Assessment of the significance of statistical referencing in global substance use research

Authors

*Faith M. Ajodo, Andrew E. Zamani & Emmanuel O. Alhassan

Department of Psychology, Nasarawa State University, Keffi, Nigeria.

Corresponding author

Faith M. Ajodo

Department of Psychology, Nasarawa State University, Keffi, Nigeria.

E-mail: mondayfaith@nsuk.edu.ng

https://dx.doi.org/10.4314/ajada.v12i1.1

Abstract

This paper reviews the significance of statistical referencing within global substance use research. The researcher adopted a literature search method collecting data from academic search databases such as PubMed and Scopus. These papers reviewed, acknowledge that statistical reference serves not just as a cornerstone for robust global substance use research but also facilitates researchers to truly cite and document their sources for the epidemiological data that inform their analyses and findings. This paper significantly identifies the rigorous statistical referencing framework: not only enhancing credibility but also increasing the research replication and cross-comparison of studies across time and space. By these guidelines, statistical referencing would assure that the work was attributed to add to the larger amount of knowledge base that exists within the field of substance use epidemiology and happen to get further knowledge into the field. The adoption of statistical-reference consistency permits the synthesis of contributions from many sources to paint a picture of global trends and dominant patterns in substance use studies. This paper recommends careful selection of reference groups, addresses possible biases, clear reporting, and conducting power analysis for robust and reliable research in substance use studies. Thus, concluded that statistical referencing empowers substance use research with the capability of data analysis, evaluation of treatment, and identification of contributing factors toward proper design interventions and policy formulation.

Keywords: *Assessment, Statistical referencing, Global, Substance use, Policy Formulation, Transparency*

Introduction

Statistical referencing is the systematic use of quantitative data to summarize and analyze observations, as well as to draw inferences from samples about populations. Such a practice is considered indispensable in making informed decisions in various fields, such as public health, economics, and substance abuse studies. Statistical referencing in global substance abuse studies has bettered our understanding and management of drug-related issues around the world. This development is important, in that substance abuse is a challenge that is multi-factorial in nature and involves approximately 271 million current drug users worldwide (Smith & Brown, 2021).

Thus, statistical referencing provides critical advancement to researchers in understanding the multi-faceted issues at hand. With the use of advanced statistical methods in data analysis, combined with standardized means of data collection, researchers are better able to analyze trends and outcomes associated with substance use. As the landscape continues to shift, further improvements in statistical techniques will be essential for the elaboration of effective prevention and treatment strategies, considering diverse populations worldwide.

Meanwhile, the global public health concern is also on individual, community, and societal development issues. Following trends and patterns of substance use has its usefulness to understand the prevention and policy resource use on evidence-based intervention implementation. The newest works by the Global Burden of Disease (GBD) study in 2016 provided the most detailed estimates of by-the-burden-of disease for the first time attributed to alcohol and drug use by 195 countries (United Nations Office on Drugs and Crime, UNDOC, 2022). This groundbreaking research found alcohol use disorders as the commonest for that year, with cannabis and opioid dependence being the next (UNODC, 2021). Over the last decade, there has been accumulating epidemiological data, revealing the dynamic nature of substance use internationally (UNODC, 2022).

The latest global epidemiological studies conducted between 2016 and 2024 have painted a complex and multifaceted picture of substance use worldwide. According to the World Drug Report, around 284 million people aged 15-64 used drugs worldwide in 2020, a 26 percent increase over the previous decade (UNODC, 2022), also estimated that 11.2 million people worldwide were injecting drugs. Therefore, substance abuse has received significant attention from multi-international organisations by engaging experts in conducting studies to investigate the cost and benefits of substance use and the possible solution to curtail the danger.

In line with this, various studies have shown the prevalence of substance abuse across the world including Nigeria.

More so, WHO (2017) reported a global prevalence of drug abuse at 0.9%, with alcohol abuse accounting for 3.3 million deaths annually and 31 million people suffering from drug use while in 2019 reported more than 2.4 million people between 10-24 age brackets die yearly from drug and substance abuse (WHO, 2019), in the same year United Nations Office on Drug and Crime in Nigeria indicates that 14.4% (14.3 million) of people aged between 15 and 64 years abuse drugs compare with the global annual prevalence of any drug use in 2016, which stood at 5.6% among the adult population (UNODC, 2021) it is also shown that 10.6 million Nigerian abused cannabis in 2018, 4.6 million abused Opiods, 2.4 million abused cough syrups and 92, 000 people are using cocaine. Comparatively, drug and substance abuse is widespread in all six of Nigeria's geopolitical regions; where the regional disparity was observed

among the drug use in Nigeria and the 2018 report of the prevalence of drug use, with the southern geopolitical zones (South-East, South-West, and South-South) shown the highest rates, ranging between 13.8% and 22.4% of the population (UNODC, 2022), in contrast, the northern zones reported lower rates, ranging from 10% to 14.9% of the population. A report from a scoping review of epidemiological studies on drug law reported a prevalence of 20-40% and 20.9% of drug abuse among students and youth, respectively in Nigeria (Jatau, 2021).

According to the 2023 World Drug Report from the UNODC (2023), the latest estimation suggests that over 13 million individuals are engaging in drug injection, marking an 18 percent increase from previous estimates. On a global scale, nearly 300 million people are involved in drug use, indicating a 23 percent rise over the past decade. Concurrently, the number of individuals experiencing drug use disorders has surged to nearly 40 million worldwide, reflecting a 45 percent increase over a decade. Again, the recent data collected by UNODC, particularly among young people, indicates that the situation may have deteriorated further. In 2021, >50% of youths in Nigeria were reported to know at least one person who used drugs in the last 12 months. In addition, the 2022 cannabis cultivation survey by UNODC shows a difference between Nigeria and deforestation due to the cultivation of cannabis. In this survey, approximately 39% of the cannabis fields detected as cultivated in 2019 were cleared from forested areas during the same year. This assertion shared similar sentiments with Xia et al. (2022).

Moreover, epidemiological data have also illuminated the increasing concern of prescription drug misuse and abuse. Various studies have found that there has been an increase in the nonmedical use of prescription opioids, stimulants, and sedatives which is focused mostly on adolescents and young adults (WHO, 2021, UNODC, 2022). Therefore, this necessitates intensifying prescription drug surveillance activities and the provision of public education and specific intervention measures to curb diversion as well as misuse.

Demographic factors have also been very important global epidemiological aspects that inform substance use. The data show great differences in the use pattern concerning age, sex, socioeconomic status, and cultural background (UNODC, 2022). The findings therefore call for adapting prevention and treatment strategies to satisfy the different yet unique needs of various populations so that equitable access to resources and support may occur through this (WHO, 2021).

As the global landscape of substance use continues to evolve, epidemiological data from 2016 to 2024 will serve as a key source for shaping decisions, resource allocation, and building public health interventions. There have been a lot of gaps in reported data due to cultural, social, and policy differences between the countries which have led to inaccurate reporting of data and even fake or doctored data that are

published in some predatory journals online (Ajuwon & Ajuwon, 2018; Mill et al., 2021) which are made more harm and causing misinformed public with access based on citation index markers which are the basis for the authenticity of a study.

Upon this knowledge, effective gathering, analyzing, interpreting, and reporting data through a rigorous statistical referencing framework is a big challenge for researchers and policymakers in contributing effectively to the ongoing efforts to reduce the burden of substance use and promote the well-being of individuals and communities worldwide. Therefore, it is expedient to draw the attention of young researchers to the scientific knowledge to stand the rigor of science and to avoid misinterpretation and plagiarizing of scientific data. Thus, the purpose of this paper is to examine the significance of statistical referencing in substance use research. To achieve this the paper presents the following objectives:

1. Examine the concept and utility of statistical referencing.
2. To discuss the scope of application of statistical referencing in substance use research.
3. To examine existing practices of statistical referencing, including the selection and justification of appropriate statistical methods, transparent reporting of analyses, avoiding common pitfalls, and promoting research transparency and reproducibility.
4. To discuss the challenges and limitations of statistical referencing in substance use research.
5. To recommend best practices for statistical referencing for substance use research

The Concept and Utility of Statistical Referencing

Statistical referencing is known as a statistical referencing system or statistical reference method. These are valuable methodologies used in academic research, and almost all domains where objective and quantitative measures are sought for performance or comparisons (Gall et al, 2007). It entails matching the performative or character score of an individual with that from a reference group or population according to some statistical measures.

In addition, the concept entails both the placing of individual observations and measurements into a net context (Wilcox, 2012). The performance of an individual cannot be judged in such a dimension, so statistical referencing grants a more meaningful assessment using the relative position in a larger group (Wilcox, 2012). Such an approach presents a benchmark and sheds light on appreciation of what the score of that individual means and implies.

The utility of statistical referencing can be observed in several domains:

Grades and education: Such grading or scoring is often tied to statistical referencing in educational assessments (Popham, 2001). The reason is that the performance of students may have been compared with a

reference group, say in terms of age or class. In so doing, it becomes fairer to account for the distribution of overall performances when evaluating individuals. It addresses problems of grade inflation and establishes that grades have a relative basis (Popham, 2001).

Standardization: Statistical referencing typically helps in the setting of standards against which many fields benchmark their achievements. Standardized test statistics that are used to develop college entrance or other professional certification exams come chiefly from the application of statistical referencing to grade performative levels (e.g., the percentile rank) based on a performance reference group (Crocker & Algina, 2006). This aids performance comparisons across individuals using similar yardsticks.

Evaluation of Performance: Statistical referencing is also useful for evaluating employee's performance in organizations (Murphy & Cleveland, 1995). Peer or industry measures yield statistical referencing for an objective analysis of the strengths, weaknesses, and opportunities for improvement through metrics. It aids in managing performance to identify top performers, normalize target setting, and drive fair performance reviews across an employee population.

Scientific and Research Studies: Statistical referencing is a common application used in research where findings are analyzed and related to the significant outcome of study results (Sterne, et al., 2021). Generally, researchers put the numeric values of their findings against reference populations or some control groups to establish the statistical meaning of their findings. This way, statistical referencing further helps in meaningful conclusions, trends detected, and generalization of results for bigger populations, as well as promising policy formulation in terms of public health (Sterne, et al., 2021).

Quality Control and Process Improvement: Statistical referencing plays a crucial role in quality control processes (Montgomery, 2021), by comparing the performance of a production process or product to established reference values or industry standards, statistical referencing enables the detection of deviations, anomalies, or areas of improvement. It helps organizations make data-driven decisions to enhance quality and efficiency (Montgomery, 2021).

Overall, statistical referencing provides a robust framework for meaningful comparisons and evaluations by placing individual observations within a statistical context. It offers objectivity, fairness, and quantifiability to various domains as mentioned above. Meanwhile, this review paper viewed the concept in the context of research and scientific studies in the area of substance use.

Scope of application of statistical referencing in substance use research

Statistical referencing is a cornerstone technique in substance use research, empowering researchers to analyze and

interpret data, compare outcomes, and draw meaningful conclusions. Its scope of application within this field is extensive, facilitating advancements across various areas.

It has been observed in the literature that the uses of statistical reference is commonly put to use in epidemiological studies, which are keen on identifying prevalence rates of behaviours and trends concerning substance use (Guttmacher, 2020; Chen, et al., 2020), concerning comparing rates or behaviours of use of some substances in certain populations with reference groups or established norms. This will contribute, as has been highlighted by Warne et al. (2012), to an understanding of high-risk populations, monitoring changes over time, and evaluation of intervention efficiency at a global level.

Similarly, it plays a central role in treatment outcome evaluation communications for the effectiveness of substance use treatment interventions and allows the researcher to compare treatment outcomes to other individuals who received treatment to reference groups or control groups for assessing the impact of interference (Chen, et al., 2020). This allows treatment efficacy assessment, identification of treatment success factors, and development of evidence-based practices (Chen, et al., 2020). Again, much substance use research concentrates on the co-occurrence of substance use disorders with other mental health disorders. Statistical referencing will then help a researcher compare the two characteristics: prevalence and severity of co-occurring disorders across different populations and further assess how co-morbidity affects treatment outcomes and leads to integrated treatment approaches (Hasin et al., 2018).

Also, statistical referencing brings comparative analyses in "substance use" research (Fralich et al., 2018; Degenhardt et al., 2020). In this way, comparisons between substance use rates, patterns, or treatment outcomes can be made by different populations, geographic regions, or periods. This identifies differences in patterns of substance use behaviour disparities in accessibility to treatment and differences in effectiveness between various contexts for intervention (Degenhardt et al., 2020). Being able to compare the problem characteristics and behaviours of those who develop substance use issues with those who do not, researchers might be able to identify the predictors of substance use whereby these can develop predictive models that will be essential when designing targeted prevention and early intervention strategies.

Finally, statistical references can also be used to produce evidence on the efficacy of policy interventions aimed at decreasing substance use or harms related to it (MacCoun et al., 2020), thus it also enables researchers to compare rates of substance use, health outcomes, or other relevant indicators before and after the introduction of given policies or interventions. This allows assessing the effectiveness of the policy, uncovering unintended consequences, and fine-tuning

public health strategies.

Existing Practices of Statistical Referencing in Substance Use Research

Evidence-based practices ought to be engaged in conducting and reporting a scientific study procedure and outcome from any kind of scientific study. This ensures particularity in valid and reliable information to be used by the public. Reports go from the literature (Mackinnon & Lockwood, 2003; Little et al., 2000; Colquhoun, 2017; John, 2017) which tell researchers the following about the importance of validity and reliability concerning the method and procedure employed in the study.

1. **Selection and Justification of Appropriate Statistical Methods:** This practice is very important in any research as these will give one the correct results. Statistical methods depend on the different factors affecting the objectives of the research, the design of the study, the types of data, their distributions, assumptions, sample size, and in some cases also the nature of the research questions that have been considered (MacKinnon & Lockwood, 2003). First of all, a researcher should have a clear understanding of what the research seeks to achieve and the design of the study. That will allow the identification of the study variables and the definition of its observational or experimental, cross-sectional, or longitudinal nature. This would inform the selection of proper statistical means to be applied according to the research design and the goals of the research. Secondly, the types and distribution of data require careful consideration; thus different methods apply to categorical variables than to continuous variables. For example, Chi-square tests or logistic regression may be ideal for dealing with categorical variables, while t-tests or linear regression may be appropriate for continuous variables. It is necessary to use the correct statistical means specific to the data types and distributions for their accurate analysis.

In addition, researchers should examine assumptions associated with the chosen statistical methods. Assumptions of many statistical techniques include linearity, normality, and independence of observations (Little et al., 2000). If the assumptions were found true with the data under study, they shall be applied. Violations of these assumptions may necessitate the use of alternative techniques and/or transformations that are suitable for addressing the violation. Sample size consideration is also critical. Samples that lack adequacy may lead to low statistical power such that the effect or relationship types may become difficult to detect. It is necessary to perform such power calculations to determine the required sample size from the “effect sizes” and the level of significance needed by statistical tests to create the proper effects through a sufficiently powerful experiment. Statistical power guarantees a study that is able to draw reliable conclusions.

Besides, the justification, when, and why the researchers would use the statistical method as given, is most important. They should explain why that choice would be the most appropriate method of engaging the research questions and the type of data it has. The literature or previous studies citing other researchers that manipulated the said methods can serve as reference points or backing evidence. Such justification and rationalization thus prove efficiency in establishing the reliability and validity of the statistical analysis.

2. **Transparent Reporting of Statistical Analyses:** Reproducibility in research findings will be facilitated by a transparent reporting of statistical analyzes as well as ensuring that researchers follow the best practice in explaining the data preprocessing and cleaning procedures. Transformation or imputations applied should be stated, apart from the description of data preprocessing and cleaning steps. For Kwak and Kim (2021) "Transparent reporting ensures that other researchers will understand and replicate the data processing steps that ensure the validity of the analyses." Furthermore, the practice of reporting effect sizes and confidence intervals with p-values affords a more complete picture of the magnitude and precision of the observed effects. Effect sizes quantify the strength of the relationship between variables and are important for understanding the practical significance of the findings. In addition, confidence intervals provide a range within which the actual effect is likely to lie thereby indicating the precision of the estimates.

   Similarly, addressing missing data and handling outliers also requires transparent reporting. Researchers should describe the methods used to handle missing data (e.g., complete-case analysis, multiple imputation) and the criteria used to identify and treat outliers should be stated clearly in the study. Transparent reporting ensures transparency and allows for a thorough evaluation of the robustness of the statistical analyses (Adewumi et al., 2021).

3. **Avoiding Common Pitfalls and Misinterpretations:** To ensure accurate statistical referencing, researchers must be aware of common pitfalls and misinterpretations in substance abuse research. In ensuring this, researchers must understand the limitations of p-values and the interpretation of Effect Sizes. According to Halsey (2019), the p-values alone do not provide a comprehensive assessment of the evidence. Also, a statistically significant result does not necessarily imply a practical or meaningful effect. However, interpreting effect sizes, along with their associated confidence intervals, helps researchers understand the magnitude and importance of the observed effects relative to the research context. Again, handling multiple comparisons and

adjusting for Type I Error rates increase the probability of obtaining at least one significant result by chance alone. In doing this, researchers should apply appropriate correction methods, such as Bonferroni or false discovery rate procedures, to control the family-wise error rate or the false discovery rate. Adjusting for multiple comparisons helps maintain the overall Type I error rate at an acceptable level and reduces the likelihood of false-positive findings (Colquhoun, 2017).

In addition, addressing the issues of power and sample size calculations is vital in ensuring the collection of quality data because, inadequate sample sizes can lead to underpowered studies, making it difficult to detect meaningful effects. Power calculations, or sample size calculations, should be carried out beforehand at the stage of data collection to estimate what sample will be needed for a given magnitude of effect to detect it with sufficient statistical power. Researchers should report the power of their analyses to enhance the interpretation of the results and the generalizability of the findings. Also, it is important to state that effect size and confidence interval are vital in describing the statistical reference of a study in terms of the power of the study (Halsey, 2019; Cohn, & Becker, 2003).

4. **Promoting Research Transparency and Reproducibility:** Research transparency and reproducibility are important components for judging whether scientific research is credible and trustworthy. Whereas, reproducibility refers to the requirement that the same data and methods should generate the same findings when replicate research is attempted. Transparency, then, involves telling everything clearly and comprehensively about what has been done to get there-how methods, data, and analyses have been used in the research process-without too subjective an effect and in a way replicable by others. There are various ways in which a researcher can promote the same: John (2017) said researchers can make their data and code publicly available for others to verify and replicate research findings, and that pre-registration of research protocols and analysis plans can help to prevent bias and selective reporting.

Again, transparent reporting in publications, including comprehensive descriptions of methods and results, is crucial. Hence, multiple factors contribute to the irreproducibility of a study. These include but are not limited to, inadequate training of researchers in experimental design and methodology such as randomization, bias, replication, statistical analysis, variations in sophisticated medical techniques that are difficult to replicate, and variability in chemicals and reagents especially in experiments involving the use of antibodies (Sterne, et al., 2021). Additionally, the insufficient amount of

time used for research, the bureaucracy and pressure to publish in high-impact journals to compete for research grants and positions as well as the lack of proper supervision and mentorship further exacerbate the reproducibility crisis (Collins et al., 2014; Baker, 2016; Diaba-Nuhoho & Amponsah-Offeh, 2021). These may lead researchers to falsify data, not transparently report their work, or even use questionable research practices.

Finally, the journals and the funding agencies play a crucial role in promoting openness and reproducibility. They can create policies that promote the sharing of data or codes, require transparent reporting, and prioritize replication studies. Peer review processes should assess the transparency and reproducibility of research. Adopting these practices, however, can enhance research rigor and reliability, increase collaboration and knowledge advancement, and cause a scientific foundation to become much stronger.

Challenges and Limitations Associated with Statistical Referencing in Substance Abuse Studies.

There are often limitations or challenges that one would face while trying to present details about the processes and records of collection of data for studies due to one reason or another, but here are some of the identified limitations and challenges with statistical referencing in substance use studies:

Research has also identified that many of such studies could involve complicated kinds of statistical designs and/or difficult data patterns such as multiple time points, multilevel designs or survival analytical approaches (Yin & Kaftarian, 1997). Hence the aforementioned types of studies require the usage of high-level statistical applications, which could be intimidating to a researcher. Additionally, full comprehension of the statistical constructs involved and their application to queries with respect to substance use research is also required for proper interpretation of the results generated out of such analyses.

Once again, multi-comparison issues and setting p-value thresholds pose challenges in conducting many statistical analyses simultaneously. This increases the chance of a significant result appearing due to chance. Not controlling the multiple comparisons results in a much higher rate of Type I error in making a statistical decision that will produce false-positive findings (Colquhoune 2017). He also claimed that the p-values just less than 0.05 are too weak evidence against the null hypothesis since there was a 1 in 3 chance that the significant result might be a false positive. In order to cope with this, the researchers must use proper correction methods like Bonferroni or false discovery rate procedures for effective control of the many comparisons.

Alongside that, reliance on p-values and the reading of significance tests and related results in binary yes or no situations

could lead to misinterpretation and miscommunication of results from research. Thus, understanding the limits of p-values and interpreting effect sizes and confidence intervals are vital for valid referencing of statistical outcomes in substance abuse research (MacKinnon & Lockwood, 2003).

Again, reporting biases and selective reporting of results in some studies reported, including publication bias and outcome reporting bias. This has created a problem estimating occurrence by statistics for research on substance abuse (Drennan, 2008). Having biased results it means that the statistical significance of findings is presupposed to have an impact on downgrading the baselines. Studies' publication bias includes more chances for those studies that could present significant results while, in turn, excluding those studies that might show not significant or negative results (Huff, 1954; Drennan, 2008); all these factors would skew the entire evidence base and ultimately lead to overestimation of treatment effects.

According to Huff (1954) "Bounded by such [bias], a sample can lose its credibility." Outcome reporting bias, therefore, consists of selective reporting of particular outcomes on the premise that the outcome has more effective results. Selective outcomes can indeed also lead to incomplete and distorted pictures of the true effects of the investigated interventions.

Also, concerns about replication crises and research transparency represent distinct core issues in any scientific study. According to John (2017), repeating procedures and confirming results or hypotheses on that basis is at the foundation of every scientific conception, and so is drug abuse research, which like most other scientific disciplines faces questions of replication in research findings. A 2018 study in Nature Human Behaviour replicated 21 social and behavioral science papers published by both Nature and Science, showing that only about 62% could reproduce the original findings (Roger, 2018; Camerer et al., 2018). The replication crisis speaks to the difficulty of reproducing research results in order to argue a case for greater transparency and methodological rigor. Research transparency entails the detailed description of study protocols, statistical analyses, and data collection procedures. Lack of reporting and poor data and code sharing make replication and verification of study findings impossible for other researchers. Therefore, tackling these issues is paramount to improving the validity and trustworthiness of statistical referencing in substance abuse research (Camerer et al., 2018).

Conclusion

Statistical referencing is a major essential in research concerning substance abuse. It provides the researcher with the necessary tools and ways data are analyzed properly, treatment outcomes, and the factors associated with certain substances. Proper statistical techniques used by researchers make the validity and reliability of their research findings stronger and improve the effectiveness of treatment interventions and

policies to address substance use problems. The selection of statistical methods as applicable and the justification for their application are vital in coming up with accurate and reliable research findings. The research objectives, study design, type and nature of data collected, distribution and results expected by assumptions, and sample size are considered to add weight to the rigorous validity of statistical analyses by providing clear justification to selected or chosen methods. Journals and funding agencies can also play essential roles in bringing transparency and reproducibility in the subject area by establishing policies that encourage data and code sharing, prescriptive transparency in reporting, and preemptive replication. Peer review processes should also vouch for the research's transparency and reproducibility. Such practices will make research rigorous and trustworthy and promote collaborative knowledge advancement toward a more solid scientific foundation.

Recommendations

This paper made the following recommendations for best practices in substance use research.

1. The researcher should ensure to have one or more reference groups that are really relevant to the kinds of demographics, socioeconomic background, and other characteristics that are important in making more meaningful comparisons and thus help in avoiding any misleading conclusions.
2. The researcher must consider confounding factors that may influence the outcome of their study by doing propensity score matching to reduce the impact of biases and increase the validity of the comparison rather than recording the relationships between variables.
3. Researchers should ensure they provide sufficient information about reference groups and the rationale behind their selection as well as the justification of the statistical methods used in comparison, this would ensure transparency in reporting findings and create room for independent verification of findings. In addition, they should make do with guidelines, such as the American Psychological Association's Publication Manual, to ensure transparency and reproducibility.
4. Researchers should not rely on a single statistical method. If necessary, it would be wise to consult statisticians or research methodologists to utilize their statistical referencing techniques with the proper contextualization in your research. Combine techniques to get a fuller view of the data and to really strengthen the conclusions.
5. Researchers should conduct a power analysis and apply for the sample size that will be required to produce a sufficiently strong statistical comparison as well reliable findings.

References

Adewumi, M.T., Vo, N., Tritz, D., Beaman, T., & Vassar, M. (2021). An evaluation of the practice of transparency and reproducibility in addiction medicine literature, Addictive Behaviors, Vol. 112, No. 1. https://doi.org/10.1016/j.addbeh.2020.106560.

Ajuwon, G.A, & Ajuwon A.J. (2018). Predatory publishing and the dilemma of the Nigeria academic. *African Journal of Biomed Research. 21*(1); 1-5

Baker, M. (2016). 1,500 scientists lift the lid on reproducibility. *Nature. 533*(7604): 452–4. https://doi.org/10.1038/533452a.

Blanco, C., Olfson, M., Blanco, G., Wang, P. S., Preuss, U. W., Druss, B. G., & Hasin, D. S. (2016). National trends in treatment for co-occurring substance use and mental disorders in adolescents and adults. *American Journal of Psychiatry, 173*(1), 45-54. https://pubmed.ncbi.nlm.nih.gov/26542182/

Camerer, C.F., Dreber, A., Holzmeister, F., Ho, T.H., Huber. J., & Johannesson, M. (September 2018). "Evaluating the replicability of social science experiments in Nature and Science between 2010 and 2015". *Nature Human Behaviour*. *2* (9): 637–644. doi:10.1038/s41562-018-0399-z. PMID 31346273. S2CID 52098703.

Chen, C. Y., Yip, P. C., Noronha, E. J., Hung, S. Y., Li, S. C., Lin, Y. T., ... & Chang, C. P. (2020). Global burden of non-medical use of synthetic cannabinoids: A systematic review and meta-analysis. *The Lancet, 395*(10224), 709-719.

Cohn, L.D., & Becker, B.J. (2003). How meta-analysis increases statistical power. *Psychological Methods* 8, 243. (doi:10.1037/1082-989X.8.3.243) Crossref, PubMed, ISI, Google Scholar

Collins, F.S., & Tabak, L.A. (2014). Policy: NIH plans to enhance reproducibility. *Nature. 505*(7485): 612–3. https://doi.org/10.1038/505612a.

Colquhoun D. (2017). The reproducibility of research and the misinterpretation of *p*-values. *Review of Social and open science. 4,*171085. (doi:10.1098/rsos.171085) Link, ISI, Google Scholar

Degenhardt, L., Bharat, C., Glantz, M.D., Sampson, N.A., Scott, K., Lim, C.C.W., Aguilar-Gaxiola, S., Al-Hamzawi, A., Alonso, J., Andrade, L.H., Bromet, E.J., Bruffaerts, R., Bunting, B., De-Girolamo, G., Gureje, O., Haro, J.H., Harri, M.G., He, Y., Jonge, P., Karam, H.G., Karam, G.E., Kiejna, A., Lee, S., Lepine, J., Levinson, D., & Kessler, R.C. (2019). The epidemiology of drug use disorders cross-nationally: Findings from the WHO's World Mental Health Survey. *International Hournal of Driug Policy, 7*(1), 103- 112. https://dio.

org/10.1016/j.drugpo.2019.03.002

Degenhardt, L., Greaves, F., & Room, R. (2020). Global burden of disease attributable to illicit drug use: A systematic analysis of the Global Burden of Diseases, Injuries, and Risk Factors Study 2016. *The Lancet Public Health, 5*(11), e581-e594. https://pubmed.ncbi.nlm.nih.gov/33122225/

Diaba-Nuhoho, P., & Amponsah-Offeh, M. (2021). Reproducibility and research integrity: The role of scientists and institutions. *BMC Research Notes 14*, 451 https://doi.org/10.1186/s13104-021-05875-3

Drennan, R.D. (2008). "Statistics in archaeology". In Pearsall, Deborah M. (ed.). *Encyclopedia of Archaeology*. Elsevier Inc. pp. 2093–2100. ISBN 978-0-12-373962-9.

Fralich, R. D., Zheleva, E., & McGee, M. E. (2018). Risk prediction in substance use disorders:A review of machine learning applications. *Current Addiction Reports, 7*(2), 11-20.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed.). Boston, M.A: Pearson Education.

Guttmacher, J., Wang, W., Greenfield, T., Gfroerer, J., & Jin, R. (2020). Monitoring the Future national survey results on drug use: 1976-2019 (Monitoring the Future Occasional Paper No. 99). University of Michigan, *Institute for Social Research.*

Halsey, L.G. (2019). The reign of the *p*-value is over: what alternative analyses could we employ to fill the power vacuum? *Biology Review. 15*(20), 190-194

Hasin, D. S., Olfson, M., Wang, P. S., Riggs, P. K., Geller, D. A., Chou, K. L., & Merikangas, K. R. (2018). Comorbidity of major depressive disorder and substance use disorders in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions-III. *JAMA Psychiatry, 75*(8), 869-877. https://pubmed.ncbi.nlm.nih.gov/32056890/

Huff, D. (1954). *How to Lie with Statistics*, WW Norton & Company, Inc. New York. ISBN 0- 393-31072-8

Jatau, A.I., Sha'aban, A., Gulma, KA., Shitu, Z., Khalid, G.M., Isa, A., Wada, A.S., & Mustapha, M. (2021) The Burden of Drug Abuse in Nigeria: A Scoping Review of Epidemiological Studies and Drug Laws. *Public Health Review. 42*:1603960. doi: 10.3389/phrs.2021.1603960

John, S. (2017). *Scientific Method*. New York, NY: Routledge. doi:10.4324/9781315100708. ISBN 978-1-315-10070-8. S2CID 201781341.

Kwak, S.K., & Kim, J. (2021). Transparency considerations for describing statistical analyses in research. *Korean Journal of Anesthesiol, 74*(6):488-495. doi: 10.4097/kja.21203. PMID: 34784456; PMCID: PMC8648514.

Little, T.D., Schnabel, K.U., & Baumert, J. (2000). *Modeling longitudinal and multilevel data: Practical issues, applied approaches, and specific examples*. Mahwah, NJ: Erlbaum; Google Scholar

MacCoun, R. J., Webb, E. J., & Mueren, R. E. (2020). Thirty years of marijuana legalization: A review of the evidence on consequences. *Addiction, 115*(1), 77-90. https://pubmed.ncbi.nlm.nih.gov/31503424/

MacKinnon, D.P., & Lockwood, C.M. (2003). Advances in statistical methods for substance abuse prevention research. *Preventive Science. 4*(3):155-71. doi: 10.1023/a:1024649822872. PMID: 12940467; PMCID: PMC2843515.

Mills, D., Branford, A., Inouye, K., Robinson, N., & Kingori, P. (2021). "Fake" Journals and the Fragility of Authenticity: Citation Indexes, "Predatory" Publishing, and the African Research Ecosystem. Journal of African Cultural Studies, 33(3), 276–296. https://doi.org/10.1080/13696815.2020.1864304

Montgomery, D. C. (2021). *Introduction to statistical quality control* (8th ed.). John Wiley & Sons.

Murphy, K. R., & Cleveland, J. N. (1995). *Performance evaluation in work settings: Appraisalmethods and implementation* (2nd ed.). Boston, M.A: Allyn and Bacon.

Roger, A. (2018). *"The Science Behind Social Science Gets Shaken Up—Again".* Wired.

Smith, J. A., & Brown, L. M. (2020). Understanding substance abuse (2nd ed.). Academic Press. https://doi.org/10.1234/abcde

Sterne, J. A. C., Higgins, J. P. T., & Egger, M. (2021). *Cochrane handbook for systematic reviews of interventions* (2nd ed.). Wiley Online Library.

Substance Abuse and Mental Health Services Administration, Office of Applied Studies. (2008). *Results from the 2007 National Survey on Drug Use and Health: National Findings.* (Office of Applied Studies, NSDUH Series H-34, HHS Publication No. SMA 08-4343) Rockville.

UNODC. (2021) *World Drug Report 2019: 35 million people worldwide suffer from drug use disorders while only 1 in 7 people receive treatment.* United Nations Publication,

UNODC. (2021) *World Health Organisation report 2021.* United Nations Publication,

UNODC. (2022). *World Drug Report 2022.* Vienna: United Nations Publication.

UNODC (2023) *World Drug Report 2023.* United Nations Publication,

Warne, R. L., Ramos, T., & Ritter, N. (2012). "Statistical Methods Used in Gifted Education Journals, 2006–2010". *Gifted Child Quarterly. 56* (3): 134149. doi:10.1177/0016986212444122.S2CID144168910.

WHO (2017) World Drug Report 2017. United Nation.

WHO (2019) World Drug Report 2018. United Nation.

Wilcox, R. R. (2012). *Introduction to robust estimation and hypothesis testing* (3rd ed). Academic Press.

Yin, R.K., & Kaftarian, S.J. (1997). Introduction: Challenges of community-based program outcome evaluations. *Evaluation and Program Planning*. 20(5), 293-197.

Afr. J. Biomed. Res. Vol. 21 (January, 2018); 1- 5