



# **Impact of Introducing Clinical Pharmacy Services in A Respiratory Diseases Clinic: A Report from North Cyprus**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author AMA was responsible for design and implementation of study. Author FR finalized the study design and coordinated implementation. Author AMA collected data, carried statistical analysis and creation of the manuscript. Authors RD and FR supervised, reviewed and improved manuscript. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aims:** The Implementation of Clinical Pharmacy Services (CPS) in hospitals is currently gaining attention in an effort to rationalize drug use in many developing countries. This study aims to introduce and evaluate ward-based CPS in a Respiratory Diseases clinic in North Cyprus and assess its efficacy and physician's perceptions toward the services.

**Study Design:** A prospective interventional study.

**Place and Duration of Study:** The study was carried out in the respiratory clinic from 01 December 2013, to 30 January 2014 at Near East University Hospital, in Nicosia, North Cyprus.

**Methodology:** Clinical Pharmacy Services (CPS) were introduced and documented over the study period of 60 days in a tertiary university hospital. DTPs and Interventions were documented and classified using DTP classification tool obtained from previous studies, and later evaluated by an independent clinical committee for their feasibility. Physician's attitudes and perceptions were evaluated before for and after introducing CPS's using a questionnaire tool.

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**Results:** 82.35% of the targeted physician's sample have responded to baseline survey, (n=17) majority (92%) did not have any previous interaction with clinical pharmacists, they generally well perceived and had high expectations to pharmaceutical care services in general. This further enhanced the post-implementation of CPS. 118 interventions were carried during the program, 86.6% accepted and regarded as clinically relevant. Interventions mostly related to cardiovascular agents. Add/ change/stop medications were the most common type of interventions (21%). Most common resultant outcome was to avoid adverse effects or toxicities. The intervention was significantly related to the number of drugs used ( $r=0.487$ ;  $p=0.006$ ), the rate of acceptance significantly was higher to services compared to DRP interventions ( $p<0.005$ ).

**Conclusion:** The introduction of CPS's lead to clinically relevant and highly accepted optimization of medicine use in different wards and clinics including respiratory diseases clinic in the case of this study, it was relatively well perceived by physicians, but also could be more valued if more optimized and practiced by talented proactive clinical pharmacists within a multidisciplinary team.

*Keywords: Pharmacy practice; clinical pharmacy; hospital pharmacy; pharmaceutical care physicians; pharmacist; relationship; perceptions.*

## 1. INTRODUCTION

Clinical pharmacists are a primary source of scientifically valid information and advice regarding the safe, appropriate, and cost-effective use of medications [1]. They are healthcare providers competent in optimizing therapy and promoting health, wellness, and disease prevention [1]. Many studies in developed countries have shown the positive impact of clinical pharmacists on therapy outcome and care provided at tertiary hospitals [2].

The current practice of clinical pharmacists is quite different than the traditional practice of dispensing or marketing (medical representatives) that influenced the physician's pharmacist relations for the decades. It's thus necessary to evaluate how physicians will percept and interact with the new practice which is thought to be the dominant pharmacy practice in the few coming years globally. In Turkey and North Cyprus, the Implementation of Clinical Pharmacy Services (CPS) in hospitals is currently gaining attention in an effort to rationalize drug use as the pharmacist specialization program was approved for this purpose in 2014 [3]. Leading pharmacy faculties as well have started adopting clinical pharmacy-based disciplines at both postgraduate and undergraduate degree levels to assure the competence of future graduate [4-6]. Yet the competence and clinical knowledge of the pharmacists don't solely determine the successful implementation and delivery of CPS [7]. It's crucial in the implementation state to adopt a stepwise manner and raise awareness of

healthcare providers towards CPS and their impact through different interventions [7]. In this study, we document the first successful introduction of Clinical pharmacy services in North Cyprus and its impact on HCP attitudes which facilitated the wider adoption of this practice in a different setting in North Cyprus [8-12] following this attempt.

No previous studies were also conducted in Cyprus describing the physician pharmacist relationship. There is a general impression that physicians do not regard pharmacists highly and do not expect them to provide any clinical services [13]. This may be clear by the fact that none of the hospitals in Cyprus had a clinical pharmacist before this study or even enough numbers of hospital pharmacists while in some settings technicians practice the dispensary duties of a pharmacist [14].

The aim of this study was to introduce and evaluate ward-based clinical pharmacy services in a respiratory diseases clinic of Near East University Hospital in TRNC and assess its efficacy and physicians perceptions toward the service.

## 2. MATERIALS AND METHODS

### 2.1 Subjects and Setting

The study was carried out in the respiratory clinic from 01 December 2013, to 30 January 2014 at Near East University Hospital, in Nicosia, North Cyprus. The Hospital comprises 209 private, single-patient rooms, 8 operating theatres, 30-bed Intensive Care Unit, 17-bed Neonatal Intensive Care Unit and more than 30 different

clinics and departments. The study is carried in the respiratory and allergic disease clinic one of the most leading clinics in the hospital. All inpatients covered by the respiratory clinic physicians were included whether, at the intensive care or normal ward patients, three physicians' two consultants and a senior resident were in charge of the clinic patients.

## 2.2 Study Design

The study is a prospective interventional study where pharmaceutical care services are provided by a clinical pharmacist for inpatients and documented over a period of two months. A questionnaire composed of 4 parts investigating physicians' expectations, previous experiences, and perceptions of clinical pharmacists was also delivered to all internal medicine physicians' including respiratory diseases clinic physicians on baseline. The Clinical services that were introduced by the pharmacist and documented as positive interventions and later on presented in the study included:

Participation in rounds with physicians and giving suggestions regarding therapy and acute management.

Covering each inpatient case for the RD department physicians ensuring proper dosing, managing drug-drug interactions, insuring proper drugs indication and use, proper administration, prescription writing, and avoiding and detecting adverse effects caused by drugs.

Counselling patients of correct use of medications with either verbal or written materials.

Providing in-services (short lectures, presentations, etc.) for physicians or health team regarding specific topics of therapy or medications use.

Providing Drug information services (DI service) were the RD clinic physicians could ask about any information related to drugs and therapy and are provided by the clinical pharmacist in printed form from reliable mentioned resources.

Preparing printed posters and brochures on drug use on request, by the clinic physicians.

After the end of the 60 days period, a survey is also carrier to only respiratory clinic physicians to evaluate their experience and perception of the clinical pharmacy services conducted at their

clinic (and also to two pediatric physicians who were clinical pharmacy services were also introduced to their clinic before the study) and were compared to the previous results obtained from baseline conducted questionnaire.

## 2.3 Data Collection

Any services or interventions regarding the optimization of rational drug use were documented and registered in a worksheet along with the involved patient information and current clinical status.

Specially designed forms were filled for each patient, collecting information of patient age; complaint, medical history, family history, medications use history, current medical problems, labs have taken during their hospital stay and medications are given during their hospital stay and on discharge.

Regarding the questionnaire, this was a self-administered questionnaire and was delivered by hand to a sample of 17 physicians. It was composed of four parts, the first collected general demographic information about the physicians their area of practice and experience level, also there educational background and country from which their degrees were obtained from, frequency of interaction and if they had any previous experience with clinical pharmacist or any contact with pharmacists in general and type or reason for such a contact were all asked.

The second part of the questionnaire addressed the physicians' degree of comfort with clinical pharmacists providing clinical services, such as patient education, involvement in designing therapeutic plans for their patients or suggesting the use of nonprescription medications, monitoring outcomes of drug therapy and others.

The third component emphasized physicians' expectations of pharmacists' professional role, while the fourth part addressed physicians experience with the introduced clinical pharmacy services and was only delivered after the end of the study for physicians in the respiratory clinic.

The used questionnaire was obtained from previous studies done to evaluate the physician's perceptions and experience. It was developed by researchers who conducted a study in 2004 and distributed the questionnaire to physicians in Kuwait [15]. Modifications suitable to Cyprus medical institution were made to the original questionnaire.

## 2.4 Data Analysis and Validation

Statistical analysis was done by an independent statistician also relevance and significance of each intervention and service were evaluated by an independent committee involving 3 pharmacology professors (2 MD and one pharmacy background). Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 15) software. Data were described using frequency distribution. Chi-square tests were used for some comparisons.

## 2.5 Ethical Considerations

Confidentiality was assured during the study and also the patient's privacy, a Letter of ethical clearance was obtained from the Institutional Review Board (IRB) of Near East University Hospital. Only Initials were used during the study and other information of address and occupation were not recorded during the pharmaceutical care. Also, health and economic outcomes were insured for patients since DTP's were identified and resolved during the study and the pharmaceutical care given.

## 3. RESULTS AND DISCUSSION

### 3.1 Results

14 physicians responded to the baseline survey from the 17 who received it (82.35%). The median age was middle-aged between 36 and 46 years old, more than half were men (57%). Table 1 shows the demographic information of respondents.

Physicians (92.9%) did not have previous interaction or rarely had with pharmacists except one physician (7.1%), also majority (86.7%) never worked with a clinical pharmacist before, while main reasons for interaction if ever occurred were for drug interaction queries (28.6%) side effects queries (21.4%) or others as shown in Table 2.

When asked to assess their comfort with specific duties of pharmaceutical care, physicians claimed to be most comfortable with activities such as monitoring outcomes of pharmacotherapeutic regimens (64.3% comfortable, 21.8% moderately comfortable). While physicians seemed uncomfortable with activities such as treating minor illnesses like

headaches (50% uncomfortable, 28.6% moderately comfortable), as shown in Table 3.

**Table 1. Personal information of respondents (n=14)**

The variable	%
<b>Age</b>	
Less than 35 yrs.	28.6%
36-46 yrs.	42.9%
More than 47 yrs.	28.6%
Median age group	36-46
<b>Gender</b>	
Male	57.1%
Female	42.9%
<b>Nationality</b>	
Cypriot	35.7%
Turkish mainlander	50%
Others	14.3%
<b>The country where the medical qualification was obtained</b>	
Cyprus	7.1%
Turkey	78.6%
Western Europe	7.1%
Eastern Europe "included Russia"	7.1%
<b>Current position</b>	
Trainee	0
Junior	7.1%
Senior	14.3%
Fellows	14.3%
Consultant	64.3%
<b>The current area of practice</b>	
Internal Medicine	85.7%
Paediatrics	14.3%

**Table 2. Frequency and reasons for interactions between physicians and pharmacists (n =14)**

Frequency of interactions	%
Never/rarely	92.9%
Once a week	7.1%
Once a day/more	
<b>Have you ever worked with a clinical pharmacist</b>	
Never	86.7%
Yes, I did work before	14.3%
<b>Reasons for interaction</b>	
Drug-availability queries	14.3%
Side-effects queries	21.4%
Drug-alternative queries	14.3%
Drug-dosage queries	0
Drug-interaction queries	28.6%
Others	21.4%

**Table 3. Physicians' degree of comfort with pharmacists providing different pharmaceutical care services (n=14)**

Pharmacists' duty	Comfortable (%)	Moderately comfortable(%)	Uncomfortable (%)
Providing patient education	50%	42.9%	7.1%
Suggesting use of nonprescription medications, eg, paracetamol	21.3%	35.7%	42.9%
Monitoring outcomes of pharmacotherapeutic regimens	64.3%	21.4%	14.3%
Designing and monitoring pharmacotherapeutic regimes	64.3%	21.4%	14.3%
Detecting and preventing prescription errors	57.1%	28.6%	14.3%
Treating minor illnesses, eg, headaches	21.4%	28.6%	50.0%
Suggesting the use of prescription medications to physicians	28.6%	42.9%	28.6%
Suggesting the use of prescription medications to patients, eg, antibiotics	21.4%	28.6%	50%

In assessing physician expectations of pharmacist responsibilities, patient medication education and drug knowledge were unanimously agreed and recognized by physicians to be expected abilities from pharmacists (100% and 93%, respectively). While physicians disagreed in views between them toward pharmacists assisting in designing drug-therapy treatment plans for patients (35.7% agree 21.4 neutral 42.9% disagree) and assisting patients in selecting appropriate nonprescription medications (42.9% agree, 21.4% neutral, 35.7% disagree)(Table 4).

After this assessment, clinical pharmacy services were introduced to the respiratory and

allergic disease clinic, 39 inpatients were covered during the study which was conducted over 60 days, 118 interventions and services were done by the clinical pharmacist mean average interventions per patient was around 2.85. Of the proposed interventions 86.4% were accepted by the physicians. 15.7% of the accepted interventions were services not directly related to the specific patient like drug information DI queries, printed counselling material and in-service education for healthcare team members. Table 5 shows patients demographic information and HCP response to pharmacist interventions, while Table 6 shows the types of interventions and services carried during the study.

**Table 4. Physicians' expectation of pharmacists' professional**

Physician expectation	Agree (%)	Neutral (%)	Disagree (%)
I expect pharmacists to educate my patients about the safe and appropriate use of their medication.	100%	0	0
I expect pharmacists to be knowledgeable drug-therapy experts.	92.9%	7.1%	0
I expect pharmacists to know the specific indication of each drug I prescribe, even when drugs have more than 1 approved or recognized the indication	57.1%	21.4%	21.4%
I expect pharmacists to be involved in resolving any drug-related problems they discover involving patients	57.1%	35.7%	7.1%
I expect pharmacists to assist my patients in selecting appropriate nonprescription medications	42.9%	21.4%	35.7%
I expect pharmacists to assist me in designing drug-therapy treatment plans for my patients	35.7%	21.4%	42.9%
I expect pharmacists to be available to me for consultation when I see patients (eg, during rounds)	50.0%	42.9%	7.1%

**Table 5. Patient's general information**

<b>Patient information</b>	
<b>Age</b>	
Mean	65.3 yrs
Median	69 yrs
Range	20 – 90 yrs
<b>Gender</b>	
Male	20 (51.2%)
Female	19 (48.8%)
<b>Drugs used during the hospital stay</b>	
Total # of drugs	439
Range	3 – 20
Median	11
Mean number of drugs used for each patient	11
<b>Interventions</b>	
Number of total interventions	118
Range	0-14
Median	2
Mean interventions per patient	2.85%
Accepted	85%
Rejected	16%

**Table 6. Types of interventions and services have done**

<b>Recommendation code</b>	<b>n (%)</b>
<b>Dosing regimen interventions</b>	
Dose Change	16 (13.5%)
Interval Change	2 (1.7%)
D/C Drug (Automatic Stop Order)	2 (1.7)
Drug Change/Add/Delete	25 (21.1%)
Alternate Therapy	1 (0.8%)
Drug Treatment Recommendations	12 (10.2%)
<b>Monitoring related interventions</b>	
Pharmacokinetics	1 (0.8%)
Drug Level	2 (1.7%)
Initiated Lab-Work	9 (7.6%)
<b>Adverse drug reactions related interventions</b>	
Drug Interaction	8 (6.8%)
Check Incomplete Orders	3 (2.5%)
<b>Services &amp; education</b>	
Discharge Patient Education	11 (9.3%)
In-Service Education	2 (1.7%)
Dose Calculation	3 (2.5%)
Provide Drug Information	14 (11.9%)
Verify Order/Dose	7 (5.9%)

Highest number of recommendations was related to drugs categorized therapeutically as cardiovascular agents 28(23.7%) antimicrobial agents were the second 23 (19.5%) while interventions and services related to bronchodilators and inhalers were the third 22(18.6%) (due counselling services mainly

18(88.8%)) followed by anticoagulation anti-thrombotic agents 12 (10.2%) respectively (Table7).

An independent clinical committee assessed the clinical significance and effect of interventions made by clinical pharmacists on

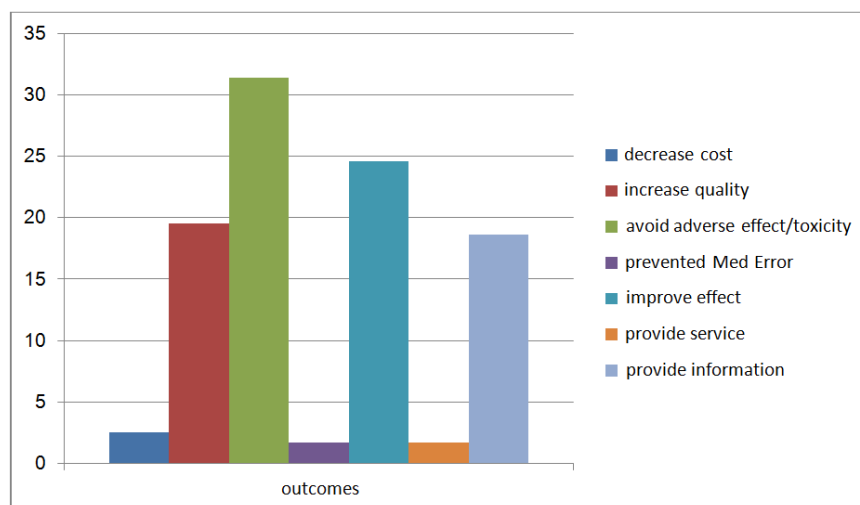
outcomes. Outcomes of the interventions were categorized mostly as those to avoid adverse effects or toxicity 37(31.4%), or improve therapeutic effects 29 (24.6%) as shown in Fig. 1.

After the 60-day program respiratory physician were asked to reflect their experience and attitudes post-intervention. To their experience, pharmacist routinely counselled their patients regarding the safe and appropriate use of their medications (60%), routinely informed them if more cost-effective alternatives existed (60%),

pharmacists appear willing to take personal responsibility for resolving any drug-related problems they discover (60%). Also, they reported that pharmacists routinely inform them if they discovered clinical problems with prescriptions (100%), frequently asked physicians to clarify for them the drug-therapy objectives they have in mind for their patients (100%) and frequently let them know if patients have experienced some problem with their medication. Tables 8 and 9 shows physicians attitudes and expectations of clinical pharmacist's pre-post intervention.

**Table 7. Therapeutic classification of drugs related to interventions**

Therapeutic class	n (%)
<b>Drugs commonly used in RD</b>	
Bronchodilators and inhalers	22 (18.6%)
Antibiotics	23 (19.5%)
<b>Drugs used commonly for non-respiratory diseases</b>	
Anticoagulants /antithrombotic	12(10.2%)
Cardiovascular agents	28 (23.7%)
Anti-inflammatory drugs	1 (0.85%)
Diuretics	4 (3.4%)
Electrolyte replacement drugs	4 (3.4%)
Essential minerals	1 (0.85%)
Drugs for hyperlipidemia	2 (1.7%)
Thyroid replacement	1 (0.85%)
BPH treatment agents	2 (1.7%)
Cough suppressants	1 (0.85%)
Analgesics	2 (1.7%)
Vitamins	2 (1.7%)
Gastro-intestinal medications	1 (0.85%)
Dietary supplements	1 (0.85%)
Psycho-therapeutic agents	2 (1.7%)
Sedative hypnotic agents	4 (3.4%)
Others	5 (4.2%)



**Fig. 1. Outcomes of carried interventions on patients**

**Table 8. RD clinic physician's expectations before and after study (n=3)**

Physician expectation	Agree (%)		Neutral (%)		Dis-agree (%)	
	Baseline	End	Baseline	End	Baseline	End
I expect pharmacists to educate my patients about the safe and appropriate use of their medication.	100%	100%	0	0	0	0
I expect pharmacists to be knowledgeable drug-therapy experts.	100%	100%	0	0	0	0
I expect pharmacists to know the specific indication of each drug I prescribe, even when drugs have more than 1 approved or recognized the indication	66%	100%	34%	0	0	0
I expect pharmacists to be involved in resolving any drug-related problems they discover involving patients	34%	100%	66%	0	0	0
I expect pharmacists to assist my patients in selecting appropriate nonprescription medications	33%	0	34%	100%	33%	0
I expect pharmacists to assist me in designing drug-therapy treatment plans for my patients	33%	66%	34%	34%	33%	0
I expect pharmacists to be available to me for consultation when I see patients (eg, during rounds)	100%	0	100%	0	0	0

**Table 9. Degree of comfort before and after the introduction of CPS (n=3)**

Pharmacists' duty	CA		Mod.CA		Un.CA	
	Baseline	End	Baseline	End	Baseline	End
Providing patient education	66%	100%	34%	0	0	0
Suggesting use of nonprescription medications, eg, paracetamol	33%	66%	34%	34%	33%	0
Monitoring outcomes of pharmacotherapeutic regimens	66%	100%	34%	0	0	0
Designing and monitoring pharmacotherapeutic Regimes	34%	0	0	100%	66%	0
Detecting and preventing prescription errors	66%	100%	34%	0	0	0
Treating minor illnesses, eg, headaches	0	0	0	0	100%	100%
Suggesting use of prescription medications to physicians	33%	100%	34%	0	33%	0
Suggesting use of prescription medications to patients, eg, antibiotics	0	0	0	0	100%	100%

### 3.2 Discussion

In this study, physicians reported no previous or rare interaction and experience with a clinical pharmacist, and thus some misperceptions towards some core clinical pharmacist's duties. Yet high expectations were reported and encouraging perception from physicians towards clinical pharmacy and pharmaceutical care duties. Different CP services and interventions

were carried resulting in improved therapy outcomes and high acceptance rate from physicians. Physician's attitudes relatively improved though enough sample size was not available to confirm this hypothesis.

As nearly all physicians were new the concept of clinical pharmacy, 40-50% did not recognize or feel comfortable with pharmacist roles of monitoring therapy plans, preventing errors and



solving them when occur, and assisting in rounds and designing treatment plans. While most RD clinicians (80-100%) reported their comfort with such roles post-study.

Studies done in developed countries showed that lack of exposure to pharmacists activities is the main reason attributed to lead to discomfort making physicians reluctant to approve and accept more clinical duties for pharmacists with more exposure [16,17].

For example in China, where many pharmacists practice clinical pharmacy in clinics and hospitals, a study done to evaluate attitudes toward clinical pharmacy services in urban general hospitals in China reported that more than 83.3% of physicians surveyed (n=646) have frequent interactions with clinical pharmacists, and had more than 80% comfort with pharmacists participation in rounds, designing therapeutic plans, assisting in treatment of complex cases, and in prescribing generally [18]. While around 84% of comfort was reported to activities of monitoring therapeutic plans and preventing prescription errors and scanning and preventing adverse drug reactions [18]. In the Netherlands a study investigating physicians and pharmacists opinions toward pharmacists' professional duties, researchers found that over 80% of the sampled healthcare professionals agreed that pharmacists should have an input in the patient's pharmacotherapeutic plan and also should participate in the pharmacotherapy audit meetings [19].

Regarding prescribing activities, though much less resistance is observed in developed countries (only 45.9% uncomfortable to clinical pharmacists having some prescribing authority for treating minor diseases, and 40% feeling comfortable to pharmacist managing outpatient clinic for anticoagulant therapy, treating chronic diseases, and having the right to continue or revise the prescription under authorization from physicians [19] but though it's universally well-known and common that it's unlikely that physicians agree with prescribing authorities given to pharmacists [20,21], as it is also seen in this study too (47% uncomfortable, 31% moderately comfortable) and other studies in Kuwait, Jordan and Qatar [15,21-23].

However, it's positive that many had high expectations, where most physicians (92%) recognize pharmacist to be knowledgeable drug-therapy experts and all (100%) accept the role

and importance of clinical pharmacists in patient education, while near to 60% accepted roles of resolving drug-related problems and monitoring pharmacotherapeutic plans. This is a good sign comparing to other countries and to the novelty of this practice in Cyprus. Similar numbers were observed in studies done in Qatar and Kuwait regarding physicians view and expectations of pharmacist role [15,22]. In Qatar physicians widely supported patient education activities (96.6%) while 77% acceptance rate was observed in Kuwait [15,22].

In the interventional part of this study, clinical pharmacy services were introduced to the respiratory and allergic disease clinic in NEU hospital, clinical pharmacy services promote rational use of medications and have positive well-documented effects on most pathologies [7, 11,12,24,25]. An intervention by a pharmacist which is regarded as a near-miss incident can be defined as any action done by the pharmacist that directly results in a change in a patient's management or therapy [26]. Implementing CPS's resulted in 118 different interventions were done on average of 2.85% per patient. The number of clinical pharmacist's interventions accepted by the physicians and types of drug-related problems that require clinical pharmacist's interventions was the main outcomes.

A relatively high degree of acceptance of the interventions as reported 86% which is comparable to studies done on implementing clinical pharmacy services in different wards and clinics in the united states resulting in 95% acceptance [27] while studies conducted in Europe report acceptance rates of clinical pharmacy services between 69 and 89 %, which is considered high [28-30] while studies also reported 88% in Turkey [31], 100% and 93% were later reported respectively from oncology and cardiology departments of the same hospital [9,10].

Such a high rate indicates that the interventions have been timely and relevant for the physicians, it also supports that a trust relationship existed and that the collaborative work relationship between the physicians and the pharmacist is what lead to this high rate [32].

Mean average age of the patients was 65 years while also polypharmacy was obvious were drugs used for the patients during their stay ranged 4-20 drugs and mean drugs used by a

patient was 11. This is comparable to a study held in Denmark where patients age ranged between 26–97 years old and drugs used ranged between 4–22 drugs per day [29], previous studies report 85% of those 65 years old and over to have at least one chronic disease, while 30% of them have 3 or more chronic diseases [32], interventions generally was noted to increase significantly with increasing number of medications per patient, while clinical pharmacists are regarded as a key approach for optimization of prescribing in this age group (Fig. 2) [33].

The most frequent types of interventions were "drug started/stopped/changed" 21.1% what reflect the common typical focus areas of rational drug therapy in the elderly and in polypharmacy patients [34,35]. Following in frequency was "dose adjustment" 13.5% which also goes with people when getting older start to loose hepatic and renal function what always necessities dose adjustment.

Of interest, cardiovascular agents were the most reported therapeutic category which interventions were mostly related to (around a quarter of all interventions) (Fig. 3), a finding also obtained from a Danish study (also nearly a quarter). Cardiovascular DRP is common in respiratory patients as the higher one-year mortality rate in MI patients with asthma and COPD was reported

due to under treatment with mostly beta-blockers [36].

Second class of medications which interventions were mostly related to was antibiotics (19.5%) and inhaled bronchodilators (18.6%), this are drugs most commonly used in such a clinic (asthma, COPD, and pneumonia) and justifies the great number of interventions related to them, added to that counselling activities were attributed to 88% of recommendations concerning inhalers while recommendation of dose changes was the second most leading type of total recommendations done in heart of that is those related to antibiotics mainly due to renal or hepatic impairment which is common for the sample age group, showing that regardless of the predicted heavy use of antibiotics in a respiratory clinic, majority of interventions were related to drug doses not to drug regimen used which may indicate physicians restriction to national and international guidelines for antibiotics use for different cases which were revised by the clinical pharmacist for every and each case encountered during the study period, and thus indicates rational drug use concerning antibiotics which is critical and important in terms of attenuating emergence of resistance to antibiotics and also in terms of cost-effectiveness were I.V antibiotics are costly and thus require rational use restricted to need.

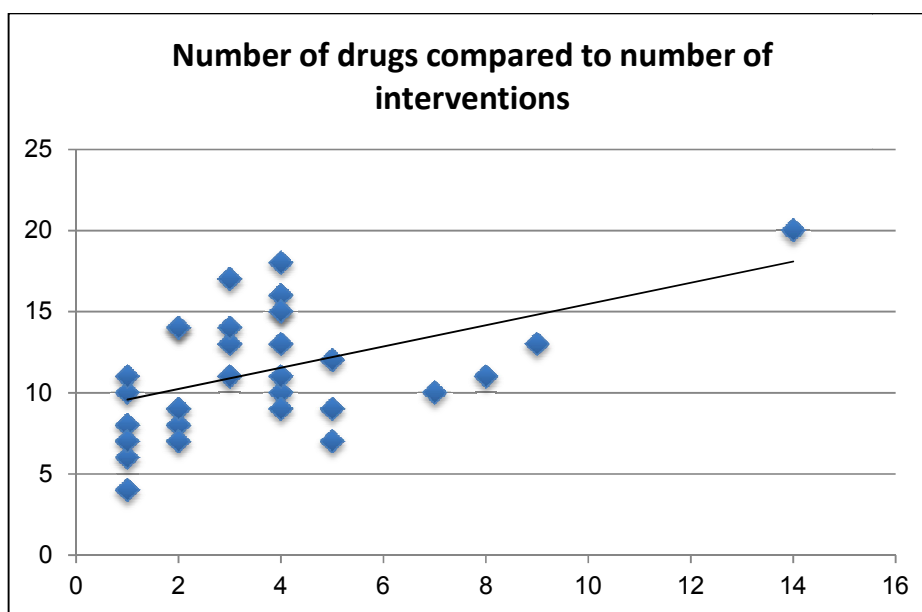
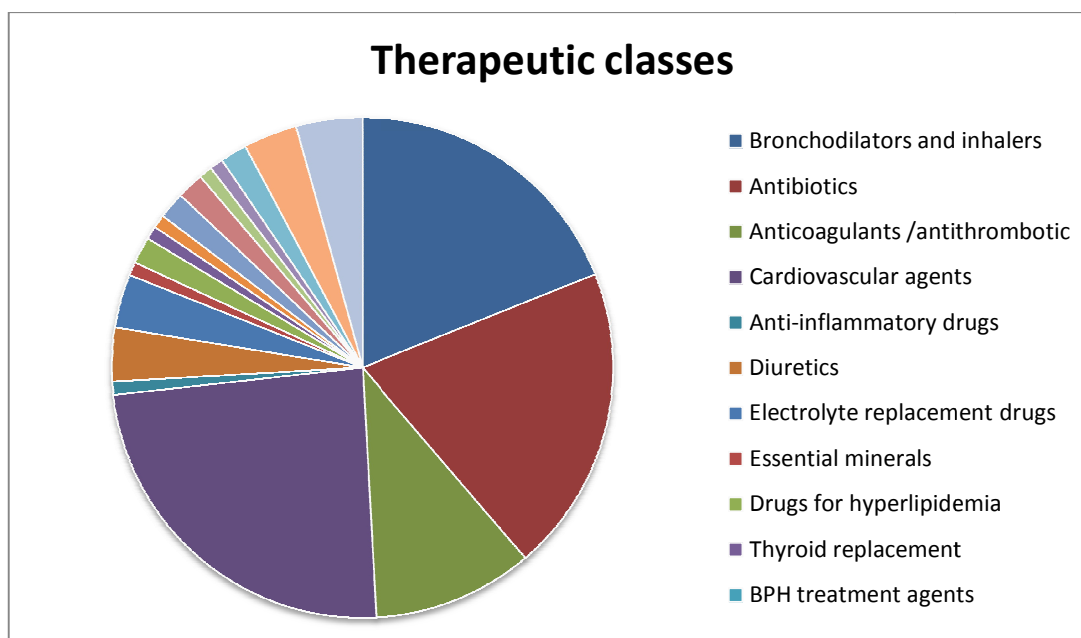


Fig. 2. Correlation between the number of drugs and the number of recommendations in individual patients



**Fig. 3. A pie chart showing therapeutic classifications of drugs related to each interventions showing cardiovascular agents to be most related agents to interventions followed by Antibiotics and bronchodilators respectively**

Comparing acceptance rate of drugs commonly used in respiratory clinics i.e. antibiotics, and bronchodilators to others e.g. cardiovascular agent, anticoagulation therapy, etc. showed significant difference in the way they were accepted, 66.7% of accepted interventions were related to drugs not commonly used or initiated by respiratory diseases clinics, which suggest that the efficacy of clinical pharmacists may be due to being drug experts in many classes of medications, and thus may reduce incidence of DTP related to comorbidities other than the acute complains which are constantly under the focus of the healthcare providers .

Also comparing acceptance rates to types of recommendations, the significant difference in the way interventional recommendations were accepted was noticed compared to services provided by the pharmacist (p= 0.004). All suggested services were accepted indicating to the importance of pharmacists being initiative and the appreciation of physicians to such collaborative relationship, pharmacists actually shouldn't wait for others to seek their services but rather should act as leaders and offer their services to others who will appreciate and respect it. Services included DI queries, printed patient education material, and CME's activities on inhalation techniques and advances in

hypertension treatment guidelines for nurses and healthcare providers.

According to similar studies done to evaluate clinical pharmacist interventions, outcomes and impact of the study were demonstrated by the number of interventions, their acceptance rate, and clinical importance. In assessing such outcomes many ways are used in different studies categorized generally into outcome measures that are explicit (criterion-based) or implicit (judgment-based) [37].

In this study we used implicit approaches, where a clinician uses information from the patient and published work to make judgments about outcomes, though sensitive, and preferred mostly, but also they are time-consuming, depends on the user's background knowledge and attitudes, and can also have low reliability, while other methods are costly to require follow up at different centres and need much cooperation and support, thus there is no ideal measure, but the strengths and weaknesses of both approaches should be considered [33].

Thus for the assessment of the interventions, a multidisciplinary independent clinical committee (two physicians & one clinical pharmacist) was responsible to review and assess the

significance of interventions, a method or an approach utilized by other investigators evaluating clinical pharmacists' interventions [36, 38].

A detailed interventions outcomes criterion was obtained from the literature review and adopted for this purpose [39]. Six main outcomes were assigned, either to increase cost, decrease cost, increase the quality of care prevent adverse effect or toxicity improve therapeutic effect, avoid an allergic reaction, provide information, or provide a service.

Interventions done by the pharmacist were assigned mainly (31%) to prevent adverse events or drug toxicity, secondly were interventions that improve therapeutic effects (24.6%) followed by those that increase the quality of care(19.5), and provided information (18.4).

The committee had assigned outcomes and validated all interventions, though reported some defects regarding the need to use of scientific named of drugs in documentation and individual cases to need for further information, some missing daily blood pressures and diagnostic information of some cases e.g. chest X-ray for a patient diagnosed with pneumonia, but defects were regarded as minor errors and did not affect results.

This was the first study to evaluate physician's perception and expectations in TRNC and Turkey, also it was the first study to implement clinical pharmacy services in Cyprus. Yet few limitations are worth mentioning. First, the low sample size was of great negative effect on the study and resulted in many interesting but un-generalizable findings regarding perceptions expectations and experiences of physicians. Also, the long term impact was not evaluated in this study.

Regarding the interventional part of the study, the limited number of pharmacist introduced the CPS's (only one) and linguistic barriers resulted in less maximization of interventions as patient education and medication history review. Also, more widely used tools for classification of DRP could be more useful for evaluating DRPs.

Finally it is also of mention that NEU hospital is regarded as the leading hospital in Cyprus and its healthcare providers are regarded as much

talented and competent, this can lead to bias if results are generalized for all hospitals in Cyprus, and better picture could be drawn if the study was multicenter study with a representative sample size and also control group.

#### **4. CONCLUSION**

The introduction of CPS's has led to clinically relevant and highly accepted optimization of medicine use in different wards and clinics including respiratory diseases clinic in the case of this study. Relatively high expectations and encouraging perception were reported from physicians towards clinical pharmacy and pharmaceutical care duties, though most physicians never experienced such activities in their settings. Perceptions were even more improved after the 60 days introduction of CPS in the respiratory clinic with a high rate of acceptance of pharmacist interventions and services.

Further studies involving control group and higher sample size should be carried to more sharply investigate physician's perceptions before and after introducing pharmaceutical care while more implementation of pharmaceutical care and clinical pharmacy practice is important in other wards for longer periods so to compare such results to these study findings. Future studies may also cover the impact on cost and degree of cost-effectiveness of introducing clinical pharmacy services in developing countries.

#### **5. AVAILABILITY OF DATA AND MATERIALS**

The data sets supporting the conclusions of this article are available in excel file and can be provided if requested.

#### **CONSENT**

It is not applicable.

#### **ETHICAL APPROVAL**

Ethical approval for this study was obtained from the institutional review board (IRB) of Near East University Hospital. The research was conducted in accordance with the declaration of Helsinki.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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