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Analysis of traffic noise annoyance at intersections in mid-sized Indian cities (Paper Id: 104)

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Introduction

Traffic noise contributes 70-80% to urban noise

Noise costs 0.2-2%GDP (WHO; 2018)

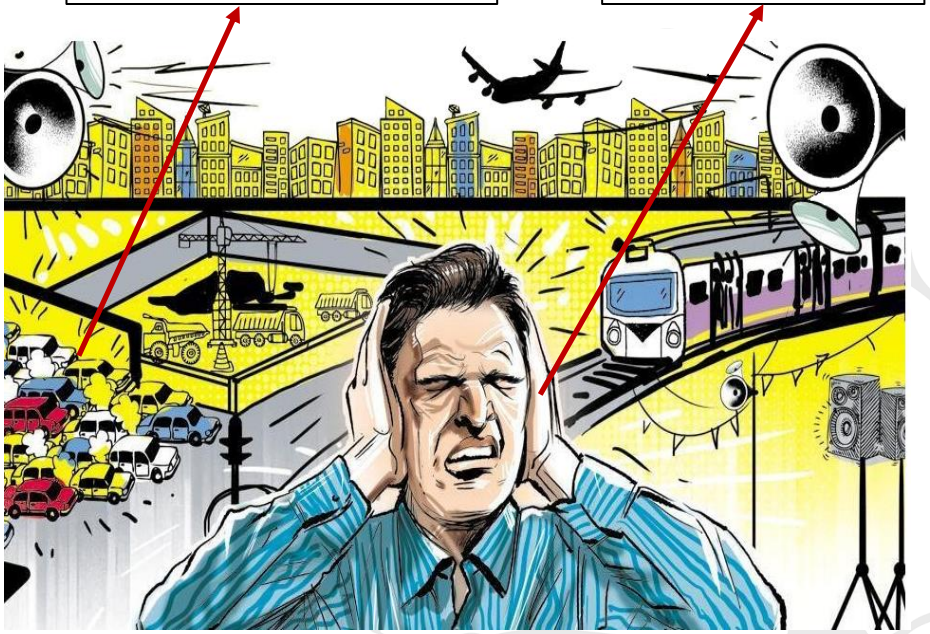

Figure: Urban noise

- Traffic noise is more serious especially at intersections (Konbattulwar et al., 2016).

- 1 in 3 people experience annoyance due to daytime noise pollution.
- Annoyance act as mediator to other health issue.

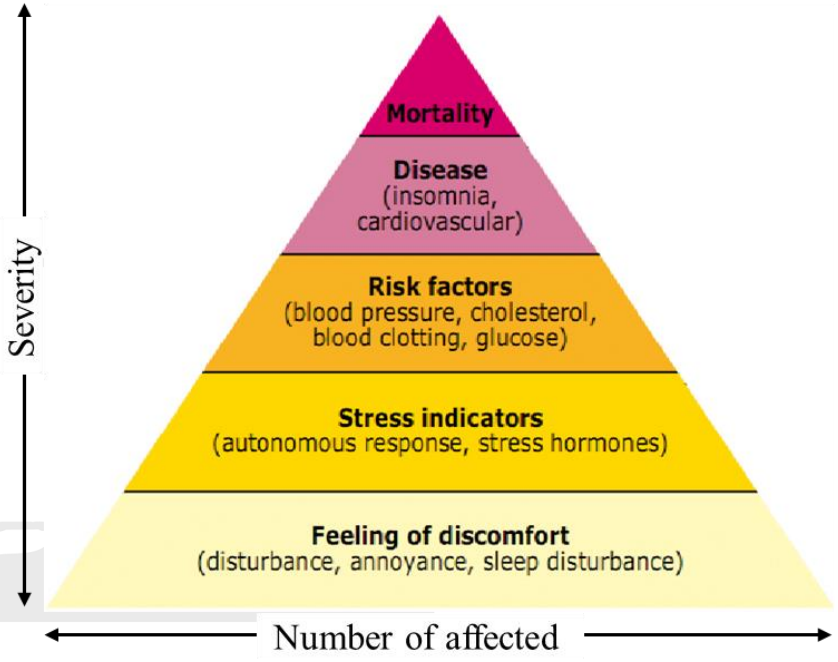

Figure: Impact of noise on health

- Konbattulwar, V., Velaga, N.R., Jain, S. and Sharmila, R.B., "Development of in-vehicle noise prediction models for Mumbai Metropolitan Region, India," Journal of Traffic and Transportation Engineering (English Edition), 3(4), pp.380-387., 2016.
- WHO. (2018). Environmental noise guidelines for the European Region. In *World Health Organization*.

Research Hypothesis

- WHO report indicates that traffic noise explain only 20% variance in traffic noise induced annoyance.
- Hence, other factors are also crucial for affecting annoyance levels.

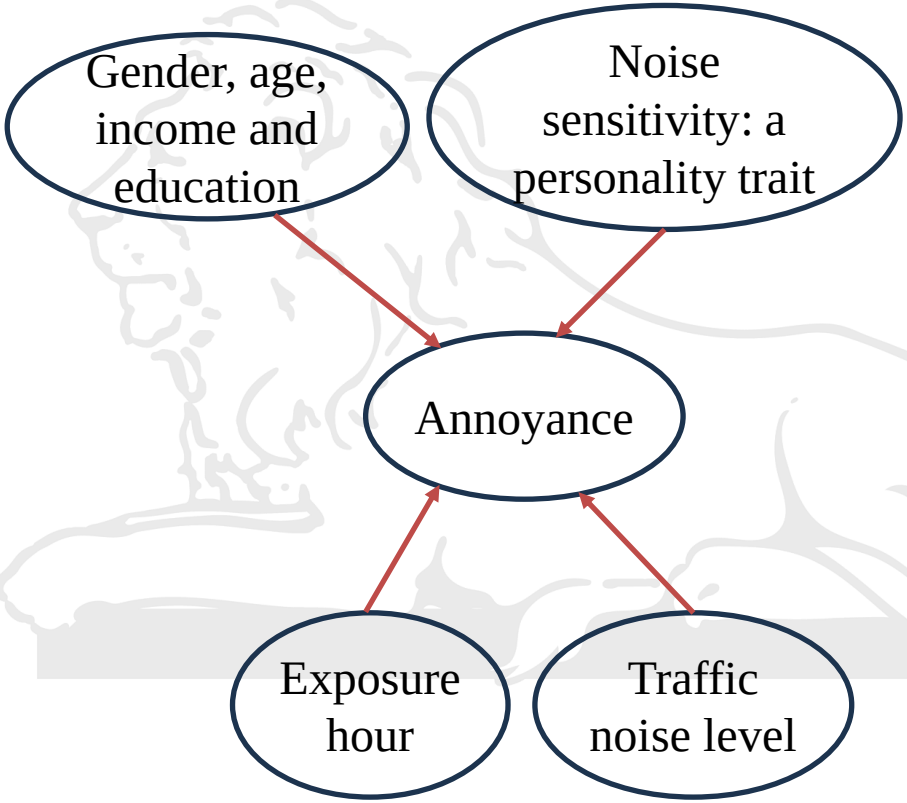

Figure: Research Hypotheses

Data Collection

- Kanpur, a typical mid-sized city, with 2.92 million inhabitants 403.7 Km^2.

Table: Selected intersections

Intersections	Land Use
Bada Chauraha	Commercial
Tat Mill	Commercial
Ghantaghar	Commercial
Fajalganj	Commercial
Kidwai Nagar	Commercial
Narauna	Commercial
Deoki	Residential
Shastri	Residential
Dabauli	Residential
Kesha Colony	Residential
New Keshavpuram	Residential
Vijay Nagar	Residential
Maryampur	Silence
Company Bagh	Silence
Sachan	Silence

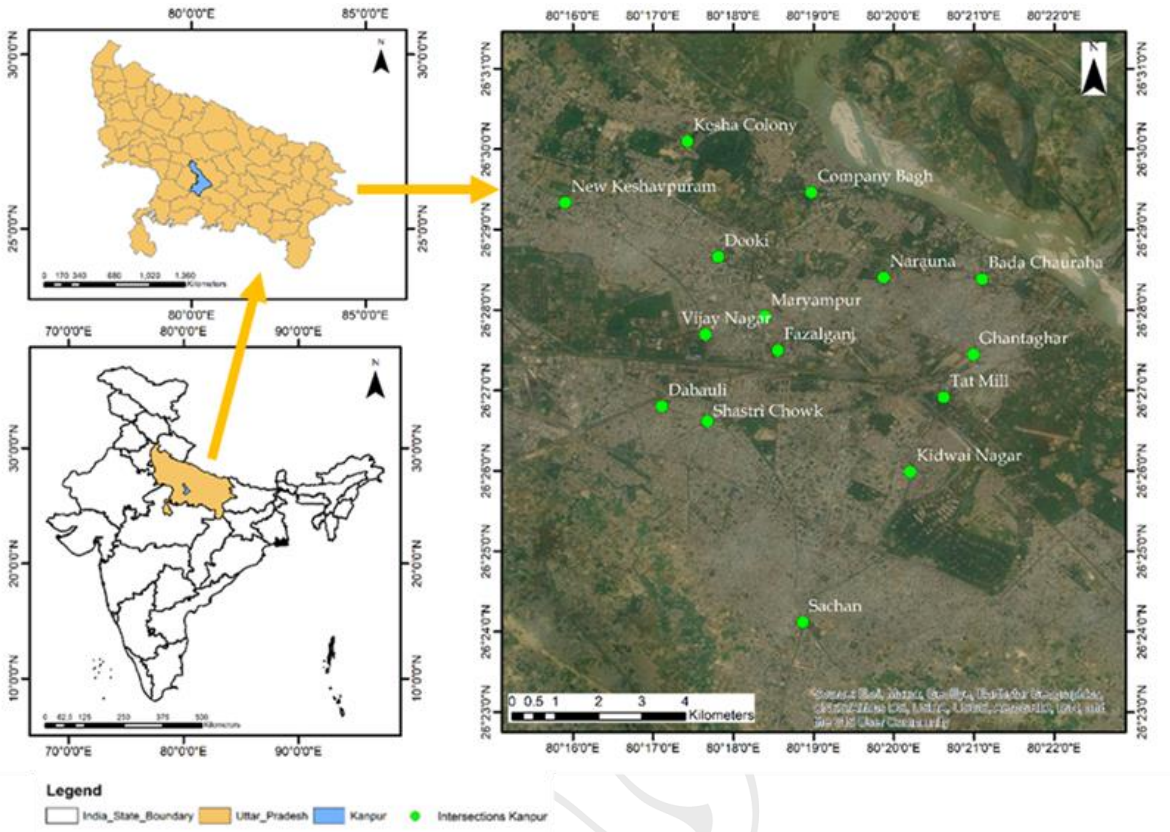

Figure: Intersection locations

- Data is measured within intersection influence zone, which lies upto 250 m from intersection stop line.
- Data is measured either directly or on 5-point Likert scale.

Data Descriptive

Table: directly measured variables

Variables	Description	Frequency
Gender (GE)	Male	357
	Female	130
Age	≤20	62
	21-30	148
	31-40	97
	41-50	95
	>50	85
Income (IN)	Not earning	66
	Upto 20000	136
	20001-35000	149
	35001-50000	83
	>50000	53
Education (EDU)	Illiterate	51
	Upto 10th	73
	Upto 12th	136
	Graduate	185
	Postgraduate and above	42
Exposure hours	<3	89
	3-6	116
	6-9	88
	9-12	158
	>12	36
Traffic noise level (Leq)	≤75 dBA	110
	75-80 dBA	352
	≥80 dBA	25

- 487 respondents participated
- 5-point scales are mentioned as: ***"Not at all = 1", "Slightly = 2", "Moderately = 3", "Very= 4"***, **and *"Extremely = 5"***.

Table: Variables measured on 5-point Likert scale

Variables	Not at all	Slightly	Moderately	Very	Extremely
Noise sensitivity (SE)	55	122	192	86	32
Annoyance (Annoy)					
Disturbance in conversation	95	144	157	71	20
Disturbance in reading	98	232	123	32	2
Disturbance in resting	122	166	117	68	14
Disturbance in sleeping	161	134	108	75	9
Disturbance in using phone	75	132	163	102	15
Disturbance in watching TV	175	134	124	48	6
Disturbance in working	74	195	162	49	7

Analysis and Results

- PLS-SEM method is applied PLS-SEM consist two component:
  1. **Measurement model:** indicator reliability, internal consistency, convergent validity and discriminant validity
  2. **Structural model:** p-value, R^2 and VIF
- **14 indicators** and **8 constructs** based on measurement model.
- Standard loading> 0.5, Cronbach alpha>0.7 (0.915 for model), Composite reliability>0.7 (0.93 for annoyance and 1 for others), AVE>0.5 (0.67 for annoyance and 1 for others), HTMT ration>0.85.

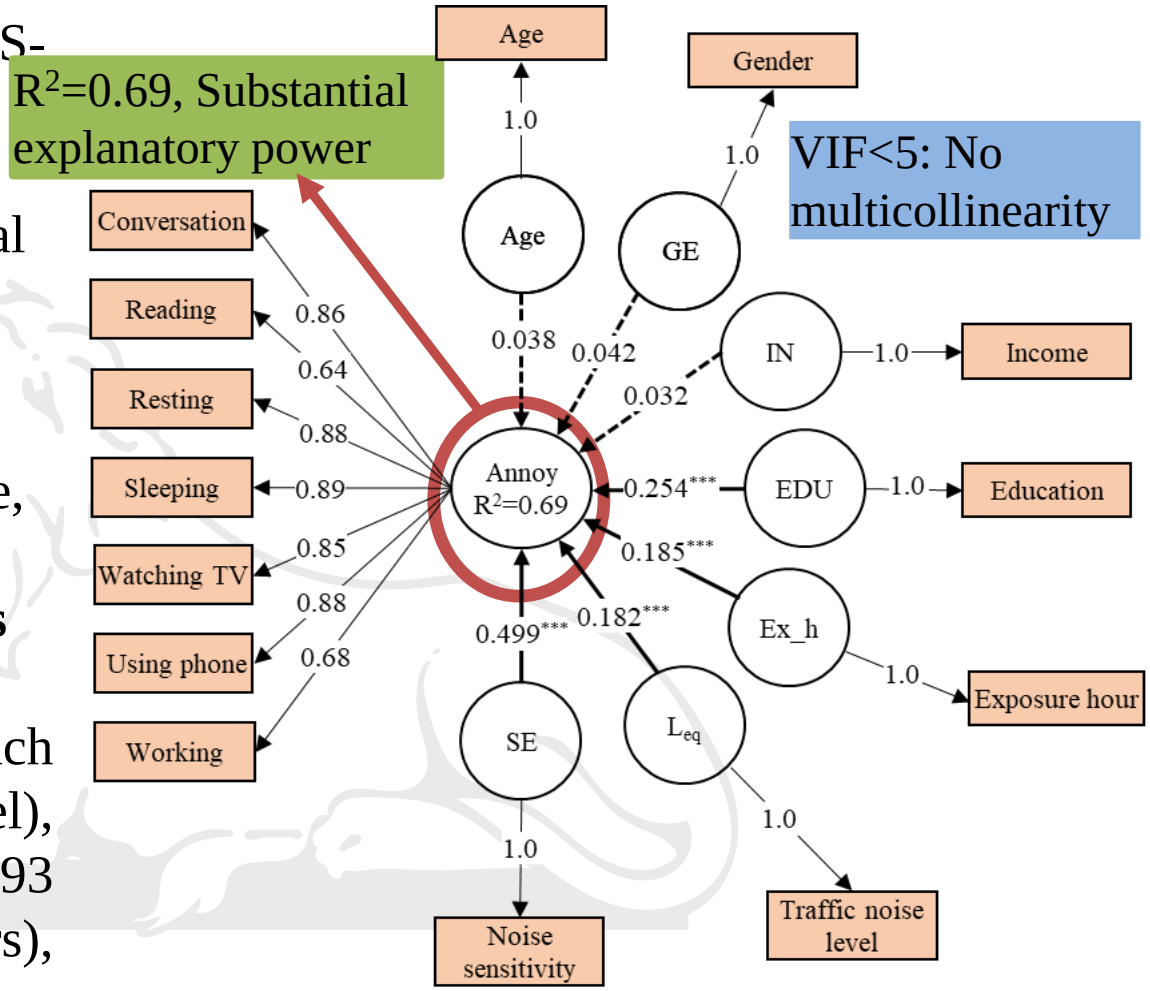

Figure: PLS-SEM annoyance model

Analysis and Results

- The effect of gender, age and income are insignificant.
- Individuals extremely sensitive to noise are 49.9% more likely to experience annoyance than those without noise sensitivity.
- Education and exposure hours contribute 25.4% and 18.5% to increment in annoyance.
- Traffic noise level contributes to an 18.2% variation in the annoyance level

Table: Result of PLS-SEM annoyance model

Path relation	β	p	Supported
Gender -> annoyance	0.042	0.07	No
Age -> annoyance	0.038	0.069	No
Income -> annoyance	0.032	0.122	No
Traffic noise level -> annoyance	**0.182**	**<0.001**	**Yes**
Exposure hour -> annoyance	**0.185**	**<0.001**	**Yes**
Education -> annoyance	**0.254**	**<0.001**	**Yes**
Sensitivity -> annoyance	**0.499**	**<0.001**	**Yes**

Conclusions

- Age, gender and income has no significant effect on annoyance.
- Education is pivotal in moulding perceptions and reactions to traffic noise-induced annoyance.
- Noise sensitivity is most important and critical in shaping annoyance mitigation measures.
- Person with longer exposure hour experience higher annoyance.
- Traffic noise level has significant effect on annoyance.
- Based on findings following policies can be recommended:
  - **Enhancing public transport infrastructure** to reduce traffic volume and congestion
  - Implication of **noise reduction initiatives** i.e., construction noise-absorbing pavements and barriers.
  - **Noise sensitivity-centric interventions** to recognize high noise sensitive area and prioritize noise control initiative in areas with a high prevalence of noise sensitive individuals.

Thank You