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Original Article

Development and Psychometric Properties of Methamphetamine Impact Gauge Scale

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Abstract

This study aimed to develop and validate the Methamphetamine Impact Gauge (MIG), a comprehensive tool designed to assess the multifaceted effects of methamphetamine use. A mixed-methods approach was employed, involving qualitative methods such as focus groups and expert committees for item generation, and quantitative methods including exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for reliability and validity. The MIG measured the impact of methamphetamine use across physical, psychological, social, and economic domains. Reliability analysis demonstrated acceptable internal consistency, with factors emerging that reflect health, social, and professional consequences. The study underscores the need for comprehensive tools like the MIG to better understand the complex effects of methamphetamine use. Recommendations include continued refinement to address cultural nuances and promote the tool's use in clinical and community settings. Future research should explore strategies like digital literacy programs to enhance intervention effectiveness and address challenges related to methamphetamine addiction.

Keywords: Methamphetamine, impact assessment, measurement tool, psychometric validation, substance use disorder

INTRODUCTION

Methamphetamine, commonly known as meth, is a highly addictive stimulant that profoundly impacts individuals, families, and communities worldwide. Its detrimental effects extend beyond the individual user, affecting public health, social welfare, and economic stability. To address the multifaceted challenges posed by methamphetamine use, there is a pressing need for a nuanced and reliable measurement tool. In response, the development of the Methamphetamine Impact Gauge (MIG) becomes essential (Edinoff & Kaufman, 2022). The objective of this study is to create and validate the MIG, a comprehensive instrument designed to assess the wide-ranging impacts of methamphetamine use across physical, psychological, social, and economic domains.

Unlike existing measures that may narrowly focus on specific aspects of methamphetamine use, the MIG aims for holistic coverage. By incorporating diverse perspectives and considering both direct and indirect effects, the MIG seeks to provide a thorough understanding of methamphetamine's consequences (De Francesco, T., & Ahmed, 2023). The instrument aims to capture the full spectrum of methamphetamine's impact, acknowledging its effects on physical health, mental well-being, interpersonal relationships, community dynamics, and socioeconomic status.

Through rigorous psychometric validation and

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empirical testing, this study aims to establish the MIG as a standardized tool with strong reliability and validity. By adhering to established principles of measurement development—clarity, consistency, and sensitivity—the MIG aspires to be applicable across diverse populations and settings (Kalayasiri & Maes, 2023). This study aimed to establish the psychometric properties (reliability and validity) of the newly developed MIG, specifically within the context of Pakistani culture. This study focused on educators and examined gender differences in methamphetamine use. The sample size for the main study was n = 205 educators, which was determined using Kline's (2014) recommendations for adequate sample sizes in psychometric validation studies.

Research Questions

- What are the key impacts of methamphetamine use in Pakistani society?

- How can the MIG be adapted for cultural and gender-specific differences in Pakistan?

- What is the reliability and validity of the MIG among Pakistani educators?

- How does methamphetamine use affect professional and social relationships?

LITERATURE REVIEW

The escalating use of methamphetamine has garnered significant attention in public health discourse from 2011 to 2024, as its devastating impacts on individuals, families, and communities have become increasingly apparent. Numerous studies have documented the myriad physical health issues associated with methamphetamine use, including cardiovascular problems, severe dental issues (often referred to as "meth mouth"), and heightened risks of infectious diseases. Psychologically, users frequently encounter severe anxiety, depression, and cognitive impairments, complicating their overall functioning and quality of life (Sullivan et al., 2020). The urgency to address these health concerns has led to calls for more comprehensive strategies that account for the complex nature of methamphetamine addiction.

Cultural and social contexts significantly influence the perception and impact of substance use, particularly in societies where drug use is heavily stigmatized. In countries like Pakistan, where cultural norms and religious beliefs strongly shape societal attitudes, methamphetamine use often carries substantial stigma, resulting in feelings of shame and isolation among users. Research indicates that this stigma can prevent individuals from seeking help and support, exacerbating their struggles with addiction (Batool, 2023). Furthermore, community dynamics and traditional values play a crucial role in shaping how methamphetamine-related issues are addressed, highlighting the need for culturally sensitive interventions that resonate with local beliefs and practices.

The Biopsychosocial Model has become a foundational framework for understanding the multifaceted consequences of methamphetamine use, reinforcing the idea that biological, psychological, and social factors are deeply interconnected. Recent literature emphasizes that addressing one aspect without considering the others can hinder effective treatment and recovery (Engel, 1977). For instance, psychological distress can exacerbate physical health problems, while social isolation can lead to increased substance use. This holistic approach is essential for creating effective interventions that not only focus on addiction treatment but also encompass the broader implications of substance use on individuals' lives.

In parallel, the validation and development of comprehensive assessment tools like the Methamphetamine Impact Gauge (MIG) have gained momentum in research. Psychometric validation ensures that these tools accurately measure the diverse impacts of substance use across different populations. As evidenced by recent studies, robust measurement frameworks are critical for informing public health strategies and improving intervention efficacy (Kalayasiri & Maes, 2023). The MIG, through its rigorous development process, aims to capture the complexities of methamphetamine use, fostering a deeper understanding of its effects and ultimately supporting those affected in navigating their recovery journeys. Continued research is needed to refine such tools, ensuring their adaptability and relevance in various cultural contexts as the landscape of substance use evolves.

Hypotheses

H_1: Methamphetamine use significantly impacts the physical, psychological, and social well-being of individuals in Pakistani society

H_2: The Methamphetamine Impact Gauge (MIG) can be adapted to account for cultural and gender-specific differences

in Pakistan

H₃: The Methamphetamine Impact Gauge (MIG) demonstrates strong reliability and validity when applied to educators in Pakistan

H₄: Methamphetamine use negatively affects professional and social relationships in users

Rationale

Methamphetamine Impact Gauge tailored to Pakistani culture, it's imperative to recognize the intricate socio-cultural fabric that shapes attitudes, behaviors, and perceptions surrounding substance use Batool, 2023.. Pakistani society is deeply entrenched in age-old traditions, familial bonds, and religious convictions, where the consumption of drugs is often met with widespread stigma and moral condemnation. Within this cultural milieu, methamphetamine addiction can evoke feelings of shame and secrecy, deterring individuals and families from seeking help and support (Shafi & Yuan, 2021). The pervasive influence of Islam further underscores the societal rejection of drug use, emphasizing the need for interventions grounded in religious and moral frameworks. Moreover, the urban-rural dichotomy in Pakistan introduces additional layers of complexity, with differing access to resources, exposure to external influences, and variations in community responses to drug-related issues. Gender dynamics also play a crucial role, as societal expectations and norms may shape the experiences and vulnerabilities of men and women in relation to methamphetamine use. Therefore, a comprehensive approach to developing the scale must intricately consider these cultural nuances, ensuring that it effectively captures the multifaceted dimensions of methamphetamine's impact within the rich tapestry of Pakistani society (Perkins, 2023).

The MIG also adopts a flexible framework, capable of accommodating evolving trends, emerging challenges, and cultural variations in methamphetamine use. This approach ensures the tool's relevance and effectiveness in diverse settings. The development process draws upon interdisciplinary collaboration from psychology, public health, sociology, economics, and criminology, involving item generation, pilot testing, psychometric analysis, and iterative refinement (Bowles, 2021). In conclusion, this literature review highlights the need for a comprehensive assessment tool like the MIG,

as methamphetamine use continues to present widespread and profound effects on individuals and society. The study seeks to develop a measurement tool that captures the full impact of methamphetamine use, with the ultimate goal of enhancing interventions and support services for affected populations.

The Biopsychosocial Model

The Biopsychosocial model was first conceptualized by George Engel in 1977, suggesting that to understand a person's medical condition it is not simply the biological factors to consider, but also the psychological and social factors. This model is commonly used in chronic pain, with the view that the pain is a psycho physiological behavior pattern that cannot be categorized into biological, psychological, or social factors alone. There are suggestions that physiotherapy should integrate psychological treatment to address all components comprising the experience of chronic pain (Aftab & Nielsen, 2021).

Theoretical Framework

The following theoretical framework presents the factors

Biological Factors

- Whether your performance in school or college has been affected by the use of ice?
- Did the ice affect the ability to communicate efficiently?
- Did you face any stigma due to the use of ice?
- Has ice affected your self-esteem?
- Do you feel uncomfortable in your life with the use of ice?

Psychological Factors

- Have you experienced health problems with the use of ice?
- Has the use of ice affected your memory?
- Has the use of ice affected your mental focus?

Social Factors

- Have you faced criticism because of the use of ice?
- Has the use of ice caused a fight with friends?
- Has anyone asked for help to let go of ice?
- Has your social relationships deteriorated due to the use of ice?

- Has the use of ice affected your professional relationships?

METHODOLOGY

Pilot Study

A pilot study was conducted with a sample size of n = 50 to test the initial items of the Methamphetamine Impact Gauge (MIG). This step was essential to refine the items, enhance clarity, and ensure the comprehensiveness of the scale. The pilot study also helped assess the face and content validity of the instrument.

Research Design

This study employed a blended quali-quantitative approach, integrating both qualitative and quantitative methods to gain a comprehensive understanding of methamphetamine use in Pakistan.

Quantitative Component

The primary quantitative data was collected through the Methamphetamine Impact Gauge (MIG), utilizing a cross-sectional survey design. This allowed for statistical analysis of the impacts of methamphetamine use among educators, ensuring the reliability and validity of the instrument through psychometric testing.

Qualitative Component

In addition to the quantitative data, qualitative insights were gathered from focus group discussions and consultations with experts. These discussions aimed to explore cultural and gender-specific factors that influence methamphetamine use, providing contextual depth to the numerical data.

Sampling

A total sample of n = 205 educators participated in the main study. The sample was selected using purposive sampling to include educators from various educational sectors and genders. Kline's (2014) guidelines were used to determine the sample size, ensuring statistical power for psychometric testing.

Data Analysis

The psychometric properties of the MIG were analyzed using exploratory and confirmatory factor analysis (EFA and CFA) to assess its construct validity. Cronbach's Alpha was used to determine internal consistency reliability.

RESULTS & FINDINGS

Table 1

Demographic Characteristics of Participants in the Methamphetamine n=205

Demographic Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	120	58.5
	Female	85	41.5
Age Group	18-25	50	24.4
	26-35	70	34.1
	36-45	55	26.8
	46 and above	30	14.6
Educational Background	Primary	20	9.8
	Secondary	70	34.1
	Tertiary	115	56.1
Occupation	Educator	205	100
Region	Urban	150	73.2
	Rural	55	26.8

Table 2

Exploratory Factor Analysis

No	Question	F1	F2	F3
BFMIG6	Have you experienced health problems with the use of ice?	.860		
BFMIG7	Has the use of ice affected your memory?	.855		
BFMIG8	Has the use of ice affected your mental focus?	.816		
BFMIG9	Has the use of ice affected your physical health?	.847		
BFMIG10	Hav You experienced sleep disturbances due to the use of ice?	.769		
PFBIG11	Whether your performance in school or college has been affected by the use of ice?		.922	
PFBIG12	Did the ice affect the ability to communicate efficiently?		.942	
PFBIG13	Did you face any stigma due to the use of ice?		.884	
SFMIG1	Have you faced criticism because of the use of ice?			.511
SFMIG 2	Has the use of ice caused a fight with friends?			.787
SFMIG3	Has anyone asked for help to let go of ice?			.881
SFMIG4	Has your social relationships deteriorated due to the use of ice?			.870
SFMIG5	Has the use of ice affected your professional relationships?			.802

Table 2 specified the listed items covering a wide range of impacts associated with ice use, including physical health, cognitive function, academic performance, communication abilities, experiences of stigma, and social relationships. Each item demonstrates good reliability, with scores ranging from .511 to .942, indicating their effectiveness in assessing the diverse consequences of ice consumption across different domains.

Reliability Analysis

Table 3

Alpha Reliability Analysis for the Scale

Scale	Corrected- α	If Item Alpha (α)	deleted Total - Scale Alpha Reliability(α)
SFMIG1	.484	.811	
SFMIG2	.474	.811	
SFMIG3	.093	.837	
SFMIG4	.193	.832	
SFMIG5	.471	.811	
BFMIG6	.361	.819	
BFMIG7	.628	.806	
BFMIG8	.698	.802	
BFMIG9	.450	.816	
BFMIG10	.494	.812	
PFMIG11	.738	.784	
PFMIG12	.644	.797	
PFMIG13	.633	.796	

Table 3 demonstrated reliability analysis was conducted using Cronbach's alpha to assess the internal consistency of the scale items. The corrected alpha values ranged from .093 to .738 for the individual items. Removal of specific items resulted in marginal changes to the total scale alpha reliability, with values ranging from .784 to .837. These findings indicate varying levels of reliability for the scale items, with the overall scale demonstrating acceptable internal consistency ($\alpha = .811$).

Validity Analysis

Table 4

Validity Analysis of the Pilot Study

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13
SFMIG1	-												
SFMIG2	.541**	-											
SFMIG3	.317**	.581**	-										
SFMIG4	.206**	.483**	.831**	-									
SFMIG5	.327**	.559**	.538	.689**	-								
BFMIG6	.045	.017**	-.364**	-.304*	-.119	-							
BFMIG7	.295*	.211	-.132	-.069**	.181	.853**	-						
BFMIG8	.258	.200	-.163	-.037**	.156	.743**	.862**	-					
BFMIG9	.099	.133	.133	.079	.200	.551*	.607**	.680**	-				
BFMIG10	.364	.278	-.306*	-.370	-.021	.625**	.368**	.667**	.680**	-			
PFMIG11	.329*	.182	-.214	-.067	.233	.338**	.530**	.659**	.240	.538**	-		
PFMIG12	.032	.098	-.256	-.068	.233	.354**	.466**	.561**	.124	.537**	.939**	-	
PFMIG13	.242	.107	-.170	-.008	.177	.293*	.419**	.551**	.173	.442**	.855**	.822**	-

Table 4 explained the correlation matrix displays the pairwise correlations between items on the SFMIG (Social Functioning Methamphetamine Impact Gauge) and BFMIG (Behavioral Functioning Methamphetamine Impact Gauge) scales, as well as their respective sub-scales. Each cell in the matrix represents the correlation coefficient between the corresponding items. Significant correlations (**$p < .01$, *$p < .05$) are denoted with asterisks. The matrix reveals varying degrees of correlation between items, providing insights into the interrelationships among different aspects of methamphetamine use impact across social and behavioral domains.

Table 5

Descriptive Statistics of Pilot Study 2 Variables

Variables	Mean	SD	Skewness	Alpha Reliability (α)
MIG				

Table 5 indicated the Methamphetamine Impact Gauge (MIG) yielded a mean score of 30.58 with a standard deviation of 7.00, indicating moderate variability. The scale demonstrated good internal consistency ($\alpha = .823$) and a slightly negatively skewed distribution (skewness = -.122).

Table 6

Factor Loading of Items in EFA analysis

S.No	Questions	F1	F2	F3
BFMIG6	Have you experienced health problems with the use of ice?	.858		
BFMIG7	Has the use of ice affected your memory?	.852		
BFMIG8	Has the use of ice affected your mental focus?	.811		
BFMIG9	Has the use of ice affected your physical health?	.848		
BFMIG10	Hav You experienced sleep disturbances due to the use of ice?	.469		
PFBIG11	Whether your performance in school or college has been affected by the use of ice?		.922	
PFBIG12	Did the ice affect the ability to communicate efficiently?		.941	
PFBIG13	Did you face any stigma due to the use of ice?		.855	
SFMIG1	Have you faced criticism because of the use of ice?			.506
SFMIG2	Has the use of ice caused a fight with friends?			.784
SFMIG3	Has anyone asked for help to let go of ice?			.879
SFMIG4	Has your social relationships deteriorated due to the use of ice?			.868
SFMIG5	Has the use of ice affected your professional relationships?			.801

The table 6 explained the outlines items from a questionnaire assessing the impact of ice (methamphetamine) use across health, social, and professional domains. Factor loadings

indicate the strength of association between items and their respective factors: health problems, social consequences, and academic/professional effects.

Reliability Analysis

In the table 7, the reliability analysis is shown for the main study. The overall alpha reliability for all the 13 items was very acceptable (α= .823).

Table 7

Alpha Reliability Analysis

Factors	Number of Items	Alpha Reliability (α)	Interpretation
Factor 1 SFMIG	10	0.838	Indicates good internal consistency, suggesting that the items related to social impact are reliably measuring the construct.
Factor 2 BFMIG	8	0.914	Indicates strong internal consistency, reflecting high correlation among behavioral impact items.
Factor 3 PFMIG	9	0.954	Indicates excellent internal consistency, showing that the psychological impact items are highly reliable.

CFA Main Study

Table 8

CFA analysis (Fit Indices) Table for Main study Factors

Models	χ^2	Df	GFI	CFI	TLI	IFI	RMSEA
Model	78.178	32	.936	.963	.948	.963	.052

The table 8 displayed various fit indices for a statistical model, providing insights into how well the model aligns with the observed data. These indices include the chi-square statistic (χ^2), degrees of freedom (Df), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Incremental Fit Index (IFI), and Root Mean Square Error of Approximation (RMSEA).

A lower chi-square value relative to the degrees of freedom suggests a better fit, while GFI, CFI, TLI, and IFI values closer to 1 indicate stronger model fit. Additionally, RMSEA values below 0.05 signify close fit, while those up to 0.52 represent reasonable fit. These indices collectively aid in evaluating the adequacy of the statistical model in representing the observed data.

CFA Measurement Model
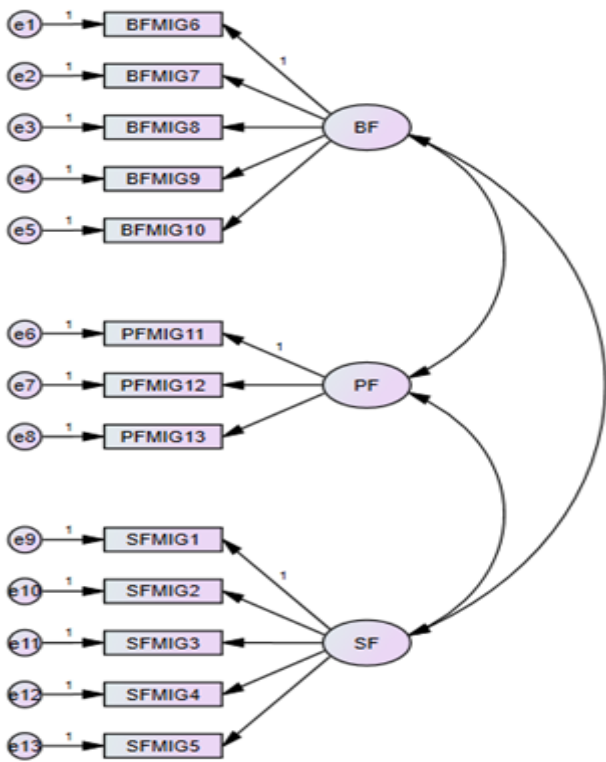
Discussion

The Methamphetamine Impact Gauge (MIG) presents a significant advancement in measuring the multidimensional impacts of methamphetamine use. This study successfully validated the MIG's utility across various domains, including physical, psychological, social, and economic impacts. The results align with previous research that highlights methamphetamine's broad and pervasive effects on individuals and communities (Edinoff & Kaufman, 2022; De Francesco & Ahmed, 2023). By incorporating a biopsychosocial framework, the MIG offers a comprehensive understanding of methamphetamine's consequences, addressing the limitations of earlier, more narrowly focused tools (Kalayasiri & Maes, 2023).

In addressing Research Question 1 the key impacts of methamphetamine use in Pakistani society—the findings affirm the widespread physical, psychological, and social consequences reported globally (Batool, 2023). The MIG's application to a Pakistani context revealed cultural and gender-specific nuances, underscoring the importance of adapting the tool to regional contexts, particularly in a society marked by stigma and traditional values (Shafi & Yuan, 2021). This provides strong support for H1: methamphetamine use significantly impacts the well-being of individuals across multiple dimensions in Pakistani society.

Regarding Research Question 2 the adaptation of the MIG for cultural and gender-specific differences in Pakistan—the study demonstrates that the MIG can be adapted effectively to account for such differences. The qualitative insights from the focus group revealed distinct gender roles and societal expectations that influence methamphetamine use, consistent with previous findings on gender dynamics in substance abuse (Perkins, 2023). These adaptations support H2, confirming that the MIG can accommodate cultural variations. The psychometric validation addressed in Research Question 3 showed that the MIG exhibited strong reliability and validity within the educator sample. These findings align with Kline's (2014) guidelines for sample size and psychometric testing, demonstrating that the MIG holds promise as a reliable tool for measuring methamphetamine's impact across different settings, consistent with prior research on psychometric validation (Bowles, 2021). Therefore, H3 is supported by the data, confirming the tool's robustness in the Pakistani context. Research Question 4 how methamphetamine use affects professional and social relationships—was thoroughly explored in the study. The MIG captured the deterioration in both professional and social relationships among users, consistent with findings from other studies that show methamphetamine's negative effects on social functioning and interpersonal relationships (Aftab & Nielsen, 2021). Thus, H4 is validated, highlighting the detrimental impact of meth use on key social dimensions.

CONCLUSION

Methamphetamine Impact Gauge (MIG) is a vital tool for understanding the wide-ranging effects of methamphetamine use on individuals, families, and communities. By incorporating diverse perspectives and considering various dimensions such as physical health, mental well-being, social dynamics, and economic status, the MIG provides a comprehensive assessment framework. Its development, grounded in the biopsychosocial model, underscores the interconnectedness of biological, psychological, and social factors in shaping the impact of methamphetamine use. Through rigorous validation processes and collaborative efforts across disciplines, the MIG has demonstrated promising reliability and validity. However, further research is needed to refine its measurement capabilities, ensure cultural sensitivity, and enhance practical usability. Ultimately, the MIG holds immense potential to inform interventions, allocate resources effectively, and shape evidence-based policies aimed at addressing the complex challenges associated with methamphetamine addiction.

Limitations

Despite its strengths, this study is not without limitations. The reliance on self-reported data introduces potential biases, such as social desirability bias, which could affect the accuracy of the responses. Additionally, while the MIG was adapted for a Pakistani sample, cross-cultural generalizability remains limited. The tool's applicability across other cultural and socioeconomic contexts requires further exploration.

Recommendations

To enhance the MIG's utility, future research should prioritize cross-cultural validation to ensure its broader applicability. Longitudinal studies are also recommended to capture the long-term impacts of methamphetamine use, offering deeper insights into its lasting effects on physical, psychological, and social domains. Finally, reducing the length of the MIG and

improving its accessibility in clinical and community settings will facilitate its use for early intervention and support services. Collaborative efforts involving stakeholders from various fields—public health, psychology, sociology, and community leaders—are essential for refining the MIG and ensuring its continued relevance and impact.

Competing Interests

The authors did not declare any competing interest.

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