 mg/dl, cognition is negatively impacted, and learning and memory are compromised (Goldin & Marshall, 2017). At BACs higher than 100 mg/dl, obvious (noticeable) intoxication symptoms occur (Goldin & Marshall, 2017). These include coordination problems, slurred speech, ataxia, higher reaction times, changes in personality, behavior, and mood, as well as impairment of judgement (Goldin & Marshall, 2017).

A high alcohol consumption level is linked to increased violent behavior risk and risk-taking behaviors (Goldin & Marshall, 2017). BACs higher than 200 mg/dl give rise to impaired social judgement, a clear ataxic or "staggering" gait, and memory difficulties, in addition to other problems (Goldin & Marshall, 2017). BACs higher than 400 mg/dl produce respiratory depression, coma, and possibly death (Goldin & Marshall, 2017). The lethal dose of alcohol varies from person to person (Goldin & Marshall, 2017). Generally, death resulting from acute alcohol intoxication happens at a BAC above 500 mg/dl (Goldin & Marshall, 2017). In non-tolerant persons, death can happen at 300 mg/dl (Goldin & Marshall, 2017). Conversely, in individuals with a high tolerance level, recovery might happen at a BAC higher than 1200 mg/dl (Goldin & Marshall, 2017). The symptoms of alcohol consumption can thus range from pleasant at relatively lower BACs to increasingly more problematic at higher BACs. Having described the symptoms of alcohol consumption and intoxication, it is important to follow with a discussion of alcohol-related impairment and excessive consumption assessments.

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## Assessment of Alcohol-Related Impairment (ARI) and Excessive Consumption

There are several approaches and tests that can help assess individuals for alcohol-related impairment (ARI). A major means of assessment is the Diagnostic and Statistical Manual of Mental Disorders, which contains a chapter entitled "Substance-Related and Addictive Disorders" (5th ed.; DSM-5; APA, 2013). There is a section in this chapter called "Alcohol-Related Disorders", which includes information specific to alcohol intoxication (APA, 2013). The reader is referred to the DSM-5 for all of the diagnostic criteria for alcohol intoxication, but some of these criteria include recent ingestion of alcohol, significant problematic behavioral and psychological changes (e.g., aggression) resulting from alcohol consumption, as well as slurred speech, unsteady gait, and impairment in attention or memory (APA, 2013).

ARI can also be assessed via laboratory tasks examining attentional inhibition, which is defined as "the ability to ignore distracting stimuli in the environment in order to focus attention on relevant information" (Weafer & Fillmore, 2012). Alcohol consumption leads to poorer performance on these tasks (Weaver & Fillmore, 2012). Additionally, we can assess ARI using measures of such executive functions as working memory, the memory system associated with keeping information active in short-term memory for immediate use (Spinola et al., 2017). Alcohol consumption can lead to poor performance on these measures also (Benson et al., 2019).

In terms of the assessment of excessive alcohol consumption in individuals, a few methods are available. These include medical tests examining for abnormalities in the activities of the liver enzymes gamma-glutamyltransferase (GGT) and alanine aminotransferase (ALT; Niemela, 2016). Also available are such self-report measures as Alcohol Use Disorders Identification Test (AUDIT), CAGE alcohol questionnaire (Cut down, Annoyed, Guilty, Eye-opener), and the Michigan Alcoholism Screening Test (MAST; Niemela, 2016). There thus exist several methods for assessing ARI and excessive alcohol consumption. The next section focuses on several important individual-level and social issues stemming from alcohol misuse.

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## Alcohol Misuse and Related Personal and Social Problems

Alcohol consumption can give rise to behavioral, personality, and cognitive changes (Goldin & Marshall, 2017). An important negative change that alcohol contributes to is aggressive behavior, including sexual violence on campuses, and aggression in bars and other public places (Parrott & Eckhardt, 2018). Individuals can also become dependent on alcohol use and develop alcohol use disorders (APA, 2013). In terms of the connection between alcohol use disorders and other psychiatric disorders, the former are associated with a wide range of other psychological illnesses, including depression, anxiety, bipolar disorder, schizophrenia, and antisocial personality disorder (Morin et al., 2017). Alcohol misuse causes society significant economic and social harm, a trend that may be intensified by global population growth (Morin et al., 2017). Alcohol abuse is thus a healthcare priority (Morin et al., 2017). In sum, the misuse of alcohol can contribute to individual as well as social problems. What follows is an examination of the treatment of alcohol-related conditions using psychological and medical approaches.

## Psychological and Medical Treatment of Alcohol-Related Conditions

Effective psychological treatment approaches for alcohol use disorders include a number of different cognitive- behavioral treatments, such as the relapse prevention (RP) model (Morin et al., 2017). This treatment model helps individuals identify "internal and external high-risk situations and triggers" (an example of an internal high-risk situation is low mood feelings, while an example of an external high-risk situation is passing by a bar; Morin et al., 2017). The model also uses cognitive and behavioral interventions to encourage use of new skills and healthy coping strategies to improve self-efficacy in dealing with high-risk situations without alcohol use (Morin et al., 2017).

Acute alcohol intoxication (AAI) is a term used in the alcohol research literature that is interchangeable with "Alcohol intoxication" in the DSM-5, and describes the state that we would refer to as "being drunk" or "inebriated" in everyday language (Caputo et al., 2019).

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The clinical management of AAI is as follows. No drug treatment is typically necessary (Caputo et al., 2019). Vital functions should be monitored, liquids provided for dehydration, and the individual should be observed for alcohol withdrawal symptoms (Caputo et al., 2019). Administration of the medication metadoxine decreases blood alcohol and alcohol metabolite concentrations, producing faster symptom resolution (Caputo et al., 2019). Alcohol hangover symptoms can be cleared up more quickly via consuming fruit and fruit juice, sleeping, anti-acid medication use, and caffeine use (Caputo et al., 2019). In severe AAI with coma, mechanical ventilation is required, as is the administration of a 5% glucose solution for hypoglycemia and vitamin B and C supplements (Caputo et al., 2019). If the intoxicated person has used other sedative drugs with alcohol, specific antidotes are needed (e.g., naloxone for opioids, flumazenil for benzodiazepines; Caputo et al., 2019). Patients who are presenting with AAI should be assessed for alcohol-related disorders so that a personalized treatment plan can be created if such disorders are present (Vonghia et al., 2008). In conclusion, there exist effective psychological and medical approaches for treating alcohol-related conditions. Thus far, we have discussed a number of the adverse consequences of the misuse of alcohol. The next section will briefly consider some of the substance's positive effects, specifically by focusing on how alcohol is utilized in modern medical settings.

**Modern Medical Uses of Alcohol**

In modern societies, alcohol is utilized in several ways in medical and healthcare contexts. For example, alcohol-based hand sanitizers (ABHS) are gaining prevalence in healthcare settings as an alternative to soap and water for hand hygiene purposes (Gold et al., 2020). Some of the reasons for the increasing prevalence of ABHS include their "…ease of use, increased availability, and proven effectiveness…", as well as their ability to protect against infection in the current COVID-19 pandemic (Balato et al., 2020; Gold et al., 2020). Alcohol can additionally be utilized as a surface disinfectant on both hard and soft surfaces in modern healthcare facilities (Alhmidi et al., 2017).

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A significant disadvantage of using alcohol for disinfectant purposes is the substance's flammability (Alhmidi et al., 2017). This disadvantage can be addressed by utilizing formulations of disinfectant agents that reduce the amount of alcohol in these agents (Alhmidi et al., 2017). It is thus apparent that alcohol can play a beneficial role in modern healthcare. The next section briefly examines new alcohol-related research.

**New Developments in the Alcohol Research Domain**

Non-invasive brain stimulation is being explored as a potential treatment for alcohol use disorders (Philip, Sorensen, McCalley, & Hanlon, 2020). This treatment approach typically involves the use of technologies such as transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS) (Philip et al., 2020). Recent research utilizing TMS specifically, has relied on a stimulation frequency of 10 Hz to elicit neuronal excitation (Addolorato et al., 2017). The non-invasive brain stimulation technique is generally safe, and can target and affect the brain regions involved in alcohol use disorders (Philip et al., 2020). Another new phenomenon in the alcohol research field is the development of wrist-worn alcohol biosensors for real-life consumption monitoring (Wang, Fridberg, Leeman, Cook, & Porges, 2019). Among the advantages of these biosensors are their small size, low cost, and power-efficiency (Wang et al., 2019). This technology requires additional validation research, however (Wang et al., 2019). Research into factors contributing to the observed variability in the alcohol readings associated with this device is also needed (Wang et al., 2019). To summarize, there are new technologies being explored and researched for dealing with the harms of alcohol misuse. We will next briefly look at some other important discoveries relating to alcohol.

**Other Important Alcohol-Related Findings**

There are a number of important alcohol-related findings for clinicians and the general public to be aware of. These include the empirical observation that, relative to males, females generally have different motivations for consuming alcohol, move from alcohol consumption to addiction to the substance at lower consumption levels and more rapidly, and experience the adverse effects of alcohol misuse more quickly and heavily (Richter, 2019).

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As well, there is the empirical association between prenatal exposure to alcohol and such psychiatric illnesses as depression and anxiety, as well as cognitive impairment (dos Santos Junior et al., 2019). Another important alcohol-linked finding is that chronic heavy consumption can produce inflammation in the central and peripheral nervous systems, which in turn creates neuroimmune dysregulation that serves as a foundation for a number of different neuropsychiatric illnesses, including depression (Neupane, 2019). Furthermore, research shows that, while moderate alcohol doses can lessen acute pain via effects on GABA, opioid, and glutamate systems, alcohol use disorder (AUD) can lead to chronic pain development (Blanton et al., 2019). There is unfortunately not enough space in this paper to devote to each of these findings the attention they deserve, but interested readers are encouraged to explore the academic literature, as well as science literature produced for the general public, for further information regarding these alcohol-linked observations.

## Conclusion

Alcohol is a widely known and used compound that, as indicated by the reviewed empirical research, carries both the potential for great harm and significant benefit. A science-informed understanding of alcohol may help individuals approach this substance in a safer and healthier way. Hopefully, this paper has aided readers with developing such an understanding, in addition to inspiring them to engage in further reading and research concerning the simultaneously dangerous and beneficial substance.

# 7. Prescriptive Authority Survey

Dear section members,

We are conducting a survey to assess section member's attitude towards gaining Prescriptive Authority (RxP) for licensed psychologists in Canada. This is a short survey that will take approximately 5-7 minutes.

Our goal is to eventually conduct a nation-wide survey through the CPA. If you have any questions or suggestions please contact either Bryan or Amir (see contact details below).

LINK TO SURVEY:

https://forms.gle/9xzTkTybyWSpgQ1U9

Kindly,

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&

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