Storage of Medicines and Temperature Control at Community Pharmacies in Rural District of Sindh, Pakistan: An Exploratory Cross-Sectional Study

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Abstract

Background: **Medicines are the essential tools for prevention, cure and control of diseases. If these medicines are ineffective then their aftermath can cause wastage of resources. Medicines lose their required effectiveness due to inadequate storage at required temperature.**

Objective: **The objective was to estimate the proportion of pharmacies with high temperature (>25°C) inside pharmacy outlets in two talukas (sub-districts) of district Thatta, Sindh**

Methodology: **An exploratory cross sectional study design was conducted from August 2013 to August 2014. All pharmacies of the two talukas were approached by doing a census. Descriptive analysis was done to calculate the frequencies and proportions.**

Results: **All pharmacies (n=62) had a temperature of >25°C inside the pharmacies. Medicines were exposed to sunlight in 39 (63%) of the pharmacies and 39 (63%) of pharmacies had refrigerators to keep insulin and vaccines. Median duration of electricity shut downs was 12 hours per day and 11% of the pharmacies had back up power supply.**

Conclusion: **More than a quarter of pharmacy owners were aware about maintaining the required temperature of < 25°C but none of them were maintaining required temperature. Considering the electricity shut down, it is important to make cost effective and long term strategies to maintain the efficacy of medicines. Proper legislation needs to be enforced with continuing training programs for pharmacy owners. Further research is required to explore different ways of maintaining required temperature to ensure the adequate efficacy of medicines.**

Key words: **Pharmacy, Temperature control, Storage, Medicines**

Introduction

Medicines including vaccines are considered as one of the important tools in combating diseases across the world, but these medicines may also cause adverse events with varying severity which usually depend upon patient as well as product related factors(1). This issue is even more critical in developing countries where most medications are not stored at appropriate conditions and can be easily purchased over the counter(1). Medicinal products require appropriate storage conditions in order to ensure the quality and efficacy of medicines (2). Medicines which are not stored on required temperature (< 25? C) can further increase unnecessary burden on economy of general population due to their ineffectiveness in curing of disease (2).

Literature shows that stability of pharmaceutical products is extremely essential to maintain their therapeutic efficacy(3). Temperature plays a key role to maintain the required efficacy of medicines (4-6). It has been suggested that more than 50% of medicines should be stored on required temperature, which is usually less than 25?C (6-8). Apart from high temperature (> 25°C), direct exposure to sunlight and improper management of medicines during shipment can also cause damage to pharmaceutical products like antivirals, multi-vitamins, acetaminophens, antibiotics, diuretics, hydrocortisone, eye drops, analgesics, anti-depressants and latex products such as male condoms (9, 10). Light can change the properties of different materials and products. This change in properties can be due to steadily increasing exposure of medicines to high temperature during storage or dispensing the medicines at the pharmacies through different mechanisms(11, 12).

Almost every country in the world has some mechanism of providing drugs to people residing in communities, either through proper prescription or without prescription of medications. These countries have retail and wholesale pharmacies working regularly to serve their community (1).

likewise other countries, there are an estimated 45 000 to 50 000 wholesale and retail drug outlets in Pakistan (1). Although there is a network of health services in Pakistan's public sector, and overabundance of private sector initiatives, 45% of the population still lacks access to health services (13). Thus, in order to meet health needs and to reduce out of pocket payment, people rely on alternative health care systems such as traditional medicine practitioners, chemists, faith healers, and homeopaths(1). Self-medication has been consistently increasing due to large gaps in the formal health sector of the country (1).

Furthermore, people usually rely on the nearby accessible medical stores or small community pharmacies to purchase medicines for different diseases (14, 15). In many countries, community pharmacies are places where people may obtain health advice and assistance to manage their disease states with required medications (16). Moreover, these pharmacies are often the first point of contact for patients seeking health care as they are usually more accessible and less socially distant than other providers including medical doctors (1). Community pharmacies have been considered as a key interface between the health care system and the general public (14, 15). It is common that many workers at community pharmacies are involved in providing health advice on most of the health problems prevailing in community (14, 15). Even most of the times, community pharmacy workers prescribe medicines, which are sometimes safe and effective when used correctly, however these can become dangerous in case of emergencies (17, 18). Community pharmacies are perceived as an easy and convenient source of advice, referral to nearby facility and source of required information by the patients and their families in developing world, including Pakistan (19, 20).

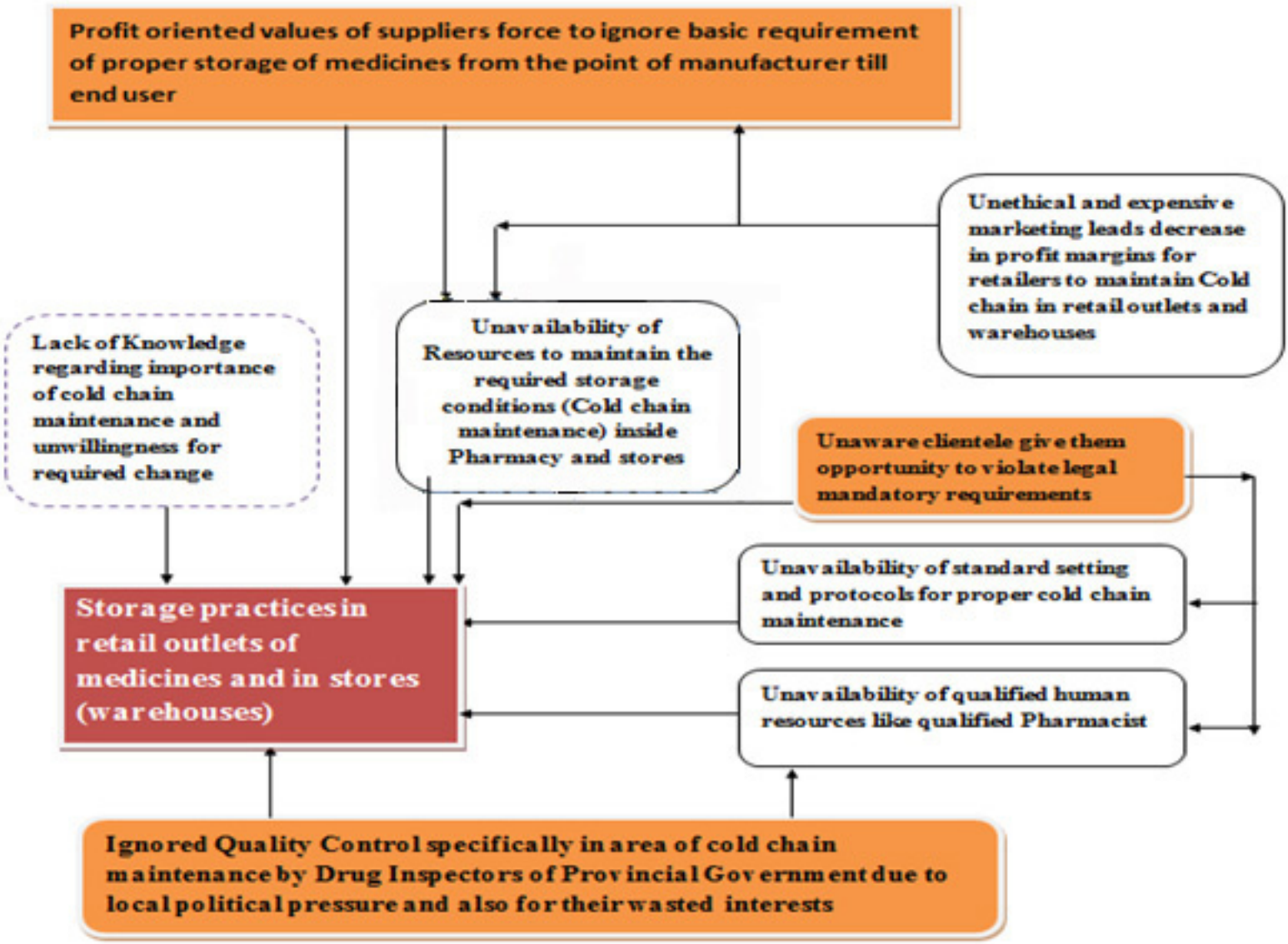
Community pharmacy owners can be considered as one of the important influential stakeholders in health care system who can affect the drug usage owing to their scale of operations and placement in the healthcare delivery system (21). Looking at importance of community pharmacies and their outreach services, many developing countries have used their potential to promote safe and effective treatments (17). This has been done by enhancing their dispensing practices and management of medicines inside pharmacy outlets and in stores, which are easily acceptable to community pharmacy workers and their owners (17).

In Pakistan unfortunately the area of community pharmacy has been ignored by policymakers to make collaboration of community pharmacy workers and owners with other stake holders in health sector of country for the betterment of population. Therefore it is essential to work in team by including community pharmacy workers for betterment of general population (22)

Thus it is essential to know the importance of community pharmacies in the context of temperature management during hot weather and particularly in rural areas of Pakistan (23).

Furthermore, in Pakistan there is an issue of increased electricity shut downs in rural areas even for more than 12 hours which prevents storing medicines at required temperature in community pharmacies of rural areas of Pakistan. Community pharmacies are one of the important sources of dispensing medicines to the Pakistani population. Knowledge about proper storage of medicines at required temperature in community pharmacies is not available. In country like Pakistan many other issues also arise in hot weather and it is a challenge to store the medicines appropriately on required temperature due to electricity shut downs and lack of backup power supply (23). Thus, it is important to know that whether the medicines are stored on required temperature or not, particularly in community pharmacies of rural areas.

Figure 1: Storage Practices in retail Pharmacies at District Level: A conceptual Framework



This study had assessed the practices regarding storage of medicines in rural area of Sindh, Pakistan. This study was aimed to estimate the proportion of pharmacies with high temperature (> 25 °C) inside the pharmacy outlets in Sindh Pakistan and to estimate the proportion of pharmacies selling vaccines, insulin and have refrigerators with and without backup power supply. This information will contribute to improve policies for managing and storing medicines appropriately especially in remote areas of Sindh.

Methods

Exploratory cross sectional study design was used to conduct this study form August 2013 to August 2014. This study was conducted in two areas of the Thatta district. These areas included two talukas (sub-districts), Sujawal and Jati. Thatta is a rural district in the southernmost part of Sindh province in Pakistan, bordering Karachi (24). The estimated population of district is around 1513194 (25) with literacy rate of 22.1% (26). There are five public sector hospitals in Thatta, as well as 8 rural health centers (RHCs) and 51 basic health units (BHUs).

Those community pharmacies which were selling at least allopathic medicines in the two talukas (sub-districts) of district Thatta (Sujawal and Jati) and whose pharmacy owners gave the written informed consent were included in this study. While those pharmacies, which were located in the hospital premises or where a medical doctor was practicing were excluded from this study.

We did a census for all pharmacies of two talukas (sub-districts) to get the list of eligible pharmacies. The census covered a total of 70 pharmacies and all 70 pharmacies and their pharmacy owners or drug sellers were approached but 8 pharmacies refused to give the informed consent thus could not be included in the study. Thus 62 pharmacies were included through consecutive non-probability sampling.

Pharmacy owners were interviewed through a structured and pretested questionnaire. A checklist was also used to assess the storage conditions in the community pharmacies during month of June and July 2014. Room thermometer was used to measure the temperature in all the selected pharmacies. Three digital thermometers and three mercury maximum/minimum thermometers were purchased and checked by comparing these thermometers with standard thermometer in biomedical department of Aga Khan University for 20 hours. The

Table 1: Knowledge of pharmacy owners about temperature and storage practices (n=62)

Characteristics	n (%)
Service provision in years by pharmacy owners [median (IQR)]	8 (6-10)
Knowledge about temperature of pharmacies (Inner half)	
Less than 25°C	18 (29.0%)
Equal to 25°C	2 (3.2%)
25°C to 30°C	41 (66.1%)
Equal to 30°C	1(1.6%)
Knowledge about temperature of pharmacies (Outer half)	
Less than 25°C	17 (27.4%)
Equal to 25°C	2 (3.2%)
25°C to 30°C	36 (58.1%)
Equal to 30°C	7 (11.3%)
Temperature monitoring	
Yes	2 (3.2%)
No	60 (96.8%)
Frequency of temperature monitoring	
Daily	1 (1.6%)
Weekly	1 (1.6%)
Calibrate the thermometer against certified thermometer	
Yes	0 (0%)
No	2 (3.2%)
Awareness about spoiling of medicines due to high temperature	
Yes	61(98.4%)
No	1 (1.6%)
knowledge about lethality of medicines due to sunlight exposure	
Antibiotics	39(62.9%)
NSAIDs	13(21.0%)
Anti-Allergic	10(16.1%)
Check outdated medicines	
Yes	60 (96.8%)
No	02 (3.2%)
Frequency of checking outdated medicines	
Weekly	11(17.7%)
Monthly	48(77.4%)
Quarterly	1 (1.6%)

biomedical department engineers agreed within standard deviation of 0.2°C. Two digital thermometers along with mercury thermometers were placed in every community pharmacy for half an hour. One thermometer was kept in outer half of the community pharmacy where first drug was placed and one in inner half of the community pharmacy along where last drug was placed. Over the same period of time maximum ambient air temperature of Karachi was also noted from website of Pakistan meteorological department, whose results displayed on different web pages. Three readings of the temperature were taken at three different timings of the day. The maximum temperature in the day was recorded at 1500 hours of each day. After taking the three readings, an average value of all readings was taken to overcome the intra rater bias.

Data was analyzed through SPSS version 19. Frequencies and proportions were generated for all the variables. Estimated prevalence of pharmacies with high temperature (>25 °C) was calculated. Descriptive statistics were computed for both continuous and categorical variables. This study was conducted only after ethical approval by Ethical Review Committee (ERC) of the Aga Khan University.

Results

From a total of 70 pharmacies, 62 pharmacy owners expressed their willingness to participate in the study, making the interview response rate as 95%. Median duration of service provision by pharmacy owners in the community was 8 years with interquartile range (IQR) of 6-10 years (Table 1).

With respect to knowledge about temperature of pharmacies, 18 (29%) of the pharmacy owners reported that temperature of inner half of pharmacy should be below 25 °C, 41 (66%) reported that temperature of inner half of pharmacy should be between 25 °C and 30 °C, 2 (3%) pharmacy owners reported that temperature should be equal to 25°C, and 1 (2%) reported that temperature should be equal to 30°C. With respect to the temperature of outer half of pharmacy, 17 (27%) of the pharmacy owners reported that temperature should be less than 25°C, 36 (58%) pharmacy owners said that it should be between 25°C and 30°C, 7 (11%) owners reported that temperature should be equal to 30°C, while 2 (3%) pharmacy owners reported that temperature should be equal to 25°C. Regarding temperature monitoring, 2 (3%) pharmacy owners reported that they used to monitor the temperature of main pharmacy with a room thermometer but none of them used to maintain the temperature of storage area up to required level. Out of these 2 pharmacies, 1 (2%) pharmacy owner reported to monitor the temperature on a daily basis while 1(2%) reported to monitor the temperature on a weekly basis. None of them used to calibrate the thermometer against the certified thermometer (Table 1).

With respect to knowledge about temperature of pharmacies, 18 (29%) of the pharmacy owners reported that temperature of inner half of pharmacy should be below 25 °C, 41 (66%) reported that temperature of inner half of pharmacy should be between 25 °C and 30 °C, 2 (3%) pharmacy owners reported that temperature should be equal to 25°C, and 1 (2%) reported that temperature should be equal to 30°C. With respect to the temperature of outer half of pharmacy, 17 (27%) of the pharmacy owners reported that temperature should be less than 25°C, 36 (58%) pharmacy owners said that it should be between 25°C and 30°C, 7 (11%) owners reported that temperature should be equal to 30°C, while 2 (3%) pharmacy owners reported that temperature should be equal to 25°C. Regarding temperature monitoring, 2 (3%) pharmacy owners reported that they used to monitor the temperature of main pharmacy with a room thermometer but none of them used to maintain the temperature of storage area up to required level. Out of these 2 pharmacies, 1 (2%) pharmacy owner reported to monitor the temperature on a daily basis while 1(2%) reported to monitor the temperature on a weekly basis. None of them used to calibrate the thermometer against the certified thermometer (Table 1).

Regarding the knowledge about toxic effects of medicines due to sunlight exposure, 39 (63%) of the pharmacy owners reported that antibiotics can become ineffective if exposed to sunlight, followed by 13 (21%) owners indicating NSAIDS become ineffective upon sunlight exposure (Table 1). Out of 62 pharmacies, 30 (48%) pharmacy owners reported selling of insulin; all of them used to keep the insulin in refrigerators. Sixteen (26%) pharmacy owners reported selling of vaccines and keeping them in refrigerators. Regarding electricity shut down, all owners reported that they face this problem in their respective talukas; its median duration being 12 hours per day (IQR: 12-14hrs) but only 7 (11%) pharmacies had a backup supply of power (Table 2).

Furthermore, 35 (56%) pharmacies were found to have items, grouped in amounts that are easy to count. With respect to expired medicines, all 62 pharmacy owners used to keep the items with short expiry dates in front, while those medicines which had long expiry date were placed at the back (“first expired first out” principle). 9 (15%) pharmacies were maintaining the record for the removal of items including date, time, witness and manner of removal (Table 3).

Approximately 1.6% of the pharmacies were found to have the poor quality items in the shelves and similar proportion had any overstocked items in the shelves (Table 3). Moreover, the floors, walls, sinks, benches, shelves, containers and dispensing bottles were found to be clean in about 59 (95%) pharmacies. Only 4 (6%) pharmacies had a clearly defined area for reception of products, and 3 (5%) pharmacy owners reported that drugs are not handled with bare hands (Table 3).

Table 2: Storage practices of the medicines required to be stored in cool place (n=6

Characteristics	n (%)
Store insulin in Refrigerator	
Yes	30 (48.4%)
No	32 (51.6%)
Store Vaccine in Refrigerator	
Yes	16 (25.8%)
No	46 (74.1%)
Electrical shut downs compromising storage	
Yes	62 (100%)
No	0 (0%)
Duration of load shedding in hours [median(IQR)]	12 (12-14)
Back up supply of power	
Yes	7 (11.3%)
No	55(88.7%)

All of the 62 pharmacies (100%) had a temperature of >25°C (Table 4). In 39 (63%) pharmacies, sunlight exposure to medicines was evident. Among the medicines exposed to sunlight, NSAIDs comprised the major proportion (51.2%), followed by antibiotics (38.4%) and multivitamins (20.5%).

Similarly, 39 (63%) pharmacies had refrigerators to keep the important medicines in cool environment but only 2 (3%) pharmacies had temperature-monitoring devices (Table 4). None of the pharmacies had a cold storage facility other than the refrigerator.

Out of 62 pharmacy owners, 16 (26%) had a separate storage area within the main pharmacy and in these areas the temperature was found to be more than 25 °C. Approximately 8 (13%) pharmacy owners reported that the store is large enough to keep all the supplies. Around 11 (18%) pharmacies had a storage room which was reserved only for pharmacy related functions, and 7 (11%) had adequate storage capacity in the warehouse for medicines and medical supplies. Moreover, in 6 (10%) pharmacies, the stores were in good condition. One (2%) pharmacy was found to have a store with cracks, holes and signs of water leakage. In 9 (15%) pharmacies, the stores had a ceiling in from which 5 (8%) were not in good condition. In 2 (3%) pharmacies, the stores were properly ventilated with appropriate air entry. Stores of 7 (11%) pharmacies were tidy with clean shelves, walls and did not have signs of any infestation. Furthermore, 15% of the stores did not have any expired items in their storage area (Table 5).

Medical supplies were stored neatly on the shelves and boxes in 82% of the pharmacies but shelves and boxes were raised off the floor in only 23% of the pharmacies. In 5 (8%) pharmacies, the supplies were categorized in various groups. None of the pharmacy owners had practice of storing the controlled substances in double locked storage space (Table 5).

Discussion

Exposure of medicines to high temperature in storage or in transport could reduce their efficacy of drugs including vaccines(11). The major factors which contribute to decreased efficacy of medicines after quality manufacturing are improper storage of medicines at undesirable temperature (22). The journey of medicines begins at the site of manufacturer and passes through warehouses, pharmacies and sometimes other environments before reaching the end user (20). Temperature conditions in earlier stages have received attention, but little work has been done in primary care settings and community pharmacy settings, both in developed and developing countries (20).

The findings of present study suggest that majority of pharmacy owners had knowledge about correct temperature for storing medicines at that temperature (<25?C) but almost 100% of the community pharmacies were having temperature (>25?C) degree centigrade, which is more than the required temperature for storing medicines safely. In both environments i.e. outer and inner half of pharmacies, medicines were exposed to temperature greater than (>25?C). These findings suggest that there is huge gap between knowledge of pharmacy owners and their practices because on one hand they highlighted that high temperature (>25?C) can affect quality of medicines and on other hand temperature control at required level (<25?C) is not ensured in community pharmacies of these rural areas. Moreover, these findings are supported by the fact that medicines were directly exposed to sunlight in 63% of the community pharmacies. These findings are consistent with other studies around the world (20).

Our study also examined storage practices in the community pharmacies. Although, 63% of the pharmacies had a refrigerator to keep the medicines in a cool environment but due to incessant electricity shut downs (estimated to

Table 3: Findings regarding storage of medicines in main pharmacy

Characteristics	n=62
Arrangement of medicines on the shelves	
In Alphabetical order	01(1.6%)
Not in Alphabetical order	61(98.4%)
Items are grouped in amounts that are easy to count	35(56.5%)
Yes	27(43.5%)
No	
Medicines with short expiry dates in front of medicines with long expiry date	
Yes	62(100%)
No	0(0%)
Medicines were stored on the first expired first out principle	
Yes	53 (85.5%)
No	09(14.5%)
Poor quality items in the shelves	
Yes	1(1.6%)
No	61(98.4%)
Overstocked items in the shelves	
Yes	1(1.6%)
No	61(98.4%)
Pharmacy area was free from moisture	
Yes	59 (95.2%)
No	03 (4.8%)
Clearly defined and separated area for reception of products	
Yes	04 (6.5%)
No	58(93.5%)
Clearly defined and separated storage area for inflammable products	
Yes	1(1.6%)
No	61(98.4%)
Drugs handling	
With bare hands	59(95.1%)
Without bare hands	3 (4.8%)
Record maintenance	
Yes	09 (14.5%)
No	53(85.4%)

Table 4: Findings regarding the temperature of community pharmacies (Objective assessment) (n=62)

Characteristics	n(%)
Temperature of inner half of Pharmacy	
30°C to 35°C	62 (100%)
< 30°C	0 (0%)
Temperature of outer half of Pharmacy	
30°C to 35°C	62 (100%)
< 30°C	0 (0%)
Stores in Pharmacy	
Yes	16 (25.8%)
No	46 (74.2%)
Temperature inside stores of pharmacy	
30°C to 35°C	16 (100%)
< 30°C	0 (0%)
Exposure of medicines to sun light	
Yes	39 (62.9%)
No	23 (37.1%)
Use of refrigerator	
Yes	39 (62.9%)
No	23 (37.1%)
Cold storage facility other than refrigerator	
Yes	0 (0%)
No	62 (100%)

be approximately 12 hours per day), and limited backup power supply, may render these medicines ineffective.

Our study reveals that 3% of the pharmacies were having a temperature monitoring facility or device. With a dearth of temperature monitoring devices, excessive electric cut-offs and limited alternative power supply for refrigeration, and may potentiate doubt on the efficacy of medicines. These findings were consistent with that reported from Banglore, India (27). These findings of having refrigerator and temperature monitoring facility were slightly different from the study findings conducted by Zahid A Bhutt et al in Urban Rawalpindi in 2005, where majority (76%) of the pharmacy owners had refrigerator and 10% of these pharmacies had temperature monitoring devices as well(28). The difference in findings of having refrigerator in current study might be due to setting of the study in the rural district of Sindh where worth of purchasing refrigerator might not be considered as compared to urban areas. Moreover, due to frequent electricity cut- offs, pharmacy owners might not prefer to invest in purchasing the refrigerator or they might not have the knowledge of keeping the required medicines in the refrigerator.

Around 25% of the pharmacies were selling vaccines and all of these pharmacies were storing the vaccines in refrigerator, despite limitations of maintaining the desired temperature. These findings were different from the studies conducted in Karachi and Rawalpindi, where more than half of the pharmacy owners were selling vaccines irrespective of appropriate storage practices(28, 29). This difference might be due to difference in demand and supply of rural and urban areas. In urban areas, community people might be aware about and might give high importance of preventive aspect of the health therefore there would be more demand for vaccines, which might be satisfied by equal supply by community pharmacies in urban areas.

Furthermore, our study also found that commonly used medicines like NSAIDs, multivitamins and antibiotics were exposed to direct sunlight and studies have also shown that such medicines show significant reductions in activity when stored at temperature more than 25oC (20). Furthermore, studies have also shown that dissolution rate of diclofenac sodium (NSAIDs) tablets significantly reduces in as little as three months following exposure to high ambient temperature(20). Although the community pharmacy owners had knowledge about the adverse effects of high temperature on medicines but they could not modify the temperature of community pharmacies alone due to multiple barriers like lack of air conditioning system, load shedding problems and lack of backup power supply in community pharmacies. Moreover, there might be other barriers or factors which might have stopped community pharmacy owners or drug sellers to maintain the required temperature in their respective pharmacies and there is strong need to explore such barriers in future studies.

Table 5: Findings regarding storage of medicines in separate storage area of main Pharmacy

Characteristics	n=62
Separate storage area in main pharmacy	
Yes	16 (25.8%)
No	46 (74.1%)
Store is large to keep all the supplies	
Yes	08 (12.9%)
No	54 (87.0%)
Storage room reserved only for pharmacy related functions	
Yes	11 (17.7%)
No	51(82.2%)
Adequate storage capacity in the warehouse for medicines	
Yes	07 (11.3%)
No	55(88.7%)
Stores were in good condition	
Yes	6 (9.7%)
No	56 (90.3%)
Proper ventilation in stores	
Yes	2 (3.2%)
No	60 (96.2%)
Signs of pest infestations	
Yes	55 (88.7%)
No	07 (11.3%)
Stores were tidy	
Yes	55 (88.7%)
No	07 (11.3%)
Stores with clean shelves and walls	
Yes	55 (88.7%)
No	07 (11.3%)
Medical supplies were stored neatly on the shelves and boxes	
Yes	51 (82.3%)
No	11 (17.4%)
Shelves and boxes were raised off floor	
Yes	14 (22.6%)
No	48 (77.4%)
Medicines shaped in groups: external, internals and injectables	
Yes	5 (8.1%)
No	57 (91.9%)

Since pharmacies are often the first point of interaction for patients looking for health care as they are usually more reachable and less socially distant than other health care providers, including general physicians and consultants. Therefore, if drugs or vaccines are compromised by quality issues such as improper storage of medicines at undesirable temperature then community people may end up with products or instructions that are useless and even dangerous for the community as a whole(28). In fact, it has been said that if a physician's medical error could terminate a life, then a singular error from the drug manufacturer or dealer can most certainly lead to the loss of many lives(30).

Strengths and Limitations of the Study

There is a scarcity of literature regarding the storage practices of medicines in community pharmacies, particularly in rural areas of Pakistan. Therefore, to the best of our knowledge this was the first study of its kind that has assessed the temperature and storage practices of medicines in community pharmacies in rural district of Sindh, Pakistan. Temperature was measured objectively with the standard procedure to avoid the measurement bias. In addition to this, study findings can be generalized to rural areas of developing countries.

The scope of this study was limited to pharmacy owners and drug inspectors but perceptions of owners of pharmaceutical companies, other government authorities, community stakeholders and policy makers could not be assessed. The collection of data was limited to only two talukas. Interviewer bias might be there due to nature of questions being asked from pharmacy owners.

Conclusions

The study found more than a quarter of pharmacy owners had knowledge about maintaining the required temperature of < 25°C but none of the pharmacies in the catchment area were maintaining required temperature of < 25°C. We also concluded that storage practices in community pharmacies / medicine stores were found to be poor and very few pharmacy owners were monitoring temperature in their pharmacies. Although there were some observed insignificant cases of satisfactory storage practices amongst community pharmacies/ medicine stores, nevertheless the evidently generally poor storage practices weighed higher because of their potential untoward chain effects on drug consumers.

Moreover, looking at the median duration of load shedding and limited backup power supply, it is very important to make cost effective and long lasting strategies to maintain the safety, efficacy of medicines and to improve quality of medicines especially in remote areas. Strict monitoring and regulation of these pharmacies are required. Such storage practices should also be evaluated at homes to see that how people store these medicines in their households. Furthermore, there is a need to enforce existing legislation with ongoing training programs directed towards pharmacy owners and drug sellers and to involve the pharmaceutical industry, which plays an important role in influencing pharmacy practices of pharmacy owners. In future, more research is required to explore the different ways of maintaining the required storage conditions of medicines to ensure the adequate efficacy, safety and effectiveness of medicines.

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