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Original Research Article

A Study on the Importance of Dietary Habits, Nutritional Patterns, and Lifestyle Behaviours as Predictors of Chronic Disease Symptoms: A Cross-Sectional KAP Study Across Different Age Groups in Delhi NCR, India

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Abstract: ***Background:*** Chronic non-communicable diseases (NCDs) represent a growing public health burden in urban India, with lifestyle behaviours increasingly recognised as modifiable risk factors. The Knowledge-Attitude-Practices (KAP) framework, integrated with the Health Belief Model (HBM), provides a structured theoretical lens for understanding multi-dimensional behavioural determinants of health outcomes. ***Objective:*** To examine dietary habits, nutritional patterns, and lifestyle behaviours as predictors of chronic disease symptom severity across four age groups (18–30, 31–45, 46–60, and 61+ years) in Delhi NCR using an integrated KAP-HBM framework. ***Methods:*** A cross-sectional survey was conducted with 100 participants from Delhi NCR, stratified across four age groups and four occupational categories. A 68-item self-administered questionnaire assessed six behavioural domains. Non-parametric tests (Spearman's correlation, Kruskal-Wallis H, Mann-Whitney U) and multiple linear regression were employed. Cronbach's alpha confirmed scale reliability. ***Results:*** Psychological well-being was the only significant independent predictor of chronic disease symptom severity ($\beta = 0.502$, $p < 0.001$, $R^2 = 0.218$). Significant age-group differences emerged for dietary practices ($H = 10.97$, $p = 0.012$), physical activity ($H = 10.67$, $p = 0.014$), and psychological well-being ($H = 8.42$, $p = 0.038$). Older adults reported healthier dietary and activity patterns but poorer psychological well-being. No significant gender differences were observed. ***Conclusion:*** Psychological well-being is the most critical independent predictor of chronic disease symptoms in this urban sample, underscoring the need for integrated mental health components within NCD prevention programmes targeting diverse age groups in Delhi NCR.

Keywords: KAP framework; Health Belief Model; chronic disease; psychological well-being; dietary habits; lifestyle behaviour; Delhi NCR; NCD prevention.

1. INTRODUCTION

Non-communicable diseases (NCDs) — including type 2 diabetes, cardiovascular disease, hypertension, and metabolic syndrome — account for approximately 63% of all deaths in India (WHO, 2023). Urban populations bear a disproportionate burden, with Delhi NCR presenting a particularly high-risk environment characterised by rapid dietary transitions, physical inactivity, psychosocial stress, and heterogeneous health literacy levels across diverse socioeconomic

strata (ICMR, 2021; Misra *et al.,* 2011). The co-occurrence of these risk factors across multiple age groups makes urban India a critical context for integrated lifestyle-disease research.

The Knowledge-Attitude-Practices (KAP) framework has been extensively applied in health behaviour research to examine structural gaps between health knowledge and observable practices (Launiala, 2009). Integrated with the Health Belief Model (HBM), which posits that perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy collectively shape health behaviour (Rosenstock, 1974; Champion & Skinner, 2008), the KAP-HBM model offers a theoretically robust, multi-dimensional framework for understanding NCD determinants. Crucially, the HBM positions psychological constructs — including self-efficacy and perceived barriers — as central mediating variables, lending theoretical support for examining psychological well-being alongside dietary and lifestyle factors.

Despite a substantial literature on individual risk factors, studies simultaneously examining the relative contribution of dietary practices, physical activity, psychological well-being, sleep quality, health literacy, and health attitudes within a single integrated framework remain scarce in the Indian context (Thankappan *et al.,* 2010; Geldsetzer *et al.,* 2018). Age-stratified analyses within urban Indian populations are particularly underexplored, despite strong evidence that behavioural NCD determinants differ substantially across the lifespan (Mathur *et al.,* 2011). This study addresses these gaps directly.

2. LITERATURE REVIEW

2.1 Burden of Non-Communicable Diseases in Urban India

India is experiencing an accelerating NCD epidemic, with chronic diseases now accounting for 63% of total mortality (WHO, 2023). The ICMR-INDIAB study (Anjana *et al.,* 2017) reported a national diabetes prevalence of 7.3%, with urban rates exceeding 11% in metropolitan areas, including Delhi. Hypertension affects approximately 29% of Indian adults, rising sharply with urbanisation (Geldsetzer *et al.,* 2018). Delhi NCR presents a convergence of NCD risk factors: high rates of sedentary occupational behaviour, rapid adoption of processed food diets, elevated psychological stress associated with urban living, and fragmented healthcare access across socioeconomic strata (Misra *et al.,* 2011). Thankappan et al. (2010), in a landmark community-based NCD risk factor study in Kerala, demonstrated that multiple lifestyle behaviours cluster together — meaning dietary, activity, and psychological risk factors rarely occur in isolation, supporting the need for multi-domain assessment frameworks.

2.2 Dietary Habits and Nutritional Patterns as NCD Predictors

Diet quality is established as a primary modifiable determinant of NCD risk. Hu et al. (2011) demonstrated in large prospective cohort studies that high dietary fat and refined carbohydrate consumption significantly increase coronary heart disease and type 2 diabetes risk. Shridhar et al. (2020), in the Indian Migration Study, documented a significant dietary transition among urban Indians toward energy-dense, nutrient-poor foods, with urban dwellers consuming more processed foods and fewer traditional plant-based foods than their rural counterparts. Gastrointestinal manifestations — including acid reflux, bloating, and altered bowel habits — represent the earliest symptomatic consequences of this dietary shift (Anjana *et al.,* 2017). In the KAP literature, dietary knowledge and dietary practices are frequently discordant, reflecting the knowing-doing gap that is a central concern of this study (Launiala, 2009).

2.3 Physical Activity and Sedentary Behaviour

Physical inactivity is the fourth leading risk factor for global mortality (WHO, 2023). Caspersen et al. (1985) established the foundational distinction between physical activity (any bodily movement), exercise (planned structured activity), and physical fitness (measurable capacity), noting that all three dimensions contribute independently to health outcomes. Misra *et al.,* (2011) documented that urban Indian adults, particularly working-age populations, exhibit high rates of occupational and leisure-time sedentary behaviour driven by desk-based employment, screen time, and inadequate access to recreational spaces. The Delhi urban context, characterised by traffic congestion, air pollution, and limited green spaces, presents environmental barriers to physical activity that are particularly relevant to the HBM's perceived barriers construct.

2.4 Psychological Well-being and Chronic Disease

The bidirectional relationship between psychological well-being and chronic physical disease is well-established. Scott *et al.,* (2016), in a landmark cross-national study across 17 countries, demonstrated that comorbid mental disorders significantly increase the risk of developing multiple chronic physical conditions. Katon (2011) documented that depression and anxiety worsen NCD symptom burden, functional impairment, and treatment adherence through shared neurobiological pathways involving the hypothalamic-pituitary-adrenal (HPA) axis, inflammatory cytokine activation, and autonomic nervous system dysregulation. In the Indian context, Thankappan *et al.,* (2010) identified psychological stress as an independent NCD risk factor, particularly among older adults facing social isolation, role loss, and chronic illness burden. Within the HBM framework, psychological distress directly undermines self-efficacy and increases perceived

barriers, theoretically reducing the effectiveness of KAP-based interventions that address knowledge and attitude without attending to mental health.

2.5 Sleep Quality as a Health Behaviour Domain

Sleep quality has emerged as a distinct and underappreciated modifiable NCD risk factor. Cappuccio et al. (2010), in a systematic review and meta-analysis of 16 prospective studies, established that short sleep duration (< 6 hours) is independently associated with all-cause mortality, type 2 diabetes, cardiovascular disease, and obesity. The mechanisms involve circadian dysregulation of cortisol and insulin secretion, increased inflammatory markers, and impaired immune function. Despite this evidence, sleep quality is rarely included as an independent domain in KAP studies, and its interaction with psychological well-being — given the well-documented bidirectional relationship between sleep disruption and psychological distress — remains underexplored in community-based NCD research in India.

2.6 Health Literacy, Attitudes, and the KAP Framework

Health literacy — defined as the capacity to obtain, process, and understand basic health information to make appropriate health decisions (Nutbeam, 2000) — is a necessary but insufficient condition for health behaviour change. Nutbeam (2000) distinguishes between functional literacy (basic reading/writing of health information), communicative literacy (extracting and applying information), and critical literacy (critically analysing and using information to exert control over health determinants). KAP studies consistently document a gap between knowledge and practice (Launiala, 2009), wherein populations may demonstrate adequate health knowledge and positive health attitudes without translating these into health-protective behaviours. Champion and Skinner (2008) note within the HBM that perceived barriers and self-efficacy are stronger proximal determinants of behaviour than knowledge or attitude, explaining why health literacy interventions without concurrent attention to psychological barriers frequently fail to improve health outcomes.

2.7 Research Gap and Theoretical Framework

A review of the existing literature reveals three key gaps that this study addresses. First, studies integrating dietary, physical activity, psychological, sleep, health literacy, and attitudinal domains within a single analytical framework are absent from the Delhi NCR context. Second, age-stratified analyses examining differential predictors of NCD symptoms across the full adult lifespan (18–61+ years) are underrepresented in urban Indian KAP research. Third, the relative predictive weight of psychological well-being versus conventional lifestyle factors (diet, activity) in determining NCD symptom severity has not been empirically tested in this population. This study employs the KAP-HBM integrated framework as its theoretical anchor, operationalising Knowledge (health literacy), Attitudes (toward health), and Practices (dietary, activity, sleep, psychological behaviours) as predictors of a chronic disease symptom outcome, consistent with Rosenstock's (1974) original HBM specification.

3. OBJECTIVES

The primary aim of this study is to examine dietary habits, nutritional patterns, and lifestyle behaviours as predictors of chronic disease symptom severity across different age groups in Delhi NCR using an integrated KAP-HBM framework.

The specific objectives are:

1. To describe the Knowledge-Attitude-Practices (KAP) profile of participants across six health behaviour domains — dietary practices, physical activity, psychological well-being, sleep quality, health literacy, and attitude toward health.
2. To examine differences in health behaviour domain scores across four age groups (18–30, 31–45, 46–60, and 61+ years) using non-parametric group comparison tests.
3. To examine gender differences in health behaviour domain scores across the study sample.
4. To assess the symptom profile and prevalence of chronic disease-related symptoms across the study population.
5. To identify the strongest independent predictors of chronic disease symptom severity using multiple linear regression analysis.

Hypothesis:

Based on the theoretical framework and literature reviewed, it is hypothesised that psychological well-being, dietary practices, and physical activity will each independently predict chronic disease symptom severity; and that significant age-stratified differences in health behaviour patterns will emerge, with older adults demonstrating poorer overall KAP profiles.

4. METHODS

4.1 Study Design and Setting

A cross-sectional observational survey design was employed, consistent with established methodologies in community-based KAP research (Launiala, 2009; Geldsetzer *et al.,* 2018). Data were collected from participants residing in Delhi NCR between November 2025 and February 2026. Ethical approval was obtained from the Institutional Review

Committee of Jamia Hamdard, New Delhi (Ref: [insert number]), and all participants provided written informed consent in accordance with the Declaration of Helsinki.

4.2 Participants and Sampling

One hundred participants were recruited using purposive quota sampling, stratified across four age groups (18–30, 31–45, 46–60, 61+ years) and four occupational categories (high school students, college students, working adults, senior citizens) with 25 participants per occupational stratum. Inclusion criteria: residence in Delhi NCR, age ≥ 18 years, ability to complete a self-administered questionnaire in English or Hindi. Participants with acute illness or cognitive impairment were excluded.

4.3 Instrument

A structured 68-item self-administered questionnaire assessed six behavioural domains on 5-point Likert scales (1 = Strongly Disagree to 5 = Strongly Agree): Dietary Practices (11 items), Physical Activity (8 items), Psychological Well-being (6 items), Sleep Quality (4 items), Health Literacy (6 items), and Attitude Toward Health (4 items). A global chronic disease symptom severity item (1 = None to 5 = Very Severe) served as the primary outcome. Negatively worded barrier items were reverse-scored prior to composite score computation (DeVellis, 2016).

4.4 Reliability Assessment

Internal consistency was evaluated using Cronbach's alpha. An alpha ≥ 0.70 was adopted as the minimum acceptable threshold (Nunnally, 1978; DeVellis, 2016). Four scales met this criterion and were designated validated scales for inferential analysis. Dietary and physical activity domains were retained as formative composite indices (Diamantopoulos & Winklhofer, 2001).

4.5 Statistical Analysis

All analyses used SPSS v22.0. Shapiro-Wilk tests confirmed non-normality for two scales, warranting non-parametric procedures throughout. Spearman's rs examined bivariate associations with symptom severity. Kruskal-Wallis H tests compared domain scores across age groups; Mann-Whitney U tests examined gender differences. Multiple linear regression (Enter method) identified independent predictors of symptom severity. Significance: $p < 0.05$ (two-tailed).

5. RESULTS

5.1 Sample Characteristics

The sample comprised 100 participants (60% male, 40% female; mean age = 35.32 years, SD = 21.08). Young adults (18–30 years: n = 61, 61%) and senior citizens (61+: n = 24, 24%) dominated the sample; middle-aged groups were smaller (31–45: n = 12; 46–60: n = 3). Each occupational category contributed 25 participants. Symptom severity distribution: 37% mild (score = 2), 26% moderate-high (score = 4), 6% severe (score = 5).

5.2 Scale Reliability

Table 1 presents Cronbach's alpha coefficients for all six domains. The reliability pattern is consistent with multidimensional health behaviour research literature, where broadly defined behavioural constructs routinely show lower internal consistency than narrowly defined psychological constructs (Streiner, 2003; DeVellis, 2016).

Table 1: Scale reliability. †Formative composite indices (Diamantopoulos & Winklhofer, 2001). α = Cronbach's alpha.

Domain	Items	α	Rating	Analysis Use	Interpretation & Literature Rationale
Psychological Well-being	6	**0.907**	Excellent	Validated scale	*Exceeds the 'excellent' threshold (≥0.90). High inter-item consistency confirms items cohesively measure a single psychological distress construct, consistent with validated mental health scales (Kessler et al., 2002).*
Attitude Toward Health	4	**0.752**	Acceptable	Validated scale	*Meets acceptable standard. 4-item scales rarely exceed 0.80; this coefficient is consistent with published health attitude measures of similar length (Champion & Skinner, 2008).*
Sleep Quality	4	**0.751**	Acceptable	Validated scale	*α = 0.751 achieved after reverse-scoring the sleep difficulty item. Correction resolved directional inconsistency, consistent with sleep scale validation procedures (Buysse et al., 1989).*
Health Literacy	6	**0.729**	Acceptable	Validated scale	*Acceptable. Health literacy items span access, comprehension, and application — moderate alpha*

					is expected and documented in similar instruments (Nutbeam, 2000).
Physical Activity Index	8	**0.674**	Questionable†	Composite index	*Below threshold. Activity items span behaviour, barriers, and environment — inherently formative dimensions not expected to intercorrelate strongly (Caspersen et al., 1985; Diamantopoulos & Winklhofer, 2001).*
Dietary Practices Index	11	**0.667**	Questionable†	Composite index	*Below threshold. Items span knowledge, behaviour, and barriers. Consistent with Hu et al. (2011), who note dietary behaviour scales routinely show lower reliability due to construct breadth.*

(Source: Researcher's data and analysis)

5.3 Descriptive Statistics

Table 2 presents domain score distributions. Attitude toward health was highest (M = 3.94, SD = 0.66), reflecting positive health orientations consistent with urban-educated samples (Geldsetzer *et al.,* 2018). Psychological well-being was lowest (M = 2.84, SD = 0.94), indicating clinically relevant psychological distress. This high-attitude, low-wellbeing pattern is central to the KAP framework's knowing-doing gap proposition (Launiala, 2009).

Table 2: Descriptive statistics. DV = dependent variable; SW p = Shapiro-Wilk p-value; †non-normal distribution. All scores on 5-point Likert scale.

Domain	M	SD	Min	Max	SW p	Interpretation & Clinical Significance
Attitude Toward Health	**3.94**	0.66	2.25	5.00	0.002†	*Highest domain. Strong positive health beliefs reflect HBM's perceived benefits construct. However, attitude alone is insufficient without commensurate behaviour (Rosenstock, 1974) — the knowing-doing gap is directly demonstrated by this study.*
Health Literacy	**3.68**	0.63	2.00	5.00	0.053	*Above midpoint, reflecting moderate-to-good capacity to access health information. Consistent with urban-educated samples (Mathur et al., 2011). Yet non-significant correlation with symptoms confirms Nutbeam's (2000) argument that functional literacy does not automatically translate to health outcomes.*
Dietary Practices Index	**3.41**	0.50	2.27	4.82	0.300	*Moderate dietary adherence with low variability (SD=0.50), indicating relatively homogeneous dietary patterns. Reflects the mixed dietary environment of urban Delhi where traditional and processed foods coexist (Shridhar et al., 2020).*
Sleep Quality	**3.33**	0.81	1.00	5.00	0.137	*Near-midpoint with high variability (SD=0.81), suggesting a subgroup with clinically poor sleep. Inadequate sleep is associated with metabolic dysregulation and immune dysfunction (Cappuccio et al., 2010). The wide range indicates heterogeneous sleep experiences across occupational groups.*
Physical Activity Index	**2.96**	0.56	1.75	4.50	0.026†	*Below midpoint — lowest positive behaviour score. Urban sedentary occupational patterns drive low activity across age groups (Misra et al., 2011). Environmental barriers (pollution, traffic, limited parks) in Delhi NCR are relevant HBM perceived barriers.*
Psychological Well-being	**2.84**	0.94	1.00	5.00	0.053	*Lowest domain and most clinically significant finding. M=2.84 indicates substantial distress. Consistent with Scott et al. (2016) and Katon (2011), psychological distress is independently associated with NCD symptom amplification via HPA axis dysregulation and inflammatory pathways.*
Symptom Severity (DV)	**2.79**	1.13	1.00	5.00	—	*Mild-to-moderate symptom burden overall. 32% scored ≥4, indicating a substantial high-symptom subgroup. Gastrointestinal and fatigue symptoms predominate, consistent with early metabolic dysregulation in urban Indian populations (Anjana et al., 2017).*

(Source: Researcher's data and analysis)

5.4 Symptom Profile

Table 3 presents individual symptom item means ranked by frequency. Consistent with the NCD epidemiological profile in urban India (Anjana *et al.,* 2017; Gupta *et al.,* 2019), gastrointestinal and metabolic symptoms predominated, with stomach issues (M = 3.40) and unusual fatigue (M = 3.14) as the most prevalent, followed by bloating (M = 3.02) and reliance on sugary drinks (M = 2.90).

Table 3. Symptom item means ranked by frequency (N=100). 5-point scale: 1=Never to 5=Very Frequently.

Symptom	M	SD	Interpretation & Clinical Relevance
Stomach issues after sugary foods	**3.40**	1.03	*Highest symptom. Sugary food-related GI distress indicates early metabolic dysregulation or functional gut disorder, consistent with rising metabolic syndrome rates in urban India (Anjana et al., 2017). Directly linked to rising ultra-processed food consumption (Shridhar et al., 2020).*
Unusual fatigue	**3.14**	1.16	*High prevalence. Unexplained fatigue is an early indicator of anaemia, hypothyroidism, and diabetes — all common in urban Indian populations. Particularly notable given that 61% of the sample are young adults who should have high energy reserves (Misra et al., 2011).*
Bloating after fatty foods	**3.02**	1.18	*Above midpoint. Dietary fat intolerance may reflect biliary dysfunction or IBS — both associated with high-fat urban diets and lifestyle stress (Shridhar et al., 2020; Scott et al., 2016).*
Reliance on sugary drinks/caffeine	**2.90**	1.12	*Energy dysregulation indicator. Dependency on stimulants is associated with insulin resistance and sleep disruption, creating a compound NCD risk pathway (Hu et al., 2011; Cappuccio et al., 2010).*
Excessive thirst	**2.85**	1.03	*Polydipsia is a cardinal diabetes symptom. Mean above 2.5 in a non-clinical sample warrants attention, particularly given the high diabetes prevalence in Delhi NCR (Anjana et al., 2017).*
Heartburn/acid reflux	**2.83**	1.22	*Moderate GERD prevalence, associated with obesity, irregular meal patterns, and processed food consumption — all prevalent in urban Delhi (Gupta et al., 2019).*
Shortness of breath (activity)	**2.81**	1.25	*Exertional dyspnoea reflects deconditioning from low physical activity (mean ACT_INDEX = 2.96). Consistent with cardiovascular risk accumulation in sedentary urban populations (Caspersen et al., 1985).*
Blurry vision	**2.80**	1.19	*Associated with diabetes and hypertension. Above-midpoint score in a community sample suggests undiagnosed cardiometabolic conditions in a subset of participants (WHO, 2023).*
Skin changes/rashes	**2.70**	1.21	*May reflect nutritional deficiencies, hormonal dysregulation, or metabolic syndrome — commonly under-reported in community NCD surveillance (ICMR, 2021).*
Numbness/tingling	**2.63**	1.28	*Peripheral neuropathy symptoms characteristic of uncontrolled diabetes and B-vitamin deficiency, common in urban Indian dietary patterns (Anjana et al., 2017).*
Frequent infections	**2.54**	1.18	*Immune dysregulation marker. Below midpoint but present in a notable proportion, suggesting suboptimal immune function linked to poor sleep and nutrition (Cappuccio et al., 2010).*
Shortness of breath (rest)	**2.42**	1.12	*More severe cardiorespiratory symptom. Lower prevalence indicates most participants are in early-stage rather than advanced metabolic risk categories.*
Slow wound healing	**2.35**	1.07	*Lowest mean. Impaired wound healing is a late-stage diabetes indicator — lower prevalence suggests most are in pre-diabetic or early metabolic risk stages, consistent with the community-based (non-clinical) sample.*

(Source: Researcher's Data and analysis)

5.5 Correlations with Symptom Severity

Table 4 presents Spearman correlations. The pattern reveals a clear hierarchy — psychological factors exert the strongest association, followed by behavioural factors (activity, sleep), while cognitive-evaluative factors (literacy, attitude) show non-significant relationships. This is consistent with the biopsychosocial model (Engel, 1977) and meta-analytic evidence that psychological distress is a stronger proximal determinant of somatic symptom expression than health knowledge or attitudes (Scott *et al.,* 2016).

Table 4: Spearman's correlations with symptom severity (N=100). ** p<0.01, * p<0.05, ns=not significant

Domain	rs	p-value	Sig.	Interpretation & Literature Rationale
Psychological Well-being	**0.454**	< 0.001	**	*Strongest correlation. Higher distress → greater symptom severity. Katon (2011) and Scott et al. (2016) demonstrate that depression/anxiety amplify somatic symptom perception through shared neurobiological pathways. Within HBM, psychological distress reduces self-efficacy and heightens perceived barriers, creating a vicious cycle with worsening symptom burden.*
Physical Activity Index	**-0.210**	0.036	*	*Significant negative correlation — lower activity → higher symptoms. Confirms physical inactivity as a primary NCD risk factor (WHO, 2023). Exercise modulates inflammatory markers, insulin sensitivity, and cardiovascular function relevant to this study's symptom profile (Caspersen et al., 1985).*
Sleep Quality	**-0.198**	0.049	*	*Significant negative correlation — poorer sleep → higher symptoms. Cappuccio et al. (2010) establish bidirectional sleep–metabolic dysfunction relationships. Sleep quality is a modifiable NCD risk factor, and its significant correlation here supports inclusion as an independent domain in KAP-based health research.*
Dietary Practices Index	**-0.170**	0.090	**ns**	*Non-significant trend (p=0.090). Directionally consistent with diet-disease literature but underpowered at N=100. Hu et al. (2011) establish diet as a long-term NCD determinant; short-term dietary patterns may not correlate strongly with current symptom expression in a cross-sectional design.*
Attitude Toward Health	**-0.130**	0.196	**ns**	*Non-significant. Confirms the knowing-doing gap: positive attitudes did not protect against symptom severity. Rosenstock's (1974) HBM posits that attitudes influence intentions, not outcomes directly — structural and psychological barriers mediate this relationship.*
Health Literacy	**-0.009**	0.927	**ns**	*Near-zero correlation. Clinically important null finding: health knowledge provides no independent protection against symptoms. Consistent with Nutbeam (2000), who argues that functional literacy without psychological empowerment and structural enablement fails to improve health outcomes.*

(Source: Researcher's Data and analysis)

5.6 Age Group Differences (Kruskal-Wallis)

Table 5 presents age group comparisons. Three domains showed significant variation, revealing a theoretically meaningful age-stratified pattern consistent with life-course health behaviour models (Elder, 1998) and the HBM's prediction that perceived susceptibility varies across developmental stages.

Table 5: Kruskal-Wallis H test across age groups. * p<0.05. M=group mean

Domain	18-30 M	31-45 M	46-60 M	61+ M	H	p	Interpretation & Literature Rationale
Dietary Practices	3.30	3.39	3.67	3.67	**10.97**	0.012*	*Older adults show significantly better dietary scores. Life-course theory (Elder, 1998) suggests illness experience motivates dietary adjustment. Mathur et al. (2011) confirm that disease experience in older adults promotes dietary behaviour change consistent with HBM's perceived severity construct driving cues to action.*
Physical Activity	2.85	2.92	3.04	3.24	**10.67**	0.014*	*Higher activity in older groups reflects cultural patterns (morning walks, yoga) among senior citizens in India. Younger urban adults face occupational sedentarism and screen-time barriers identified as key HBM perceived barriers in the Delhi context (Misra et al., 2011).*
Psych. Well-being	3.01	2.94	2.28	2.42	**8.42**	0.038*	*Markedly lower psychological well-being in older groups (46-60: M=2.28; 61+: M=2.42 vs. 18-30: M=3.01). Chronic disease burden, bereavement, social isolation, and reduced autonomy are well-documented contributors to older adult psychological distress in India (Thankappan et al., 2010; Scott et al., 2016).*
Sleep Quality	3.25	3.42	3.83	3.42	**3.91**	0.271	*Non-significant. Uniform sleep quality across age groups may reflect Indian cultural practices (afternoon napping,*

							early bedtimes) that normalise sleep across the lifespan, contrasting with Western samples where sleep deteriorates with age (Cappuccio et al., 2010).
Health Literacy	3.68	3.87	3.72	3.60	**1.96**	0.582	*Non-significant. Uniform health literacy across age groups reflects relatively equal information access in Delhi NCR, contrasting with rural Indian contexts where older adults show markedly lower health literacy (Nutbeam, 2000).*
Attitude	3.89	4.06	3.92	3.98	**0.39**	0.942	*Non-significant. Uniformly positive health attitudes across all age groups (range 3.89–4.06) confirm KAP literature findings that attitude is the most stable and least age-differentiated health behaviour dimension (Launiala, 2009; Champion & Skinner, 2008).*

(Source: Researcher's Data and analysis)

5.7 Gender Differences (Mann-Whitney U)

Table 6 presents gender comparisons. No significant differences were found across any domain — a finding that is itself theoretically important within the KAP-HBM framework, suggesting that health behaviour patterns in this urban Delhi NCR sample are not gender-differentiated.

Table 6: Mann-Whitney U gender comparisons. All p > 0.05 (ns).

Domain	Male M (n=60)	Female M (n=40)	p	Interpretation & Literature Rationale
Dietary Practices	**3.47**	**3.33**	0.169	*Non-significant. Males show marginally higher dietary scores, contrary to common assumptions of gender-differentiated dietary patterns. Occupational access to cafeteria food in urban settings may equalise dietary practices regardless of gender (Geldsetzer et al., 2018).*
Physical Activity	**3.04**	**2.83**	0.052	*Borderline (p=0.052). A trend toward higher male activity is noted, consistent with gender-normative physical activity patterns in India. Non-significance suggests urban occupational sedentarism affects both genders equally (Misra et al., 2011).*
Psych. Well-being	**2.75**	**2.97**	0.188	*Non-significant. Females show marginally better well-being, contrasting with global meta-analyses showing higher depression in women (Scott et al., 2016). May reflect the protective effect of social support networks among urban Indian women or social desirability bias in male self-reporting.*
Sleep Quality	**3.38**	**3.24**	0.477	*Non-significant. Similar sleep quality between genders consistent with urban Indian samples where occupational stress affects sleep equally (Cappuccio et al., 2010). Gender differences typically emerge only in clinical populations or older age groups.*
Health Literacy	**3.73**	**3.61**	0.191	*Non-significant. Comparable health literacy between genders reflects equal educational attainment in the occupational categories sampled. Contrasts with national surveys showing gender disparities in less-educated populations (Nutbeam, 2000).*
Attitude	**3.98**	**3.88**	0.539	*Non-significant. Both genders hold equally positive health attitudes, consistent with Launiala's (2009) observation that attitude is the most uniformly distributed KAP dimension across demographic groups in educated urban samples.*

(Source: Researcher's Data and Analysis)

5.8 Multiple Regression: Predictors of Symptom Severity

Table 7 presents the full regression model. The model explained 21.8% of variance in symptom severity (R^2 = 0.218, Adjusted R^2 = 0.167), consistent with expected explanatory power of self-reported behavioural predictors in community health studies (Cohen, 1988). Only psychological well-being reached statistical significance — a finding with major theoretical and practical implications.

Table 7: Multiple regression: predictors of symptom severity. R^2=0.218, Adjusted R^2=0.167, N=100. ** p<0.001.

Predictor	B	SE	t	p	Interpretation & Literature Rationale
(Constant)	1.831	1.188	1.541	0.127	*Non-significant intercept. When all predictors are theoretically zero, baseline symptom severity ~1.83 — consistent with low but non-zero symptom burden expected even in healthy community populations.*
Psychological Well-being	**0.502**	0.131	3.823	**<0.001****	*Only significant predictor (p<0.001). Each 1-unit increase in psychological distress corresponds to 0.50 units higher symptom severity. Confirms the biopsychosocial model (Engel, 1977) and is consistent with Katon (2011) and Scott et al. (2016), who establish psychological distress as a direct predictor of somatic symptom burden across NCD populations via HPA axis and inflammatory mechanisms.*
Physical Activity Index	-0.277	0.218	-1.267	0.208	*Non-significant despite significant bivariate correlation (rs=-0.210, p=0.036). Suggests physical activity's protective effect is partially mediated by psychological well-being — active individuals tend to have better mental health (WHO, 2023), which in turn reduces symptoms, explaining the attenuation in the multivariable model.*
Dietary Practices Index	0.243	0.268	0.906	0.367	*Non-significant. Positive coefficient may reflect reverse causality — individuals experiencing more symptoms may be more motivated to improve dietary practices (HBM perceived severity → cues to action). This health behaviour paradox is also observed in the age group analysis (Table 5).*
Sleep Quality	-0.048	0.143	-0.332	0.741	*Non-significant in the multivariable model despite significant bivariate correlation (p=0.049). Suppression by psychological well-being is likely, given the well-established bidirectional sleep–psychological distress relationship (Cappuccio et al., 2010).*
Health Literacy	0.037	0.233	0.159	0.874	*Non-significant. Confirms the knowing-doing gap at the multivariable level. Nutbeam (2000) cautions that health literacy influences outcomes only when accompanied by psychological empowerment and structural enablers — neither of which were directly targeted in this sample.*
Attitude Toward Health	-0.116	0.220	-0.525	0.601	*Non-significant. Ceiling-like uniformity in attitude scores (M=3.94, SD=0.66) limits predictive power. Rosenstock (1974) acknowledges attitude as a distal rather than proximal determinant of health outcomes, consistent with this null finding.*

(Source: Researcher's Data and analysis)

6. DISCUSSION

This study presents an integrated KAP-HBM analysis of chronic disease symptom determinants across age groups in Delhi NCR. All five study objectives were addressed; the findings yield four principal theoretical and clinical conclusions.

6.1 Psychological Well-being as the Dominant Predictor

The singular significance of psychological well-being (β=0.502, p<0.001) across all six predictor domains confirms the biopsychosocial model (Engel, 1977) and directly responds to Objective 5. This aligns with Scott *et al.,* (2016), who demonstrated across 17 countries that comorbid mental disorders significantly increase chronic disease risk, and with Katon (2011), who documented that depression and anxiety worsen symptom burden through HPA axis dysregulation, inflammatory cytokine activation, and autonomic nervous system dysfunction. Importantly, the five non-significant predictors do not diminish this finding — they clarify it: when psychological well-being is statistically controlled, no other domain contributes meaningfully, suggesting that psychological state may mediate or moderate the effects of lifestyle behaviours on symptom expression. This has a direct and urgent implication for NCD prevention programming in urban India: information-based dietary and physical activity interventions are insufficient without concurrent attention to mental health.

6.2 The Age-Stratified Health Behaviour Paradox

Addressing Objectives 2 and 4, the finding that older adults (61+) show healthier dietary and physical activity scores yet the worst psychological well-being constitutes a 'healthy behaviour, poor well-being' paradox. This is interpretable through the HBM's perceived severity construct (Rosenstock, 1974; Mathur *et al.,* 2011): older adults, motivated by accumulated illness experience, adopt health-protective behaviours while simultaneously suffering greater psychological distress from chronic disease burden, social isolation, bereavement, and reduced autonomy — all well-documented in the Indian elderly population (Thankappan *et al.,* 2010). Conversely, the elevated symptom burden among young adults (18–30 years) despite high health attitudes confirms the KAP knowing-doing gap in this age group, where urban lifestyle pressures — occupational stress, irregular meals, screen-based sedentarism — manifest as early subclinical symptoms despite good health intentions (Misra *et al.,* 2011; Gupta *et al.,* 2019).

6.3 The Health Literacy–Attitude Disconnect

Addressing Objective 1, the strong correlation between health literacy and attitude ($r_s=0.660$, $p<0.001$) alongside non-significant associations with symptom severity demonstrates the KAP knowing-doing gap empirically. Participants held good health knowledge and positive attitudes but these did not translate into protection against chronic disease symptoms. This is precisely the limitation that Nutbeam (2000) identifies: functional health literacy enables information access but not necessarily behavioural change or health outcomes without psychological empowerment and structural support. The HBM's perceived barriers construct provides the theoretical explanation — even knowledgeable, positively-oriented individuals cannot act on health information when psychological distress and environmental barriers override their intentions.

6.4 Gastrointestinal Symptoms and Dietary Transition

Addressing Objective 4, the predominance of gastrointestinal symptoms — particularly stomach issues after sugary foods (M=3.40) and bloating after fatty foods (M=3.02) — provides symptomatic evidence of the dietary transition documented by Shridhar *et al.,* (2020) in urban India. Co-occurring reliance on sugary drinks (M=2.90) and unusual fatigue (M=3.14) suggest early metabolic dysregulation patterns consistent with pre-diabetic states increasingly prevalent among young urban Indians (Anjana *et al.,* 2017).

6.5 Limitations

The sample of N=100 limits statistical power and generalisability. The age distribution, skewed toward young adults (61%), reduces precision for middle-aged cohort comparisons. Cross-sectional design precludes causal inference — the psychological well-being–symptom relationship is likely bidirectional. Dietary and physical activity composite indices showed questionable reliability ($\alpha=0.667$ and 0.674), acknowledged as a study limitation. Social desirability bias in self-reported data is inherent. Future studies should employ larger probability samples, longitudinal designs, objective physiological measures (HbA1c, accelerometry), and validated psychological distress instruments (PHQ-9, GAD-7).

7. CONCLUSION

This cross-sectional KAP-HBM study demonstrates that psychological well-being is the strongest and most significant independent predictor of chronic disease symptom severity in urban Delhi NCR, surpassing dietary practices, physical activity, sleep quality, health literacy, and health attitudes in a multivariable framework. Age-stratified analyses reveal a health behaviour paradox — older adults demonstrate healthier lifestyle behaviours but poorer psychological well-being, while young adults carry a disproportionate symptom burden despite high health attitudes — confirming the central knowing-doing gap proposition of the KAP framework.

These findings carry direct implications for NCD prevention policy in urban India. Public health programmes must move decisively beyond dietary counselling and physical activity promotion to integrate structured psychological well-being components — including stress management, social support strengthening, and mental health literacy — into community health programmes. Age-differentiated intervention strategies are recommended: addressing occupational stress and lifestyle irregularity in young adults, and psychological vulnerability, social isolation, and chronic illness coping in older adults. The KAP-HBM integrated framework adopted here provides a replicable, theoretically validated model for future community-based NCD research in comparable urban Indian contexts.

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