



# Prevalence of noncommunicable diseases and usage of healthcare devices among the masses dwelling in South India, Kadapa

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## ABSTRACT

Non-communicable diseases (NCDs) are much prevalent now-a-days and majority of the patients utilize different medical devices in order to manage these diseases. Hence, there is a strong need to evaluate the utility of medical devices by the population of these diseases. The current study was aimed to assess the usage of medical devices for disease management in the urban and rural settings of a south Indian district. A cross-sectional study was carried out for 18 months with the subjects who met the inclusion criteria. The subjects were recruited into the study by obtaining the ethics committee approval and informed consent from all subjects. A total of 3,000 subjects were screened and among them 1,024 (34.13%) subjects were recruited, with 593 (57.91%) subjects belonging to rural settings and 431 (42.08%) subjects belonging to urban settings. 559 were male (54.68%) and 464 were female (45.31%). In the subjects selected, patients with diabetes and hypertension covered the major part, with 70.70% among other NCDs. Medical devices usage awareness was observed among 520 (50.78%) subjects of the total recruited subjects, and among them 327 (68.65%) and 193 (37.11%) subjects were urban and rural areas, respectively. Some of the commonly used devices among the subjects were glucometers, digital BP apparatus, thermometer, pulse oximeter, and inhaler machine, which constituted about 186 (35.96%), 82 (15.76%), 181 (34.42%), 24 (4.80%), and 47 (9.03%), respectively. Overall, the awareness of medical device usage among the total subjects recruited was found to be 50.78%, with a slightly higher percentage of awareness in urban areas (62.88%;  $n = 327$ ) as compared to rural settings (37.11%;  $n = 193$ ). Hence, it is essential to see that both the rural and urban areas' population need greater awareness on utilization of medical devices through different initiatives.

## INTRODUCTION

Due to rapid industrialization and urbanization, the prevalence of non-communicable diseases (NCDs) like diabetes, hypertension, thyroid, obesity and cardiovascular diseases had increased in the recent past. This is majorly because of the significant modification in the lifestyle. The burden of NCDs was commonly observed among low- and middle-income countries, accounting for an early 80% of all premature mortalities (Arokiasamy, 2018;

Baig *et al.*, 2017; Barik and Arokiasamy, 2016; Eren *et al.*, 2008). Furthermore, untreated or uncontrolled diabetes may lead to microvascular and macrovascular complications (Pelluri *et al.*, 2021). In developing countries like India, nearly 62% of the deaths were caused mainly due to the NCDs (Arokiasamy *et al.*, 2018; Eren *et al.*, 2008; Barik *et al.*, 2016; Baig *et al.*, 2017). This state of affairs is due to the improper utilization of primary healthcare settings by 28% and 22% of urban and rural population, respectively (Raban *et al.*, 2012; Ramana *et al.*, 2015; Rathod *et al.*, 2014; Sinha *et al.*, 2017; Pati *et al.*, 2014).

In such a condition, it is essential to utilize the health care resources effectively and regularly should have the monitoring of the various vital signs, like body temperature, blood pressure, heart rate or pulse, and respiratory rate or breathing rate. Along with these parameters, consistent checks of blood sugar levels and body

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weight changes is also often considered as significant (Pati *et al.*, 2014; Raban *et al.*, 2012; Ramana, 2015; Rathod *et al.*, 2014; Sinha and Pati, 2017). Certain population effected with NCDs, typically use medical devices blood glucose monitors, pulse oximeters, blood pressure monitors, pedometers and weighing scales, and thermometers for constant monitoring of important body metrics in order to diagnose the serious illnesses not only readily but promptly. This had enabled us to improve the effectiveness of treatment and quality of life. In this regard, an assessment study on the use of common medical devices in facilitating the regular observation of the chief body attributes was carried out, all in the comfort of a person's home (Fleming *et al.*, 2018; Frist, 2014; Garewal, 2015; Nethan *et al.*, 2017). These fundamental health conditions were worse in limited-resource settings, like rural areas, where the true problems of any nation shall be highlighted; however, improving the knowledge regarding the usage of medical devices in these areas also shall help in improving the management of NCDs (Pati *et al.*, 2014; Raban *et al.*, 2012; Ramana, 2015; Rathod *et al.*, 2014; Sinha and Pati, 2017). In view of the above facts, a prospective observational study was conducted in a south Indian district, Kadapa region of Andhra Pradesh, focusing on use of common medical devices used in management of NCDs both in urban and rural settings.

## MATERIALS AND METHODS

### Study population

The study population included patients of both urban and rural areas of Kadapa district of Andhra Pradesh, India.

### Inclusion criteria

Adults of both genders suffering with NCDs and residing in urban and rural areas of Kadapa district were included as study participants.

### Exclusion criteria

The following categories of patients were excluded from the study:

- Vulnerable populations, like pediatrics, geriatrics, and pregnant and lactating women, were excluded.
- Mentally challenged people were excluded.
- People who had not given their consent were excluded.

The questionnaire used in the study was according to the World Health Organization WHO STEPwise Approach to NCD Risk Factor Surveillance guidelines. Data were obtained by interviewing each subject, and socio-demographic details, such as age, gender, marital status, occupation, and education, were obtained. Past history and family history of comorbidities, substance abuse, dietary habits, and awareness of any medical emergency number were also included in the questionnaire. This cross-sectional study was conducted on subjects of both genders for a period of 18 months. The medical history of the subjects was collected with the consent of subjects aged  $\geq 35$  years and  $\leq 65$  years, and this survey was conducted as per the prepared questionnaire and then evaluated. Ethical clearance was obtained before the written (or thumb impression) consent was obtained from each subject and the nature and purpose of the study were explained and they were assured privacy and confidentiality of the information provided. Various medical devices that were included in this study were digital BP apparatus, glucometers, thermometer, inhaler machine, and pulse oximeter.

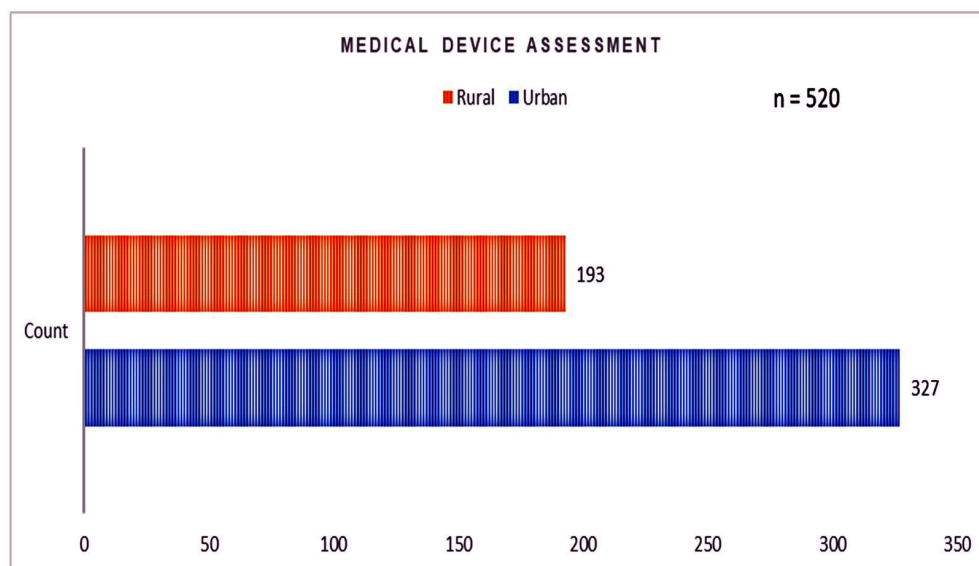
## RESULTS AND DISCUSSION

After the final screening of 3,000 subjects, 1,024 (34.13%) subjects met the criteria; 45.31% and 54.68% were female and male subjects, respectively. In Table 1, it is clearly explained that 26.07% ( $n = 267$ ) and 73.92% ( $n = 757$ ) of subjects are illiterates and literates, respectively. Occupational status demonstrated that 17.96% ( $n = 184$ ) and 82.03% ( $n = 840$ ) of subjects were salaried and daily wage labors, respectively. The diabetic and hypertensive subjects constituted about 70.70% ( $n = 724$ ), diabetic subjects constituted 8.7% ( $n = 90$ ), and other pathological conditions constituted about 20.50% ( $n = 210$ ). In the south Indian district assessment of healthcare devices, usage was observed among 193 (37.11%) and 327 (68.65%) subjects in rural and urban areas, respectively, and a crystal-clear picture of it is shown in Figure 1. An overview of other NCDs, like heart, cancer, respiratory, kidney, and brain disease, constituted about 7.42% ( $n = 76$ ), 2.34% ( $n = 24$ ), 5.56% ( $n = 57$ ), 3.41% ( $n = 35$ ), and 1.75% ( $n = 18$ ), respectively, and all these details are clearly explained in Table 2. Metabolic type of NCDs was more prevalent with a significant  $p$ -value  $< 0.0001$ , with CI ranging between 25.27 and 35.15. An overview on commonly used healthcare devices is mentioned in Table 3, and the different medical devices used by the subjects were

**Table 1.** Demographic details of study participants.

Characteristics	Rural $N = 593$ (%)	Urban $N = 431$ (%)	$p$ value	95% CI
Gender				
Male	203 (34.23%)	356 (82.59%)	$<0.0001$	42.86–53.31
Female	390 (65.77%)	75 (17.41%)	$<0.0001$	37.15–56.64
Literacy levels				
Above secondary school	326 (54.97%)	430 (99.76%)	$<0.0001$	39.37–50.22
Illiterates	270 (45.53%)	1 (0.24%)	0.3647	–34.12–51.25
Occupational status				
Daily wage labors	592 (99.83%)	247 (57.30%)	$<0.0001$	36.46–48.76
Salaried subjects	1 (0.16%)	184 (42.69%)	0.3921	–37.02–49.75

$p$  value  $< 0.05$  was considered as statistically significant.



**Figure 1.** Medical device assessment was demonstrated among 327 (62.88%) and 193 (37.11%) among urban and rural areas, respectively.

**Table 2.** Distribution of NCDs.

Disease category	Rural N = 593 (%)	Urban N = 431 (%)	p value	95% CI
Diabetes and hypertension (Metabolic)	396 (66.77%)	418 (96.98%)	<0.0001	25.27–35.15
Heart failures and myocardial infraction (Cardiovascular)	66 (11.12%)	10 (2.32%)	0.3897	–20.39–18.85
Cancer (Oncology)	23 (3.87%)	1 (0.23%)	0.8537	–75.63–20.08
Asthma and COPD (Respiratory)	56 (9.44%)	1 (0.23%)	0.7551	–70.17–19.66
Acute and chronic renal failure (Renal)	33 (5.56%)	1 (0.23%)	0.8190	–73.98–18.69
Epilepsy (Neurological)	18 (3.03%)	1 (0.23%)	0.8740	–76.45–22.01

p value < 0.05 was considered as statistically significant.

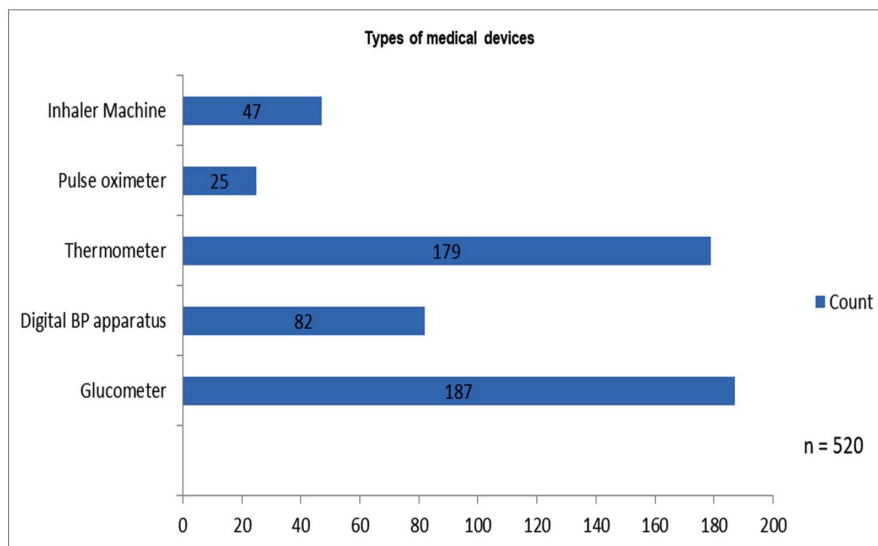
**Table 3.** Distribution of different devices usage among the population.

Devices	Rural N = 239 (%)	Urban N = 281 (%)	p value	95% CI
Glucometer	1 (0.41%)	186 (66.19%)	0.1677	–13.63–72.20
Digital BP apparatus	66 (27.61%)	16 (5.69%)	0.0645	–1.88–34.62
Thermometer	109 (45.60%)	72 (25.62%)	0.0068	5.63–32.72
Pulse oximeter	18 (7.53%)	6 (2.13%)	0.6414	–34.47–26.32
Inhaler machine	46 (19.24%)	1 (0.355%)	0.6364	–60.74–32.45

p value < 0.05 was considered as statistically significant.

glucometers, digital BP apparatus, thermometer, pulse oximeter, and inhaler machine, constituting about 35.96%, 15.76%, 34.42%, 4.80%, and 9.03%, with significant p-values of 0.1677, 0.0645, 0.0068, 0.6414, and 0.6364, respectively, and all these findings are shown in Figure 2. Knowledge on the usage of various healthcare devices and the medical device usage awareness among the rural masses was found to be 37.11% (n = 193) and urban awareness was found to be 62.88% (n = 327), with a significant p-value < 0.0001, and all these details are clearly explained in Table 4.

Eventually, it was clearly understood that awareness on the usage of healthcare devices was slightly more in urban settings compared to rural settings. The digital interventions among the masses with NCDs in India are still in the toddling stage, whereas in developing countries, the situation was a bit better, so some initiatives and programs need to be taken up for igniting the minds of the masses so as to place digital health at dazzling heights (DeGennaro *et al.*, 2018; Joshi *et al.*, 2012; Kandpal *et al.*, 2013; Upadhyay, 2012; Vijayakarthekeyan *et al.*, 2017).



**Figure 2.** Various medical devices among the study population includes usage of device link glucometers, digital BP apparatus, thermometer, pulse oximeter and inhaler machine constituted about 35.96, 15.76, 34.42, 4.80 and 9.03%, respectively.

**Table 4.** Awareness on usage of medical devices among the population.

Medical device usage awareness	Having awareness (Yes)	Not having awareness (No)	<i>p</i> value	95% CI
Urban awareness <i>N</i> = 431 (%)	327 (62.88)	104 (24.12)	<0.0001	28.24–47.56
Rural awareness <i>N</i> = 593 (%)	193 (37.11)	400 (67.45)	<0.0001	21.88–38.19

*p* value < 0.05 was considered as statistically significant.

## CONCLUSION

From the study's findings, it is confirmed that knowledge on the usage of medical devices for the management of NCDs was found to be 50.78% in the south Indian district; this very minimal as compared to the other developed countries, so each and every individual should remember that this digital health is the need of the hour in the global village, to be as the survival of the fittest, and led a healthy life with no quality adjusted life years. Some of the limitations of this study include that a diverse variety of devices was not monitored and data collection from geriatric patients was challenging and geographically was confined to one region only. In the future, this study can be extended to other regions as well.

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## LIST OF ABBREVIATIONS

CI: confidence interval; NCDs: noncommunicable diseases; *p*-value: probability value.

## AUTHOR CONTRIBUTIONS

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for

important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be an author as per the international committee of medical journal editors (ICMJE) requirements/guidelines.

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## CONFLICTS OF INTEREST

The authors report no financial or any other conflicts of interest in this work.

## DATA AVAILABILITY

All data generated and analyzed are included within this research article.

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## ETHICAL CONSIDERATION

The study procedure was approved by the Institutional Review board, Dated:21.02.2020 (IRB/Jan/75) of Vasavi institute of pharmaceutical sciences, Kadapa. The present study was conducted accordance with good clinical practice guidelines. Informed consent form was collected before enrolling into the study.

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