Title: Heat impact on women- Pilot study at Ahmedabad, Gujarat

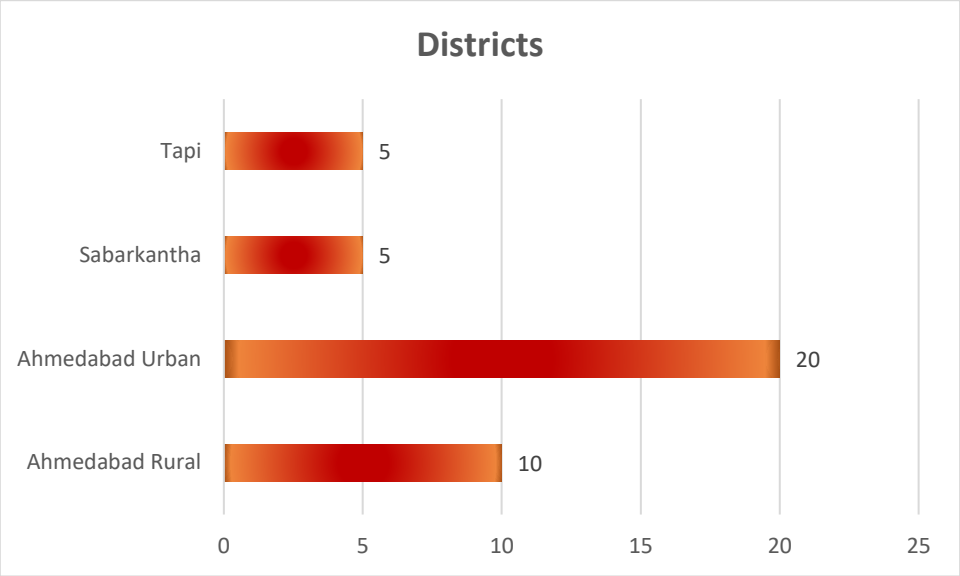

Figure1*: Distribution of participants across districts, (N=40)*

The highest number of participants were from Ahmedabad Urban (20), followed by Ahmedabad Rural (10). Fewer participants were from Tapi and Sabarkantha, with 5 each. The distribution highlights a greater representation from urban areas compared to rural and smaller districts.

Table 1: Distribution of study participants across districts and villages, (N=20).

District	Village name	n (%) *
Ahmedabad Rural, (n=10)	Goraj	5(50)
	Vinchiya	5(50)
Ahmedabad Urban, (n=20)	Behrampura	5(25)
	Shantinagar	5(25)
	Maku Bhai Ni Chali	10(50)
Sabarkantha, (n=5)	Amba Mahuda	2(40)
	Dantral	3(60)
Tapi, (n=5)	Lakhali	5(100)

*Percentage based on village composition.

The distribution of participants varies across districts. In Ahmedabad Rural, Goraj and Vinchiya each contributed 50% of the total participants. In Ahmedabad Urban, Maku Bhai Ni Chali accounted for the largest proportion (50%), while Behrampura and Shantinagar contributed 25% each. In Sabarkantha, Dantral had a higher representation (60%) compared to Amba Mahuda (40%). In Tapi, all participants were from Lakhali (100%), indicating a single-site recruitment. This variation reflects differences in participant distribution across study locations (Table 1).

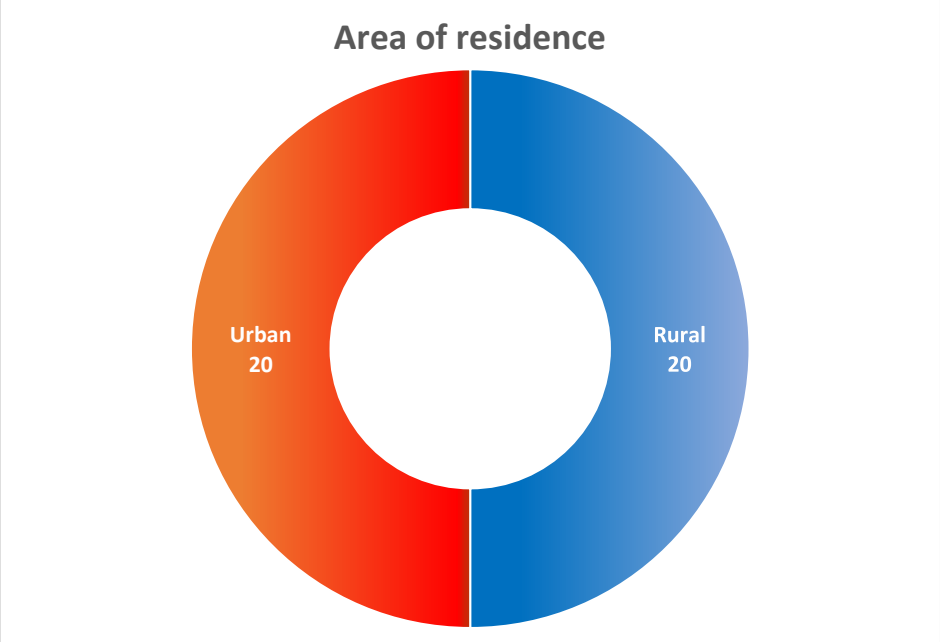

Figure 2: *Area of residence of the participants*, (N=40)

The study sample is evenly distributed between urban and rural areas, with 50% (n=20) of participants residing in urban settings and 50% (n=20) in rural settings.

Table 2: Socio-demographic characteristics of study participants by area of residence, (N=40)

S. No	Variables		Urban (n=20), n (%)	Rural (n=20), n (%)
1.	Age of the participant[a]		42.9(7.2)	38.1(9.5)
2.	Education level	No formal education	12 (60.0)	8(40.0)
		Primary	4 (20.0)	3(15.0)
		Secondary	4 (20.0)	2(10.0)
		Higher secondary	-	4(20.0)
		University	-	3(15.0)
3.	Marital status	Married	15(75.0)	16(80.0)
		Divorced	1(5.0)	-
		Widow	4(20.0)	1(5.0)
		Separated	-	1(5.0)
		Unmarried	-	2(10.0)
4.	Pregnancy status	Not pregnant	20(100.0)	20(100.0)
5.	Number of family members in the family [a]		4.9(1.9)	5.8(1.9)
6.	Number of earning members [b]		2(2,3)	3(2,4)
7.	Total monthly income of the family (in INR) [a]		12900 (5398.8)	8263(3633.8) [c]

a- Mean (SD), b- Median (IQR), c- implies n=19.

The mean age of urban participants (42.9 years) was higher than that of rural participants (38.1 years). A higher proportion of urban participants (60%) had no formal education, while rural participants had greater representation in higher secondary (20%) and university education (15%). Marital status differed, with widowhood more common in urban areas (20%), whereas 10% of rural participants were unmarried. Rural households had a larger family size (5.8 vs. 4.9 members) and a higher median number of earning members (3 vs. 2). The mean total monthly income was significantly higher in urban households, ₹12,900 compared to rural households, ₹8,263.

Table 3: Occupational characteristics and work environment of study participants by area of residence, (N=40).

S. No	Variables		Urban (n=20), n (%)	Rural (n=20), n (%)
1.	Occupation	Farm & animal husbandry	-	20(100.0)
		Street vendor	5(25.0)	-
		Construction worker	5(25.0)	-
		Home- based work	5(25.0)	-
		Waste recycler	5(25.0)	-
2.	Nature of work site	Outdoor	15(75.0)	20(100.0)
		Indoor	5(25.0)	-
3.	Hours worked per day (in hours) [a]		6.4(1.6)	6.0(1.3)
4.	Hours exposed to dust, dirt and heat during work (in hours) [a]		6.4(1.6)	6.0(1.3)
5.	Mode of travel to work	Rickshaw	7(35.0)	-
		walks	8(40.0)	20(100)
		Not applicable	5(25.0)	-
6.	Time taken to commute to work (in mins) [b]		30(20,30)	10(5,10)
7.	Involvement in household chores		20(100.0)	20(100.0)
8.	Hours spend in doing household chores (in hours) [b]		3(2,3)	3(2,4)

a- Mean (SD), b- Median (IQR)

All rural participants (100%) were engaged in farm and animal husbandry, while urban participants were distributed across street vending, construction work, home-based work, and waste recycling (25% each). Additionally, all rural participants (100%) worked outdoors, compared to 75% of urban participants. Both groups had similar daily working hours (urban: 6.4, rural: 6.0) and exposure to dust, dirt, and heat. While all rural participants walked to work, urban participants used a mix of walking (40%) and rickshaws (35%), with a longer median commute time (30 vs. 10 minutes). All participants were involved in household chores, spending a median of 3 hours daily on these activities.

Table 4: Housing and environmental conditions in urban and rural areas, (N=40)

S. No	Variables		Urban (n=20), n (%)	Rural (n=20), n (%)
1.	Years of occupancy [a]		15(5.5,33.7)	14(5.7,24.7)
2.	Ownership of the house	Own	14(70.0)	20(100.0)
		Others	6(30.0)	-
3.	Source of water supply	Water pipeline in house (tap)	14(70.0)	9(45.0)
		Public hand pump	1(5.0)	1(5.0)
		Both (Tap + Public Handpump)	5(25.0)	5(25.0)
		Well (Borewell)	-	5(25.0)
4.	Frequency of water supply	Daily at certain hours (in 24 hrs)	19(95.0)	15(75.0)
		One to two days in a week	1(5.0)	-
		Every day for 24 hours	-	5(25.0)
5.	Location of kitchen	Inside the house but a separate room	10(50.0)	13(65.0)
		Inside the house but not a separate room	9(45.0)	1(5.0)
		Outside the house	1(5.0)	6(30.0)
6.	Fuel used for cooking	Clean fuel (electricity, LPG, Biogas) =1	19(95.0)	1(5.0)
		Unclean fuel (kerosene, coal, charcoal, wood, straw, crop waste, dung cake) =2	1(5.0)	13(65.0)
		Both= 3	-	6(30.0)
7.	Has access to electricity (yes)		20(100.0)	19(95.0)
8.	Household experiencing frequent power outages (yes)		2(10.0)	17(85.0)

9.	Frequency of power outage in the last month [b]	Once a day	-	1(5.0)
		Few times a week	2(10.0)	6(30.0)
		Few times a month	-	3(15.0)
10.	Type of house	Kachha	1(5.0)	6(30.0)
		Pucca	9(45.0)	8(40.0)
		Semi-pucca	10(50.0)	6(30.0)
11.	Number of rooms in home [a]		2(1,2) [c]	2(2,3)
12.	Number of doors in home [a]		2(1,2)	2(1,2)
13.	Number of windows in home [a]		1(1,1)	1(1,2)
14.	Facilities enhancing cross-ventilation present		5(25.0)	17(85.0)

a- Median (IQR), b- (urban n=2, rural n=17), c- implies n=19.

Rural participants were more likely to own their homes (100%) but had fewer pucca houses (40%) and greater reliance on kachha structures (30%), which may provide less insulation from heat. Water supply was more consistent in urban areas, while rural households faced less frequent supply and higher dependence on borewells.

Fuel use differed significantly, with 95% of urban households using clean fuels, compared to only 5% in rural areas, where unclean fuels were commonly used. Electricity access was high in both areas, but 85% of rural households reported frequent power outages, affecting cooling and ventilation. While cross-ventilation was more common in rural homes (85% vs. 25%), urban homes had fewer openings for airflow, which may contribute to heat retention.

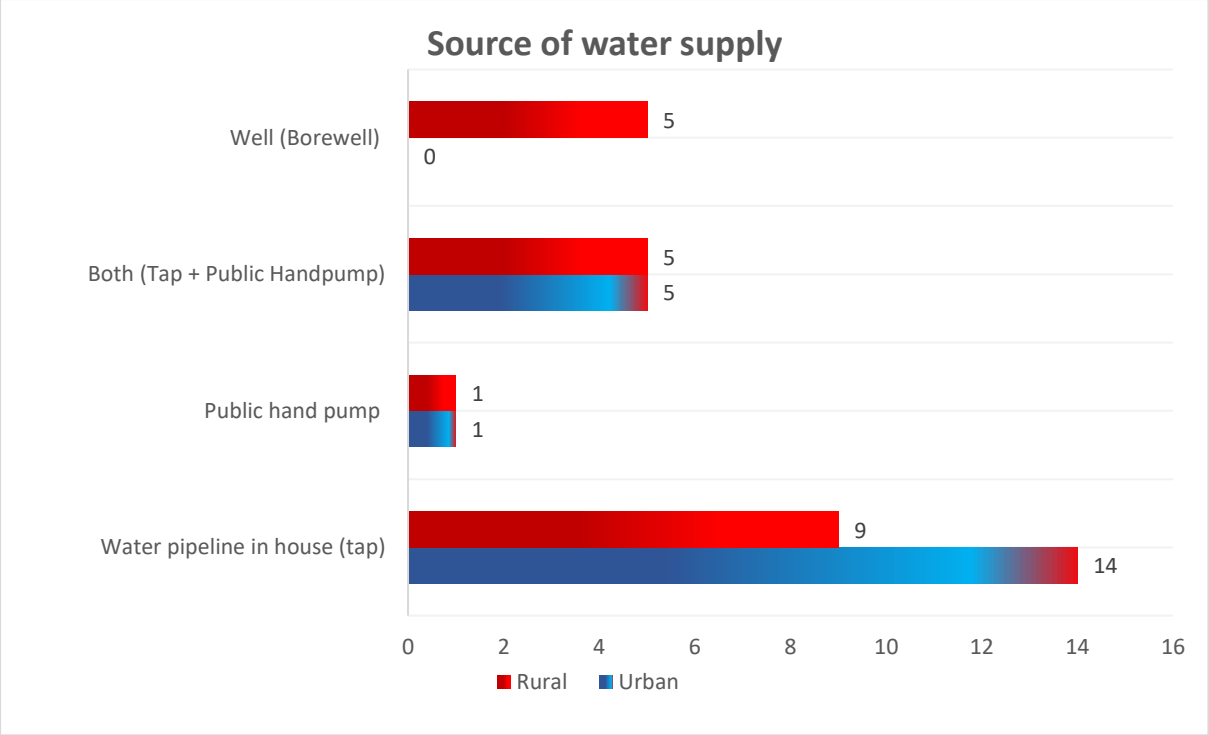

Figure 3: *Source of water supply in urban and rural areas, (N=40)*

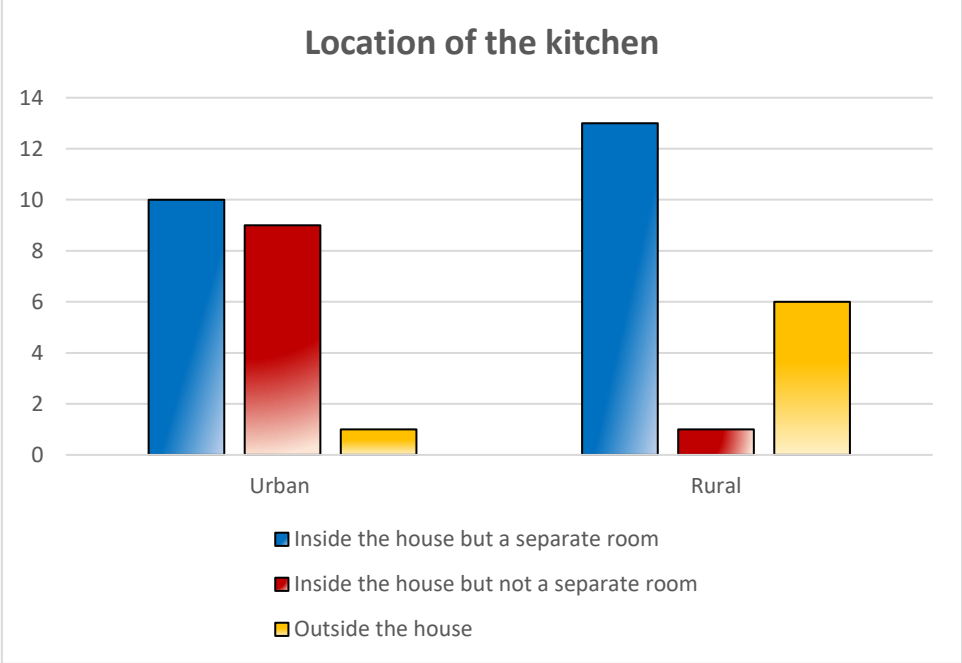

Figure 4: *Location of the kitchen in urban and rural households, (N=40)*

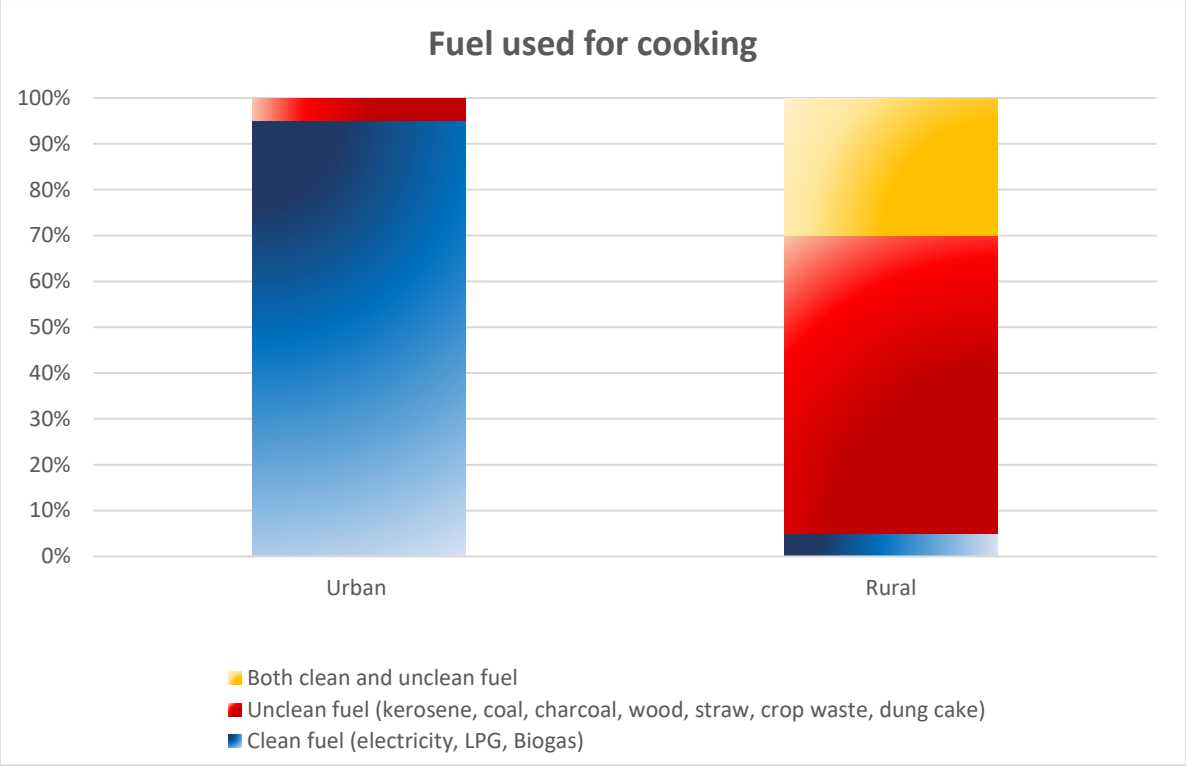

Figure 5: *Fuel used for cooking in urban and rural households, (N=40).*

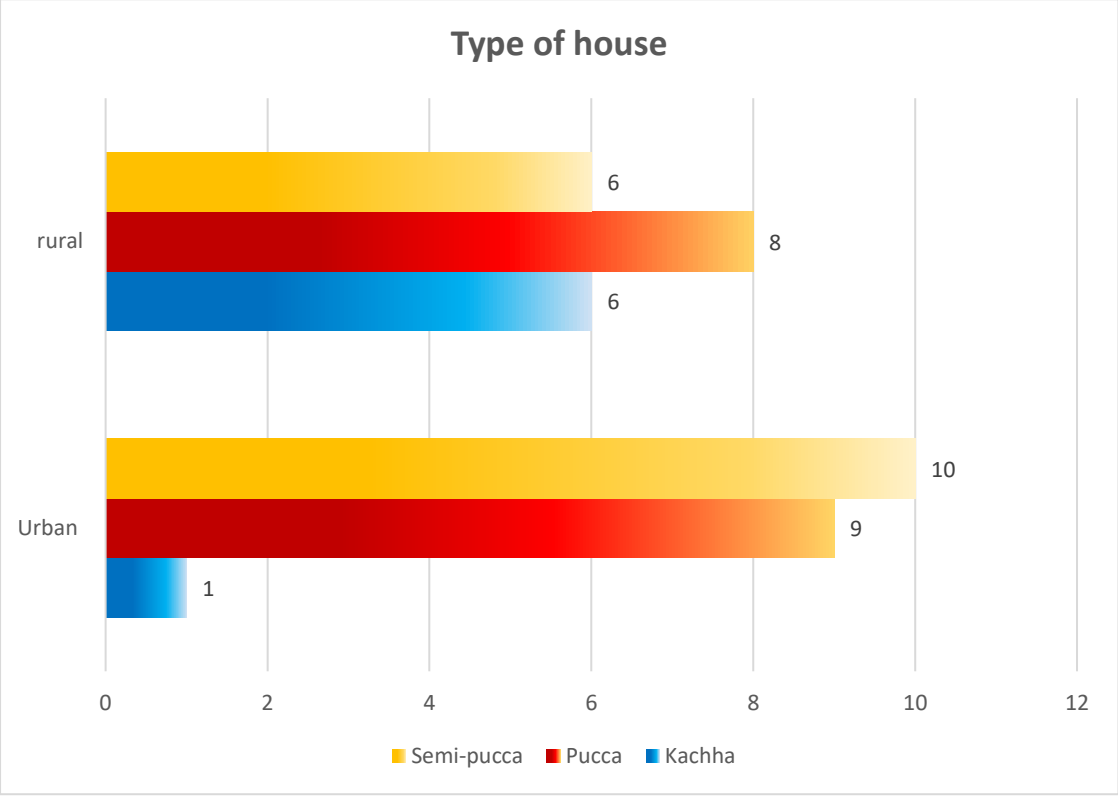

Figure 6: *Distribution of house types in urban and rural areas, (N=40)*

Table 5: Health conditions and occupational health impacts in urban and rural areas, (N= 40)

S. No	Variables		Urban (n=20), n (%)	Rural (n=20), n (%)
1.	History of diabetes present		1(5.0)	1(5.0)
2.	History of hypertension present		8(40.0)	4(20.0)
3.	History of respiratory illness present		5(25.0)	2(10.0)
4.	History of other pre-existing illness present		4(20.0)	-
5.	Health problems faced as a result of occupation	Chest pain	2(10.0)	1(5.0)
		Breathing issues and Incessant/wheezing cough	5(25.0)	1(5.0)
		Skin irritation, rashes and bumps	5(25.0)	3(15.0)
		Joints and calf pain	4(20.0)	13(65.0)
		Neck and shoulder pain	1(5.0)	-
		Hand/ wrist and arm stiffness	3(15.0)	-
		Feet, ankle and hand swelling	-	1(5.0)
		Tiredness, exhausted and weakness	-	1(5.0)
6.	Noticed changes in mental health due to work	Increased anxiety and stress	13(65.0)	5(25.0)
		Increased irritability and agitation	-	5(25.0)
		Sleep disruption/ insomnia	6(30.0)	3(15.0)
		Refused to reply/ none	1(5.0)	7(35.0)
7.	Average hours of sleep per day in the last week (in hours) [a]		5.7(1.1)	6.7(1.0)

a- Mean (SD)

Pre-existing health conditions varied between urban and rural participants, with hypertension (40% vs. 20%) and respiratory illnesses (25% vs. 10%) more common in urban areas. Occupational health issues also differed, with joint and calf pain (65%) more prevalent in rural

participants, while urban participants reported higher rates of breathing issues (25%) and skin irritation (25%)**.** Mental health impacts due to work were more frequently reported in urban areas, with 65% experiencing increased anxiety and stress compared to 25% in rural areas. Sleep disruption was also higher among urban participants (30%)**,** and they reported less average sleep per night (5.7 vs. 6.7 hours) than rural participants.

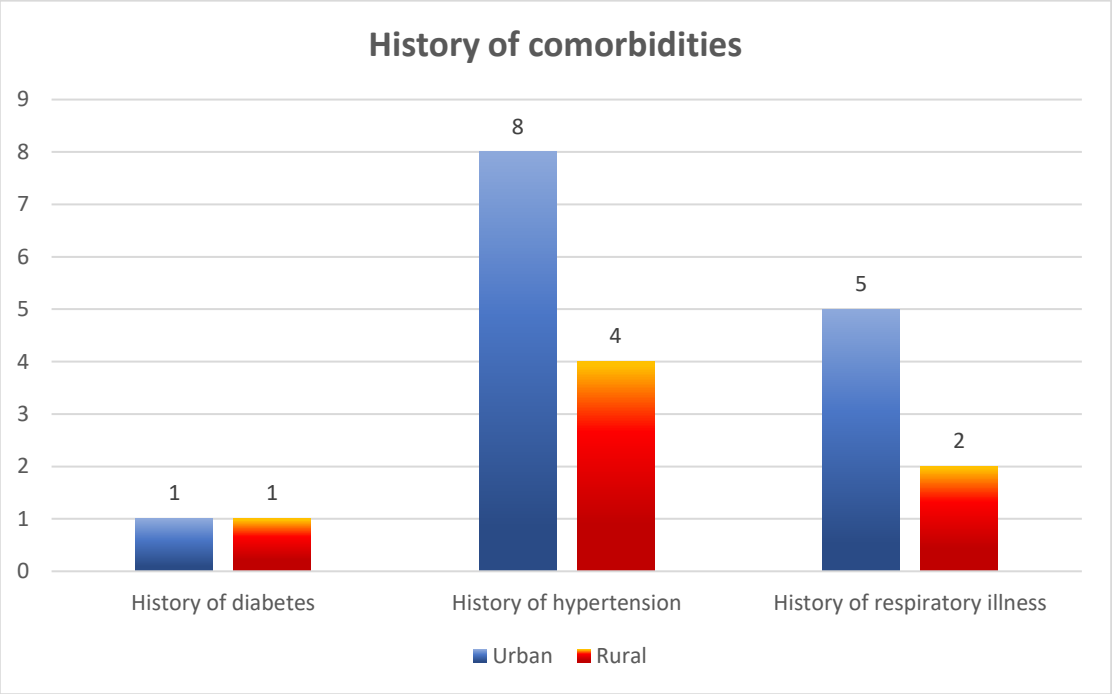

Figure 7: *Comparison of comorbidity history in urban and rural populations, (N=40).*

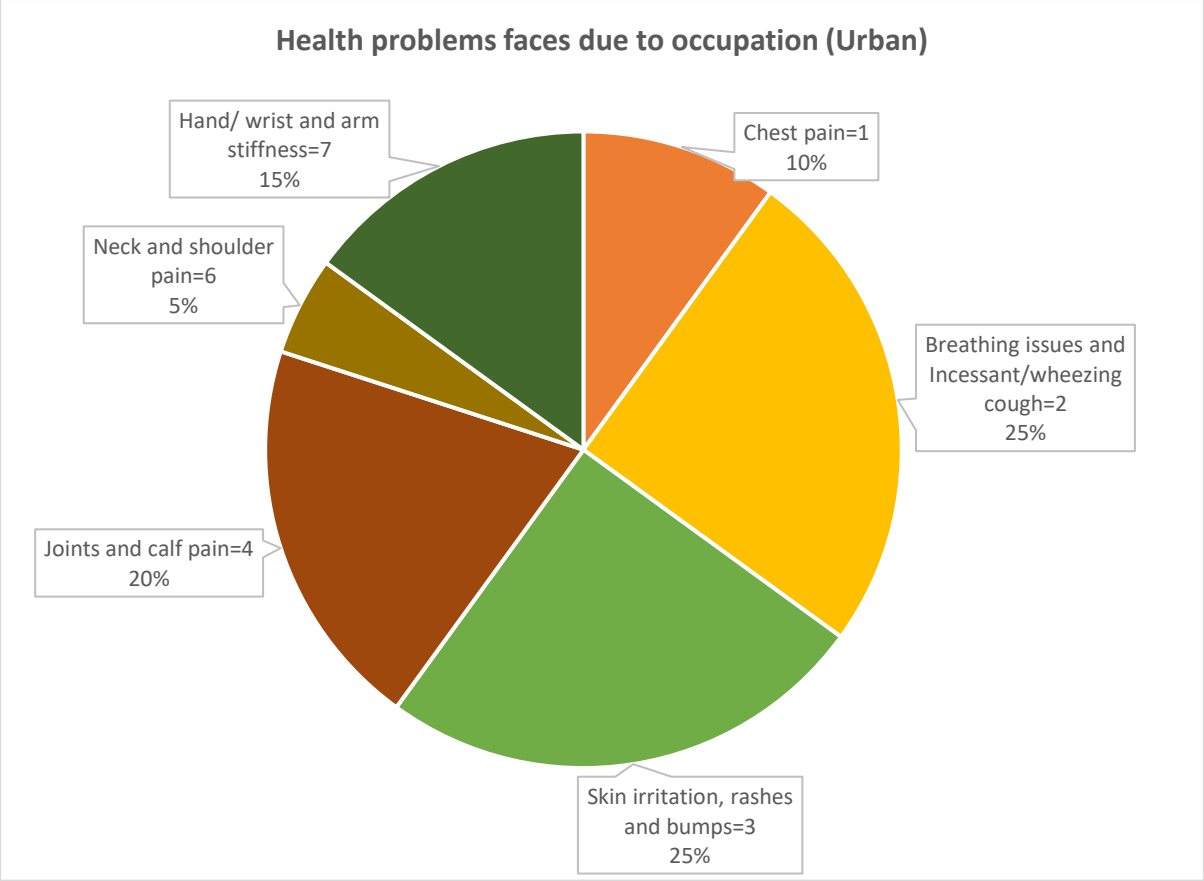

Figure 8: *Occupational health problems among urban workers, (N=20).*

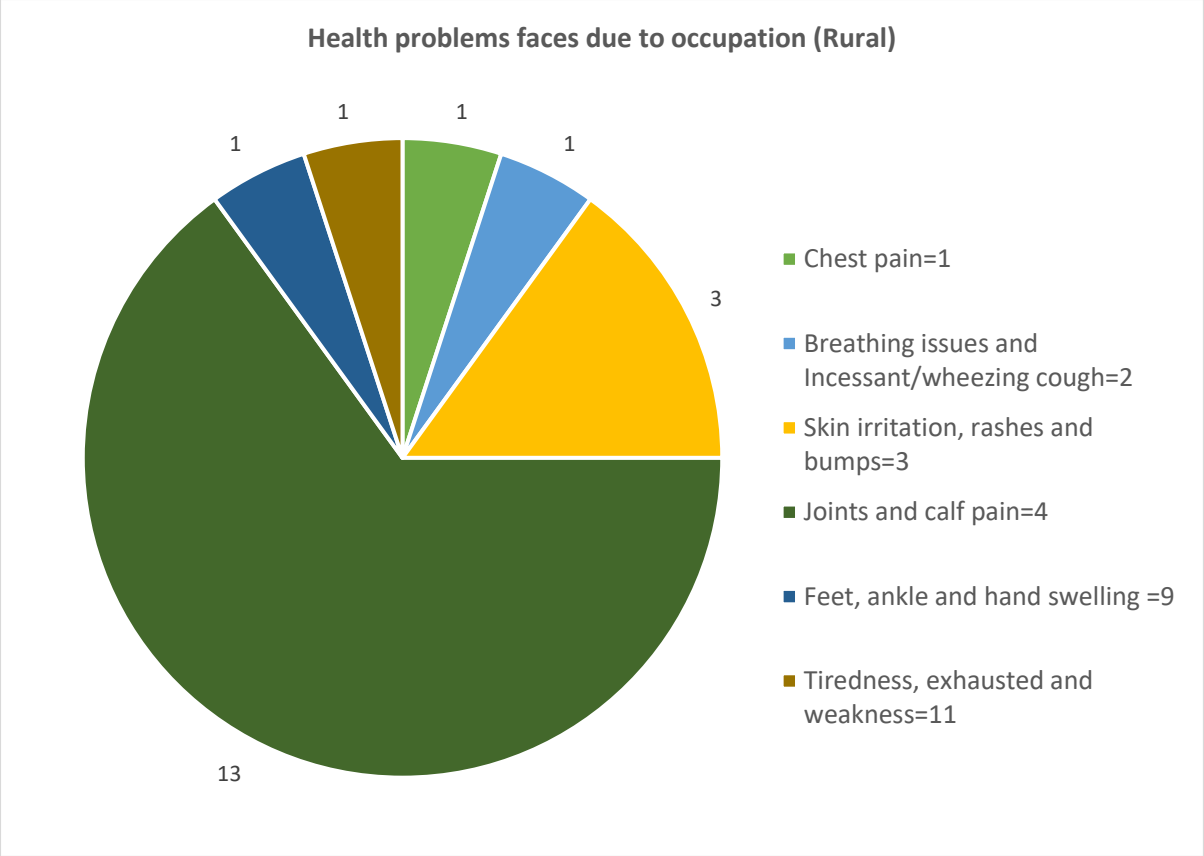

Figure 9: *Occupational health problems among rural workers, (N=20).*

Table 6: Healthcare access, awareness, and occupational health impacts in urban and rural areas, (N=40).

S. No	Variables		Urban (n=20), n (%)	Rural (n=20), n (%)
1.	Nearest healthcare facility	Sub-centre	-	**13(65.0)**
		PHC/UHC	-	5(25.0)
		CHC	6(30.0)	1(5.0)
		Govt. hospitals, medical college	8(40.0)	-
		Private Health facility	6(30.0)	1(5.0)
2.	Regular community awareness programs conducted on health risks during heatwaves (yes)		7(35.0)	20(100.0)
3.	Health education programs conducted on health risks related to occupation (yes)		3(15.0)	1(5.0)
4.	Action taken during illness	Consult a physician	18(90.0)	19(95.0)
		Consult a pharmacist at pharmacy outlet	2(10.0)	-
		Self-medication	-	1(5.0)
5.	Availability of health insurance to cover healthcare expenses (yes)		10(50.0)	14(70.0)
6.	Admitted to a health facility due to work related illness (yes)		1(5.0)	2(10.0)
7.	Admitted to a health facility due to heat related illness (yes)		1(5.0)	2(10.0)
8.	Wage loss due to absenteeism (yes)		14(70.0)	-
9.	Incurred income loss in summer (Yes)		6(30.0)	
10.	Occupational health problem affects daily tasks (yes)		17(85.0)	12(60.0) [a]
11.	Occupational health related problem prolongs task (yes)		19(95.0)	10(50.0)
12.	Heat affects daily activities (yes)		14(70.0)	14(70.0)

a- implies n=19.

Healthcare access differed between urban and rural participants, with 65% of rural participants relying on sub-centres and 40% of urban participants accessing government hospitals or medical colleges. Regular community awareness programs on heatwave health risks were more common in rural areas (100% vs. 35%), but occupational health education was low in both settings (15% urban, 5% rural). Most participants consulted a physician when ill (90% urban, 95% rural), and government health insurance coverage was higher in rural areas (70%) than urban areas (50%). Work-related illness or heat-related illness led to hospital admission in a small proportion (5–10%). Work absenteeism due to health issues resulted in wage loss for 70% of urban participants, while rural workers did not report wage loss. Heat exposure affected daily activities for 70% in both settings, and occupational health problems prolonged tasks for 95% of urban and 50% of rural workers.

Table 7: Coping strategies for heat stress and financial burden of occupational health problems, (N=40).

S. No	**Variables**		**Urban (n=20), n (%)**	**Rural (n=20), n (%)**
1.	Copings strategy for heat stress	Take rest	9(45.0)	16(80.0)
		Drinking more water	11(55.0)	4(20.0)
2.	Availability of sufficient water (yes)		5(25.0)	8(40.0)
3.	Spent Out-of- Pocket to deal with occupational health problems		9(45.0)	2(10.0)
4.	Spent Out-of- Pocket to deal with heat related health problems		-	-

Coping strategies for heat stress varied between urban and rural participants, with 80% of rural workers preferring rest, while 55% of urban workers focused on increasing water intake. Access to sufficient water was reported by 40% of rural and 25% of urban participants. Out-of-pocket expenses for managing occupational health issues were higher among urban workers (45%) compared to rural workers (10%), indicating potential disparities in financial burden and healthcare accessibility.

Table 8: Workplace amenities and use of protective measures, (N=40)

S. No	Variables	Urban (n=20), n (%)	Rural (n=20), n (%)
1.	Availability of drinking water facility at workplace (yes)	14(70.0)	18(90.0)
2.	Availability of clean and hygienic toilet facilities (yes)	5(25.0)	4(20.0)
3.	Availability of a clean hand washing facility (yes)	11(55.0)	14(70.0)
4.	Availability of resting space at work (yes)	10(50.0)	12(60.0)
5.	Availability of shade at workplace (yes)	6(30.0)	19(95.0)
6.	Use of protective clothing/ masks/ gloves/ safety equipment at work (yes)	4(20.0)	13(65.0)

Drinking water availability was higher in rural workplaces (90%) compared to urban settings (70%). However, clean and hygienic toilet facilities remained low in both areas (urban: 25%, rural: 20%). Handwashing facilities were more commonly available in rural (70%) than urban (55%) workplaces. Notably, rural workplaces provided more shade (95%) and resting spaces (60%) than urban ones (30% and 50%, respectively). The use of protective equipment, such as clothing, masks, or gloves, was significantly higher among rural workers (65%) than urban workers (20%), indicating better adherence to safety measures in rural settings.

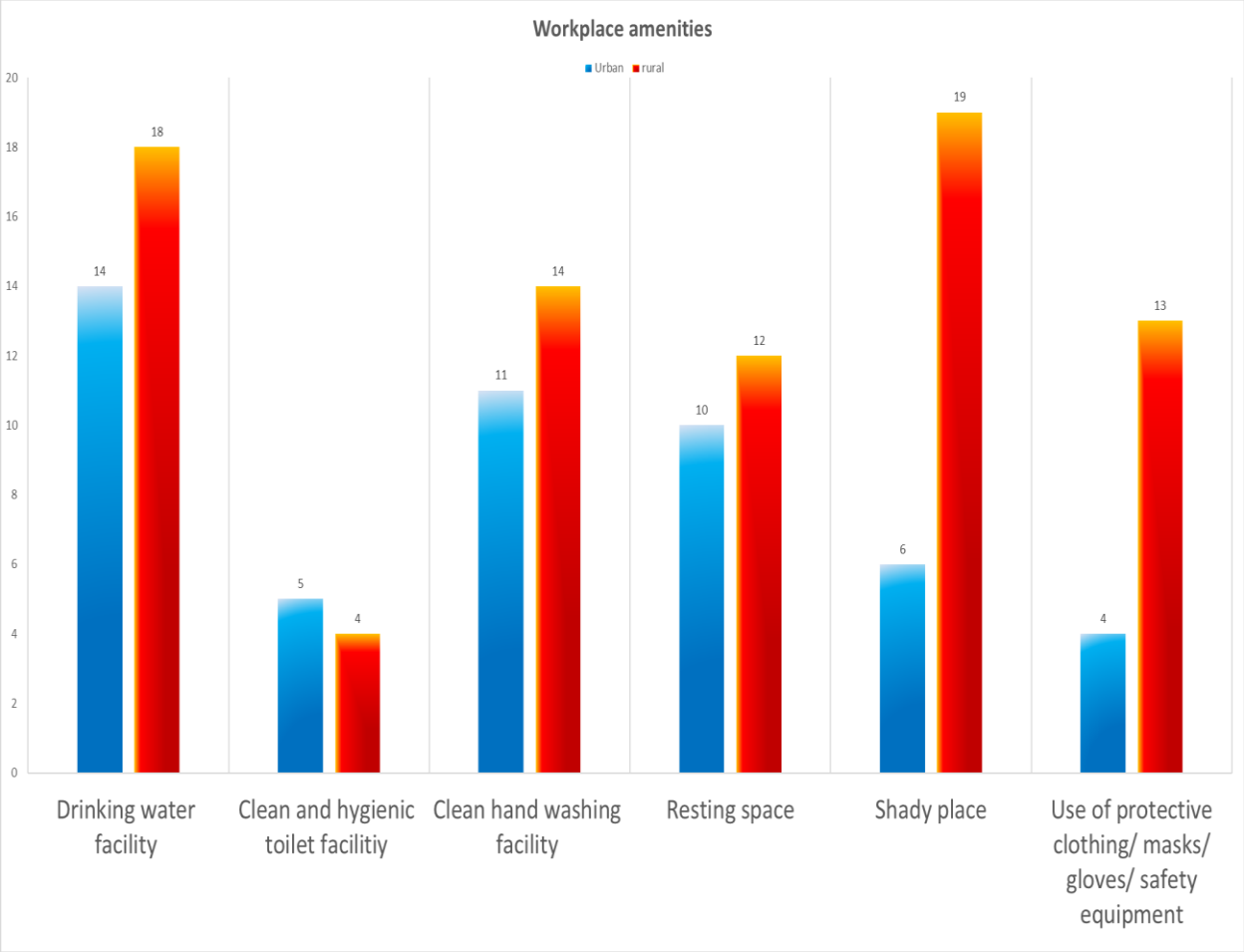

Figure 10: *Availability of work place amenities, (N=40).*

Summary:

High temperatures affect health in many ways, depending on living conditions, family size, and work environment. Houses made of kuchha or semi-pucca materials trap more heat in rural areas, while urban pucca houses contribute to overall heat buildup. The number of windows and ventilation impact airflow, and crowded homes tend to get hotter. Cooking fuels like firewood and cow dung add to indoor heat, especially in poorly ventilated kitchens. Family size and age also matter—elderly people, pregnant women, and young children are more vulnerable to heat stress. Outdoor workers face direct sun exposure, while indoor workers in hot, poorly ventilated spaces struggle with discomfort and dehydration. Heat can worsen health problems, especially for those with hypertension, diabetes, or breathing issues. It can also make joint pain, skin irritation, and respiratory problems worse. To reduce these risks, better housing designs, proper ventilation, cooling measures, hydration, and cleaner cooking fuels are important.