Putative Role of Community Pharmacies in Case Detection of Dengue in South India: A Community Intervention Trial

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ABSTRACT

Background: Before visiting a doctor, the majority of people in developing countries stroll to the community pharmacy to buy over-the-counter (OTC) fever medications. **Objectives:** The purpose of the current study is to evaluate the role of community pharmacies for dengue case identification. **Materials and Methods:** A community intervention trial was conducted among the pharmacy staffs in Tamil Nadu. Prior to intervention, pharmacy staffs are trained using modules. Community pharmacy staff members collected information on those with dengue symptoms who visited the enrolled pharmacies for OTC medications during the intervention period and gave it to the research pharmacists engaged for this project. Each suspicious case was followed up on by phone, and research pharmacists offered patient education. Before and after the intervention, community pharmacy staffs' knowledge and their perceptions of dengue referral and health education were compared. The number of dengue suspects detected by pharmacy staffs, as well as the number of suspects diagnosed, was also documented. **Results:** The study involved 191 pharmacies in total. After the intervention, community pharmacy staffs showed a statistically significant ($p<0.001$) improvement in their knowledge, perceptions of referring dengue suspects and giving health education to the community. Using the research methodology, community pharmacy staff suspected 241 dengue cases. Dengue fever was diagnosed in 9 of them by physicians. **Conclusion:** The study model is deemed acceptable by all study stakeholders, according to the findings of the feedback analysis. Undiagnosed dengue cases in the community can be identified using the study methodology.

Keywords: Epidemiology, Communicable, mHealth, WhatsApp.

INTRODUCTION

With roughly 50 million cases recorded each year, dengue fever is one of the viral illnesses that spreads the fastest in the world.[1] Dengue fever is endemic in South East Asia (SEA), the Western Pacific, Africa, the Eastern Mediterranean, and Latin America.[2] Southeast Asia spends about $950 million a year on treating dengue disease.[3,4] Dengue fever has become a major public health issue in India, where it significantly increases morbidity and mortality. Dengue fever cases are on the rise in Tamil Nadu.[5] The state of Tamil Nadu has had the highest number of dengue cases in India through March 31st 2021. Dengue outbreaks have been reported in Tamil Nadu's southern districts, including Dindigul, Madurai, Sivagangai, and Virudhunagar, since the beginning of the year, with Thiruvallur in the Chennai district

reporting the largest number of cases.[6]

Early detection and treatment are critical for lowering the case fatality rate in dengue fever.[7] In most poor and middle-income countries, health human resources are in short supply.[8] All allied health workers should be included in the concerted fight against dengue fever, which is a national priority in our country. A community pharmacy, sometimes known as a retail pharmacy, is a facility that stores and distributes medications to the general people. Community pharmacists or retail pharmacists are pharmacists who work in a community pharmacy. Community pharmacists are essential in today's environment because they handle patients' requests for health care access connected to their medication needs. In India, however, the community pharmacist's primary function remains the distribution of drugs. The majority of community pharmacists in India are diploma holders. Most of these pharmacists receive minimal training after they are qualified, and they are not exposed to up-to-date information.[9]

According to the law, every community pharmacy must have a pharmacist on duty. In reality, there aren't many pharmacists working on-site; instead, the drugstore owner, or another supporter with experience selling medications, like an assistant or attendant, handles the dispensing. About half of all pharmacies are run without pharmacists.[10] The term "community pharmacy staffs" is used throughout this paper to refer to those who work in a community pharmacy but are not pharmacists.

The staff at community pharmacies is the community's first point of contact for any information about health care. Before seeing a doctor, people walk to the local pharmacy for OTC fever drugs. Community pharmacy personnel may come across several cases of undetected dengue cases. As a result, the current study aims to identify and report suspected dengue fever cases by screening those fever cases for OTC using community pharmacy staffs.

It has been hypothesized that community pharmacy staffs will find it difficult to follow up on each suspected case on a regular basis. As a result, we used research pharmacists to educate and follow up on those suspect cases. The primary endpoint of the current study is to determine the feasibility and usefulness of identification of dengue suspects by community pharmacy staffs with training and to educate and follow up those suspects by research pharmacists using mobile phone communication.

MATERIALS AND METHODS

Community pharmacy in the Tiruvallur district participated in a 12-month community intervention trial with pre- and post-test comparative studies. The study was approved by the Institutional Ethics Committee of the Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Porur, Chennai - 600 116, Tamil Nadu, India. (Approval No. IEC-NI/18/JUL/65/32). The study was registered in Clinical Trial Registry - India (CTRI No. CTRI/2019/05/019069). Written informed consent was obtained from the study participants and the study was conducted according to revised National Ethical Guidelines for Biomedical and Health Research Involving Human Participants, Indian Council of Medical Research (ICMR) 2017 and also followed Good Clinical Practice (GCP).

Two research pharmacists were appointed for this study. Pharmacies were issued an invitation letter with the study's title and description to enroll in the study through research pharmacists. Allopathic private pharmacies' pharmacy staffs were enrolled in the trial after obtaining written informed consent. Through the use of pharmacy staff, patients were successively recruited to the participating community pharmacies. No incentives were given to pharmacy staff or patients. An already-validated pre- and post-intervention questionnaire was used for data collection.[11]

Pre intervention stage

The research pharmacists went to the community pharmacies in the chosen area five times in total. In Visit 1, the study's aim and procedure were described to community pharmacy staffs. The community pharmacy staffs provided written informed consent at the next visit (Visit 2). The pre-intervention questionnaire was given to pharmacy staffs to assess their understanding of dengue fever, as well as their current practice of providing patient education and referral to a government health facility for those seeking OTC fever medicine (Visit 3).

Using National Vector Borne Disease Control Program (NVBDCP) material available in English and Tamil,[12] the necessity of early diagnosis of dengue, the distinction between common fever and dengue fever, prevention, complications, and therapy of dengue were all topics covered in training for community pharmacy workers. Differentiating dengue from other febrile illnesses like zika and malaria was also taught to pharmacy staffs. A poster with the signs and symptoms of dengue fever, as well as the research pharmacist's WhatsApp number, was displayed on the community pharmacy notice board or at a location designated by the staffs.

Mobile numbers of all the community pharmacy staffs who were involved in the study was obtained and they were called after their working time, especially on weekends and they were confirmed for the understanding of the education. Anytime staff contacted the research pharmacists, all the study-related procedures were explained and their questions were answered.

Intervention stage

All successive customers who visited community pharmacies during the intervention period without a prescription for over-the-counter fever medicine were questioned by pharmacy employees to determine whether they had a fever (the person themselves or a family member). The pharmacy personnel asked about dengue symptoms including petechial rash, high fever, headache, and eye and muscle pain. Each pharmacy maintained a consent register. The staff of the community pharmacy was instructed to record the name, address, and phone number of the person who visited the drugstore or suffered a setback in that register.

Each day, before to closing the pharmacy, staff members of community pharmacies were asked to WhatsApp information on suspected dengue cases recorded in the registry to research pharmacists.

Community pharmacy staffs were requested to WhatsApp the data of dengue suspected cases listed in the registry every day before shutting the drugstore to research pharmacists. Following receipt of a list of suspected dengue cases from various community pharmacy staffs, research pharmacists called the suspected cases the next day. On call 1, attempts were made to get in touch with the caller; if this was not possible, family members who had already arrived at the pharmacy were contacted. During the call, the specifics of the presenting symptoms were obtained. They were instructed about the nature of the illness, its risk factors, and the need of early detection. A local government health centre was suggested to the patient or relative, and they were informed that the government health centre offers free dengue diagnosis and treatment.

In call 2, the patient's health status and any previous hospital or government health facility visits were recorded. Doctors' directions and diagnostic information were noted in detail. The patient or a family member was encouraged to visit a hospital or government health centre if they hadn't already.

If the person visited a government health facility or any hospital, the specifics of the diagnosis and doctor's

recommendations were noted on call 3. Patients who had symptoms but had not visited a hospital were re-educated, and the reasons for not vising the hospital were scheduled to be noted. If a person did not answer a call for any reason, a second call was placed after an hour. The details of patients who had not visited the hospital after three reminder calls were to be forwarded to the concerned Medical Officer (MO), who would trace the patients using their field staff and take any necessary action, as is standard procedure in the health system.

Post intervention stage

After the intervention period, community pharmacy staffs were given a post-intervention questionnaire (Visit 5). The questions were on the feasibility of using the study model, as well as opinions on scaling up and improvement ideas. The number of dengue suspects detected, referred, patients who visited PHC, and the number of patients diagnosed as a result of the intervention were all documented. Figure 1 depicts a schematic illustration of the work plan.

Data analysis

The data was input into an excel spreadsheet. An independent researcher double-checked the data entry for quality assurance, and it was input into EpiData Version 3.1 and analyzed with SPSS statistics version 20.0. The percentages were used to represent qualitative variables. McNemar's Chi-Square test was used to compare pre and
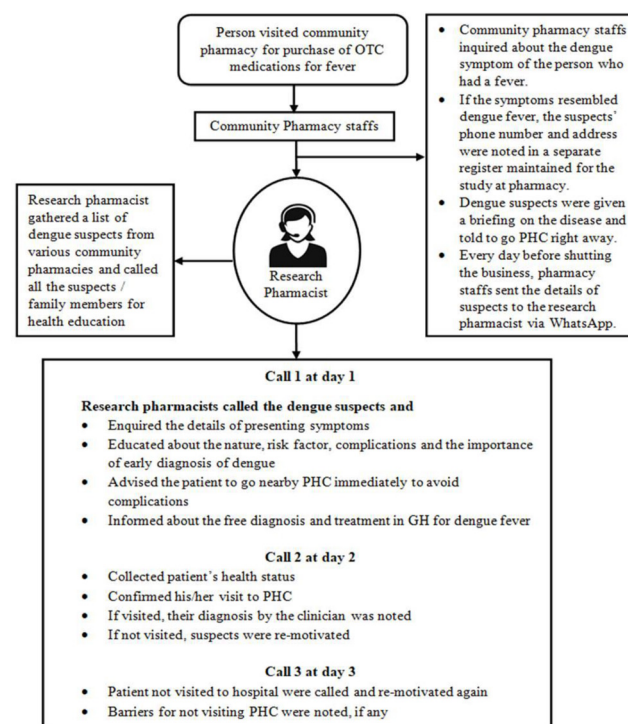

Figure 1: Study model.

post intervention differences. Statistical significance was defined as a *p*-value 0.05.

RESULTS

Characteristics of Participants

284 community pharmacies were contacted in all. 191 of them consented to take part throughout every step of the study. Others declined to join because they didn't want to add to their work load by participating in a research study (12) and others because the drugstore owner wouldn't let them participate in research-related activities (81). Table 1 summarizes the socio-demographic features of community pharmacy staffs. Male staffs were in greater numbers (61%) than female staffs, with the majority of them being between the ages of 31 and 50.

Pre and post intervention of knowledge and perception of pharmacy staffs in the study

Table 2 shows the responses of the community pharmacy staff's knowledge regarding dengue before and after the intervention. Only 52.8% of the staffs were aware that the Government is providing the facility of free diagnosis and treatment for dengue cases. At the end of the study, while collecting the post intervention data, such as the feasibility of using the study model in dengue case identification and referral, the knowledge of dengue was rechecked. There was a statistically significant (*p*<0.001) increase in the staffs of community pharmacies' knowledge for every item. When pharmacy staff perceptions of sending dengue suspects and educating the community about health issues were compared before and after

Table 2: Community pharmacy staffs' knowledge about dengue before and after intervention (*n*=191).

Variables	Pre intervention	Post intervention	*p*-value
Vector for dengue	89 (47%)	191(100%)	<0.001
Vector of dengue breeds in	63 (32.9%)	185 (96.8%)	<0.001
Confirmatory test	85 (44.5%)	182 (95.2%)	<0.001
Risk factors	72 (37.6%)	175 (91.6%)	<0.001
Symptoms	93 (48.6%)	191 (100%)	<0.001
Duration of therapy	64 (33.5%)	186 (97.3%)	<0.001
Contagious	92 (48.1%)	190 (99.4%)	<0.001
Vaccination	77 (40.3%)	189 (98.9%)	<0.001
Permanent treatment	82 (42.9%)	187 (97.9%)	<0.001
Awareness of free diagnosis, treatment by the Government	101 (52.8%)	191 (100%)	<0.001

the intervention, a statistically significant (*p*<0.001) improvement was found (Table 3).

Process and outcome indicators

During the intervention period, 1,84,132 people visited pharmacies to acquire OTC fever-relief medications. Among these, 241 people had symptoms that suggested they might have dengue fever, as determined by the community pharmacy staff. They were all given information regarding dengue by community pharmacy staff, who also recommended patients to visit a PHC for a doctor's appointment and to refrain from using self-medication. While the phone number and address of others were recorded on a separate register kept at each community pharmacy, 39 people were reluctant to consent to the study.

Research pharmacists called all the consented dengue suspects. All the 202 suspects responded to the phone call made by the research pharmacists. Of them, 178 suspects visited their nearby PHC/clinic at the first phone call and were not diagnosed as dengue fever. On subsequent phone calls (day 2 and day 3), it is observed that their health status is well improved. 24 suspects who were not going to hospital on first call were called on day 2 and 3 and motivated again to go nearby hospitals for definitive diagnosis of their health condition. On their hospital visit, 9 cases were diagnosed as dengue fever by the clinicians.

Feedback analysis of the study

Community pharmacy staffs, research pharmacists, dengue suspects and dengue cases all provided feedback on the study model. At the community pharmacy staffs

Table 1: Characteristics of the pharmacy staffs (*n*=191).

Socio-demographic variables n %		
Gender		
Male	116	61
Female	75	39
Age in years		
18-30	64	34
31-50	102	53
51-70	25	13
Qualification		
Diploma in Pharmacy	49	26
Bachelor in Pharmacy	52	27
Non-pharmacists	90	47
Experience		
1-5 years	81	42
6-10 years	62	32
≥11 years	48	25

Table 3: Perception of community pharmacy staffs in dengue referral and health education before and after the intervention (*n*=191).					
Variables	**Almost always**	**Often**	**Sometimes**	**Seldom**	**Never**
Patients visit GH after referral					
Pre intervention	65 (34%)	53 (27.7%)	36 (18.8%)	25 (13%)	12 (6.2%)
Post intervention	102 (53%)*	50 (26.1%)	49 (25.6%)	-	-
Referral increases patient trust					
Pre intervention	74 (38.7%)	45 (23.5%)	32 (16.7%)	30 (15.7%)	10 (5.2)
Post intervention	120 (62.8%)*	55 (28.7%)	16 (8.3%)	-	_
Health education to dengue suspects					
Pre intervention	69 (36.1%)	50 (26.1%)	29 (15.1%)	28 (14.6%)	15 (7.8%)
Post intervention	135 (70.6%)*	40 (20.9%)	16 (8.3%)	-	-
Health education hampers work schedule					
Pre intervention	73 (38.2%)	53 (27.7%)	35 (18.3%)	23 (12%)	7 (3%)
Post intervention	125 (65.4%)*	60 (31.4%)	6 (3%)	-	-

* $p<0.001$.

level, all pharmacy staffs were comfortable with keeping a registry at their pharmacy and submitting daily reports of dengue suspects to research pharmacists via WhatsApp. They did, however, require a reminder call. Receiving the dengue suspects list from the community pharmacy staffs via WhatsApp was extremely convenient for the research pharmacists.

The provision of health education to dengue suspects through phone call was favorably appreciated by the suspects and their families. The efforts made by community pharmacy staffs and research pharmacists were appreciated by both dengue suspects and cases in the study. All of the study's stakeholders rated the feasibility of employing the study model in the identification and referral of dengue suspects as "satisfied."

36 (19%) pharmacy staffs offered suggestions for improving the study model, such as creating a WhatsApp group among community pharmacy staffs and sending a reminder message to the group for daily reporting to research pharmacists. Patients may have requested that a WhatsApp or SMS message about dengue be sent to them so that they can save and understand it at their own leisure, according to research pharmacists.

DISCUSSION

This is the first study to show community pharmacy staffs participating in the detection and referral of dengue cases through research pharmacists. Because there is no specific medicine or commercially available vaccine for dengue fever, prevention is the sole option. As a result, it's critical to report dengue fever infections as soon as possible so that preventative actions can be taken before the disease spreads further.[13]

However, in the present day, when someone develops a fever, they attempt to treat it at home. When the condition doesn't get better, people visit the pharmacy and ask for OTC medications for myalgia, fever, and other conditions. If their health condition does not improve after taking OTC medication for a few days, they go to the hospital for medical guidance. If the fever is a dengue fever, by the time the patient sees a doctor, the situation has worsened and may progress to dengue hemorrhagic fever, which can lead to death.

Patients who go to the pharmacy without a prescription should be thoroughly assessed for dengue symptoms and referred to a hospital for a confirmed diagnosis. According to a survey conducted by Ravichandran A and Basavareddy A in 2016, community pharmacists administered 72.32% of OTC drugs for fever.[14] Another study on the incidence of self-medication in Chennai found that 73% of self-medication was for the common cold, 52% for aches and pains, and 32% for fever.[15]

The Tamil Nadu government has taken significant steps to prevent and control dengue fever. The Tamil Nadu Health Department has directed community pharmacists to refer all patients who take OTC fever drugs to government hospitals via drug inspectors (DI). Patients can get a free diagnosis and treatment for dengue fever at government clinics. Dengue fever is on the rise in Tamil Nadu, despite many steps made by the state health authority to contain it.[16] The goal of developing community-based control initiatives is to inform the existing community of the steps needed to

eradicate mosquito breeding grounds.[17] Depending on their level of education and understanding, members of a community are categorized into a variety of categories.[18] The importance of community-based dengue mosquito eradication efforts has been demonstrated by increased community awareness in the Kerala district,[19] Mexico,[20] and Cuba.[21]

Recently, the Ministry of Health and Family Welfare, Government of India prepared and released a document entitled, "Strategy and plan of action for effective community participation for prevention and control of dengue". This was introduced with the aim that implementation of community-based comprehensive program, involving local institutions and understanding of the community, enable the community members to participate in the planning and management of prevention and control activities.[22]

Community pharmacists, who frequently interact with patients, are crucial to the treatment and management of dengue. Because they are a part of their own community, people put a lot of faith in them.[10] Due to factors including lengthy wait times to see doctors and lack of consulting fees, people prefer to use them.[23] Community pharmacists frequently encounter undiagnosed dengue patients since they are the initial point of contact for patients. As a result, it gives community pharmacists a fantastic opportunity to identify persons exhibiting dengue symptoms and advise them to visit a hospital for a clinical investigation. Community pharmacists were therefore used in the current investigation to identify the dengue suspects.

Community pharmacists have long been respected as health experts in developed nations and have participated in international programmes alongside doctors. It is clear that community pharmacies have a considerable impact on the healthcare system.[24] Contrary to developments in developed nations, community pharmacist participation in community life is still incredibly low in developing nations like India. Since community pharmacists already have a lot on their plates, they are unable to spend enough time with each patient to keep track of their health.[11,25] The absence of an information and communication network is one of the major issues faced by healthcare professionals in developing nations like India. In conventional clinical and public health institutions, information is channeled through a hierarchy of physicians and regional or national authorities before being disseminated to the general public through periodic announcements. The widespread use of mobile phones in developing nations has created new potential to boost productivity, efficiency, and communication in the healthcare industry. Mobile

health, or mHealth, is the use of traditional wireless and mobile technology to achieve health goals.[26] In the literature, even in low- and middle-income settings, there has been widespread acknowledgement of the potential of mHealth integration into current health systems.[27-30] In the present study also both community pharmacy staffs and research pharmacists were highly comfortable in sharing the dengue suspects via mobile phone communication and WhatsApp messages. Also, the provision of health education through a phone call to dengue suspects was well received by the suspects and their family members.

The present study has shown that the study model for dengue identification in the present format was highly appreciated. In addition, the underlying non-technical reasons that prevent dengue case identification and referral from community pharmacy staffs have to be addressed for success of interventions related to dengue case identification. Effective strategies for enabling voluntary rather than obligatory compliance for identification of dengue cases from community pharmacy staffs have to be considered.

Limitations

The involvement of a research pharmacists in this study substantially aided in achieving the goal. However, the hiring of a research pharmacists is a major impediment to implementing this paradigm in a program or on a nationwide scale.

CONCLUSION

Community pharmacy staffs received training that enhanced their understanding of dengue, as well as their referral and perspectives of giving health education to the community. All of the dengue suspects favorably appreciated the pharmacists' education. Community pharmacy staffs were helpful in referral cases and research pharmacists were comfortable delivering patient education over the phone, and the dengue suspects and cases welcomed the service. Overall, the studied study model is a feasible and effective method for identifying undiagnosed dengue cases that go to the pharmacy for over-the-counter medications.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

OTC: Over-The-Counter; **SEA:** South East Asia; **NVBDCP:** National Vector Borne Disease Control Program; **DI:** Drug Inspectors; **MO:** Medical Officer.

SUMMARY

Patients who go to the pharmacy for over-the-counter fever treatments may have dengue fever. Community pharmacy staffs are swamped with work and unable to keep track of each dengue suspect. In the present study, a paradigm is developed to get and follow a dengue suspect list from community pharmacies. The developed methodology proved successful in identifying underdiagnosed dengue cases in the community. The model developed and implemented in this study was devised after extensive discussion with various stakeholders and is best suited to selected districts of Tamil Nadu. Blind mere acceptance of model without local modification may not serve the true purpose. Hence, few meticulous steps are required for replicating this model in different cities, districts, states, and counties. The first and most crucial step is to comprehend the model and discuss it with all stakeholders and penetration of mobile technology, its acceptance and usage in that particular area.

REFERENCES

1. Special programme for research and training in tropical diseases. World Health Organization., World Health Organization. Epidemic and Pandemic Alert and Response. Dengue: guidelines for diagnosis, treatment, prevention, and control. TDR; 2009: 147.

2. Chang SF, Huang JH, Shu PY. Characteristics of dengue epidemics in Taiwan. J Formos Med Assoc. 2012;111(6):297-9. doi: 10.1016/j.jfma.2011.12.001, PMID 22748618.

3. Guzman MG, Harris E. Dengue. Lancet. 2015;385(9966):453-65. doi: 10.1016/S0140-6736(14)60572-9, PMID 25230594.

4. Shepard DS, Undurraga EA, Halasa YA. Economic and disease burden of dengue in Southeast Asia. PLOS Negl Trop Dis. 2013;7(2):e2055. doi: 10.1371/journal.pntd.0002055, PMID 23437406.

5. Available from: https://www.livemint.com/Science/LHBiyAUyUMf1jr2UoXnJGJ/Dengue-deaths-on-the-rise-in-Tamil-Nadu.html assessed on May 16; 2018 [cited 7/11/2022].

6. Available from: http://nvbdcp.gov.in/DENGU1.html assessed on November 16; 2019 [cited 7/11/2022].

7. Shet A, Kang G. Dengue in India: towards a better understanding of priorities and progress. Int J Infect Dis. 2019;84S:S1-3. doi: 10.1016/j.ijid.2019.03.008, PMID 30877040.

8. Kabene SM, Orchard C, Howard JM, Soriano MA, Leduc R. The importance of human resources management in health care: a global context. Hum Resour Health. 2006;4:20. doi: 10.1186/1478-4491-4-20, PMID 16872531.

9. Basak SC, Sathyanarayana D. Community pharmacy practice in India: past, present and future. South Med Rev. 2009;2(1):11-4. PMID 23093872.

10. Basak SC, Prasad GS, Arunkumar A, Senthilkumar S. An attempt to develop community pharmacy practice: results of two surveys and two workshops conducted in Tamil Nadu. Indian J Pharm Sci. 2005;67:362-7.

11. Gopi R, Pankaj SB, Rajanandh MG. Usefulness and effectiveness of community pharmacists-led mobile phone communication in identification and referral of presumptive tuberculosis cases in a selected district of Tamil Nadu. Indian J Tuberc. 2021. doi: 10.1016/j.ijtb.2021.10.002.

12. Available from: https://nvbdcp.gov.in/index1.php?lang=1&level=1&sublinkid=5776&lid=3690 [cited 7/11/2022].

13. World Health Organization. Available from: http://www.who.int/denguecontrol/en/ [cited 7/11/2022].

14. Ravichandran A, Basavareddy A. Perception of pharmacists regarding over-the-counter medication: A survey. Indian J Pharmacol. 2016;48(6):729-32. doi: 10.4103/0253-7613.194857, PMID 28066116.

15. Varadarajan V, P. Paul CM, S. S, S. P, Kumar K, P. U. DD A cross sectional study on the prevalence of self-medication in a Chennai based population, Tamil Nadu, India. Int J Community Med Public Health;4(2): 418-23. doi: 10.18203/2394-6040.ijcmph20170265.

16. Available from: https://www.deccanchronicle.com/lifestyle/health-and-wellbeing/220318/tamil-nadu-health-department-buzzing-with-action-against-dengue.html [cited 7/11/2022].

17. Rather IA, Parray HA, Lone JB, Paek WK, Lim J, Bajpai VK, *et al*. Prevention and control strategies to counter dengue virus infection. Front Cell Infect Microbiol. 2017;7:336. doi: 10.3389/fcimb.2017.00336, PMID 28791258.

18. Abbas A, Abbas RZ, Khan JA, *et al*. Integrated strategies for the control and prevention of dengue vectors with particular reference to Aedes aegypti. Pak Vet J. 2014;34:1-10.

19. George LS, S. A, Paul N, Leelamoni K. Community based interventional study on dengue awareness and vector control in a rural population in Ernakulam, Kerala. Int J Community Med Public Health. 2017;4(4):962-7. doi: 10.18203/2394-6040.ijcmph20170984.

20. Tapia-Conyer R, Méndez-Galván J, Burciaga-Zúñiga P. Community participation in the prevention and control of dengue: the patio limpio strategy in Mexico. Paediatr Int Child Health. 2012;32;Suppl 1:10-3. doi: 10.1179/2046904712Z.00000000047, PMID 22668443.

21. Vanlerberghe V, Toledo ME, Rodríguez M, Gómez D, Baly A, Benítez JR, *et al*. Community involvement in dengue vector control: cluster randomised trial. MEDICC Rev. 2010;12(1):41-7. doi: 10.1136/bmj.b1959, PMID 20387334.

22. Available from: http://nvbdcp.gov.in/DENGU1.html assessed on May 16; 2018 [cited 7/11/2022].

23. Mossialos E, Courtin E, Naci H, Benrimoj S, Bouvy M, Farris K, *et al*. From "retailers" to health care providers: transforming the role of community pharmacists in chronic disease management. Health Policy. 2015;119(5):628-39. doi: 10.1016/j.healthpol.2015.02.007, PMID 25747809.

24. Katoue MG, Awad AI, Kombian SB. Role of community pharmacists in the prevention and management of the metabolic syndrome in Kuwait. Int J Clin Pharm. 2013;35(1):57-64. doi: 10.1007/s11096-012-9705-4, PMID 23070619.

25. Crilly P, Patel N, Ogunrinde A, Berko D, Kayyali R. Community pharmacists' involvement in research in the United Kingdom. Pharmacy (Basel). 2017;5(3):48. doi: 10.3390/pharmacy5030048, PMID 28970460.

26. WHO New horizon for health through mobile technologies. Global Observatory for e-health Series. World Health Organization; 2011.

27. Labrique AB, Vasudevan L, Kochi E, Fabricant R, Mehl G. Mhealth innovations as health system strengthening tools: 12 common applications and a visual framework. Glob Health SciPract. 2013;1(2):160-71. doi: 10.9745/GHSP-D-13-00031, PMID 25276529.

28. Velayutham B, Thomas B, Nair D, Thiruvengadam K, Prashant S, Kittusami S, *et al*. The usefulness and feasibility of mobile interface in tuberculosis notification (MITUN) voice based system for notification of tuberculosis by

private medical practitioners--A pilot project. PLOS ONE. 2015;10(9):e0138274. doi: 10.1371/journal.pone.0138274, PMID 26376197.

29. Abdulrahman SA, Rampal L, Ibrahim F, Radhakrishnan AP, Kadir Shahar H, Othman N. Mobile phone reminders and peer counseling improve adherence and treatment outcomes of patients on ART in Malaysia: A randomized clinical trial. PLOS ONE. 2017;12(5):e0177698. doi: 10.1371/journal.pone.0177698, PMID 28520768.

30. Ganesan M, Prashant S, Mary VP, *et al*. The use of mobile phone as a tool for capturing patient data in southern rural Tamil Nadu, India. J Health Inform Dev Ctries. 2011; 5(11):219-27.