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.

HIGHLIGHTS
• This study provides real-time survey information on the usage of medical devices in the management of noncommunicable diseases (NCDs) in rural and urban areas of Kadapa District, Andhra Pradesh, India.
• The findings of study could be used to establish different initiatives for continuous monitoring of the health condition of the masses.
• The survey data on NCDs were statistically analyzed using MedCalc statistical software.

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 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.

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

*p value < 0.05 was considered as statistically significant.
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 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

### Table 2. Distribution of NCDs.

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

\(p\) value < 0.05 was considered as statistically significant.

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

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

\(p\) value < 0.05 was considered as statistically significant.
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; Vijayakarthikeyan et al., 2017).

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.

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

<table>
<thead>
<tr>
<th>Medical device usage awareness</th>
<th>Having awareness (Yes)</th>
<th>Not having awareness (No)</th>
<th>p value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban awareness N = 431 (%)</td>
<td>327 (62.88)</td>
<td>104 (24.12)</td>
<td>&lt;0.0001</td>
<td>28.24–47.56</td>
</tr>
<tr>
<td>Rural awareness N = 593 (%)</td>
<td>193 (37.11)</td>
<td>400 (67.45)</td>
<td>&lt;0.0001</td>
<td>21.88–38.19</td>
</tr>
</tbody>
</table>

*p value < 0.05 was considered as statistically significant.

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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