THE COMPUTERISATION OF COMMUNITY PHARMACY

REBECCA MARY FOSTER

Doctor of Philosophy

THE UNIVERSITY OF ASTON IN BIRMINGHAM

January 1992

THE UNIVERSITY OF ASTON IN BIRMINGHAM

SUMMARY

THE COMPUTERISATION OF COMMUNITY PHARMACY

Rebecca Mary Foster

Submitted for the degree of Doctor of Philosophy, 1992

Computers have, over the past 10 to 15 years, become an integral part of many activities carried out by British community pharmacists. This thesis employs quantitative and qualitative research methods to explore the use of computers and other forms of information technology (IT) in a number of these activities.

Mail questionnaires were used to estimate the level of IT use among British community pharmacists in 1989 and 1990. Comparison of the results suggests that the percentage of community pharmacists using computers and other forms of IT is increasing, and that the range of applications to which pharmacy computers are put is expanding.

The use of an electronic, on-line information service, PINS, by community pharmacists was investigated using mail questionnaires. The majority of community pharmacists who subscribed to the service, and who responded to the questionnaire, claimed to use PINS less than they had expected to. In addition, most did not find it user-friendly.

A computer program to aid pharmacists when responding to their patients' symptoms was investigated using interviews and direct observation. The aid was not found to help pharmacists in responding to patients' symptoms because of impracticalities involved in its operation. Use of the same computer program by members of the public without the involvement of a pharmacist was also studied. In this setting, the program was favourably accepted by the majority of those who used it.

Provision of computer generated information leaflets from pharmacies was investigated using mail questionnaires and interviews. The leaflets were found to be popular with the majority of recipients interviewed. Since starting to give out the leaflets, 27 out of 55 pharmacists who responded to the questionnaire had experienced an increase in the numbers of prescriptions they dispensed. 46 had experienced an increase in the number of patient enquiries they received.

The majority of pharmacists who responded to a questionnaire about EPoS did not agree that an EPoS system would be of benefit in their pharmacies. Respondents in independent and small multiple pharmacies were least likely to agree that such a systems would be beneficial.

Keywords: Community pharmacy, Computers, Information technology.

For my parents

with much gratitude

ACKNOWLEDGEMENTS

I would like to thank my supervisors, Michael Jepson and Barry Strickland-Hodge for all their help, advice and encouragement.

I thank all those pharmacists, computer suppliers and members of the public who gave their time to be interviewed, complete questionnaires or try out computer systems.

I also thank everyone who I have consulted for advice and information during my research: Special thanks go to David Shenton for his help with the PINS investigation; Michael Field for letting me use his pharmacy in a case study; Roger King for his help with the computerised aid to diagnosis; Alison Dean for carrying out some of the interviews; and to John Richardson Computers Ltd. and Hadley Hutt Computing Ltd. for their generous contributions towards the cost of the research.

CONTENTS

Publications

1 Boakes RM, Strickland-Hodge B, Jespon MH, Computers in community pharmacy: a national survey of current uses and future developments.
Pharmaceutical Journal 1990; **244**: 620-623.

2 Boakes RM, Strickland-Hodge B, Jepson MH, Survey of use of the Pharmacy Information and News Service (PINS) among community pharmacists.
International Journal of Pharmacy Practice 1991; **1**: 98-101.

3 Boakes RM, Jepson MH, Strickland-Hodge B, The use of electronic point of sale (EPoS) in community pharmacy.
Pharmacy Practice research session and posters. September 1991.
Royal Pharmaceutical Society of Great Britain.

TABLES AND FIGURES

Figures

ABBREVIATIONS USED IN THE TEXT

ADR	Adverse Drug Reaction
APA	American Pharmaceutical Association
BBC	British Broadcasting Corporation
BMA	British Medical Association
BNF	British National Formulary
CAL	Computer Aided/Assisted Learning
CBS	Channel Business Systems
CSM	Committee on the Safety of Medicines
CUG	Closed User Group
EAN	European Article Number
EDBS	Exeter Data Base Systems
EPoS	Electronic Point of Sale
GP	General Practitioner
IBM	International Business Machines
ICML	Independent Chemists Marketing Limited
IT	Information Technology
JRC	John Richardson Computers Ltd.
MAR	Medication Administration Record
NHS	National Health Service
OLTP	On-Line Transaction Processing technology
OTC	Over The Counter
PCM	Patient Counselling Module
PIL	Patient Information Leaflet
PILLS	Patient records, Interactions, Leaflets and Labelling

PINS	Pharmacy Information and News Service
PPA	Prescription Pricing Authority
PPI	Patient Package Insert
PSGB	Pharmaceutical Society of Great Britain
PSNC	Pharmaceutical Services Negotiating Committee
PSS	Packet Switch Stream
RPSGB	Royal Pharmaceutical Society of Great Britain
SPSS	Statistical Package for Social Sciences
USA	United States of America

GLOSSARY

Acoustic coupler - A soundproof box into which the handset of an ordinary telephone is placed. The box is connected to a keyboard and printer, and the operation of keys is converted from electrical pulses to acoustic signals. These are picked up by the telephone's microphone and transmitted as signals to the computer. Similarly the signals from the computer are emitted acoustically by the telephone's earpiece and converted into electrical pulses by the acoustic coupler in order to operate the printer.

Adverse Drug Reaction (ADR) - A noxious reaction to a drug that would not normally have been expected on the basis of its known pharmacology.

Artificial Intelligence - The ability of machines to perform tasks that would normally require human intelligence. Examples of artificial intelligence applications include general problem solvers, speech recognition systems, and expert systems.

Bulletin board - a service, based on the transfer of data between computers via the telephone network, which enables letters and documents to be sent to a central computer and then viewed by other computer users.

Communications - The activities associated with the generation, transfer and reception of messages or signals that are sent from a source to a receiver.

Community pharmacy - A professional activity involving the supply of, and provision of information about, medicines and medical and surgical appliances required for the prevention or treatment of disease under domiciliary conditions.

Contra-indication - A combination of a drug and a patient's condition which, if the drug was administered to that patient, would result in a deterioration in the patient's health.

Drug interaction - An unusual pharmacological response which cannot be explained by the action of a single drug but is due to two or more drugs acting simultaneously.

Electronic mail - A service which enables letters and documents to be sent between computers via the telephone network.

Expert System - A computer program designed to help solve problems which would normally require the knowledge of an expert in a particular field.

Floppy disc - A single, flexible magnetic disc on which information is stored in electronic form.

Hardware - The physical components and devices which make up a computer.

Information Technology (IT) - The term is used to refer to systems employing electronic, electrical and mechanical devices to access, record, process, communicate or retrieve information.

Interlex - The Interactions Lexicon of Pharmaceutical Products, a software product which provides information on the joint effect of pairs of pharmaceutical products.

Microcomputer - A computer based on a single chip microprocessor.

Minicomputer - A computer, larger than a microcomputer but smaller than a mainframe computer, which consists of a number of functional devices.

Mainframe computer - A large computer consisting of a number of single units.

Multitasking - A mode of operation of a computer where processor time and memory space are shared amongst several programs.

Multiuser - A mode of operation of a computer which allows processor time to be shared amongst a number of terminals, so that each terminal appears to be using the whole computer all the time.

On-line information source - A source of information held on a central computer to which users have a direct computer link.

Patient Medication Record (PMR) - A record of medicines which have been dispensed to a patient, such records are being held in a computerised form by an increasing number of community pharmacists.

Prescription Pricing Authority (PPA) - Responsible for pricing prescriptions on behalf of the Family Health Service Authorities (FHSAs) who are responsible for providing general medical, dental, opthalmic and pharmaceutical services.

Repeat Prescription - A prescription for a medicine, or medical or surgical appliance, that is a repeat of a prescription for the same item written some time before.

Software - The programs which direct the operation of a computer.

SPSS - The Statistical Package for the Social Sciences, a software package designed to manipulate statistical data.

Chapter 1. COMPUTERS IN COMMUNITY PHARMACY - AN OVERVIEW

1. 1 Introduction

Microprocessors based on compact integrated electronic circuits have allowed the development of a wide range of modern computers which have now become a part of business, technology, education and domestic life in the developed world.

One area into which computers have penetrated is community pharmacy. This is the branch of the profession of pharmacy with responsibility for serving local communities. A community pharmacy is typically a shop where prescriptions are dispensed and medicines are sold, in addition advice is available on the medicines supplied and on the treatment of minor ailments[1]. In this setting, computers have developed over the past 10 to 15 years from large mainframe or minicomputers, only found in a small number of pharmacies, to small, multi-function microcomputers present in the majority of British pharmacies. Community pharmacy computers are now used for business and professional functions including labelling, maintenance of patient medication records, drug interaction monitoring, stock control, stock ordering, account keeping, and provision of information.

Computers have brought about major changes to the practice of community pharmacy and will continue to do so as they develop further. This thesis explores the effects of computers and other forms of

Information Technology (IT) on the roles of the community pharmacist in Great Britain.

1. 2 Computers around the world

The patterns of the development of pharmacy computers in different parts of the world have varied according to the health service structures present, and to the pressures experienced by pharmacists. This chapter will discuss the use of pharmacy computers in a number of countries around the world.

1. 2. 1 Computers in the United States of America

One of the first uses of computers by community pharmacists in the United States was batch processing of prescription charges. As there is no National Health Service in the USA, pharmacists charge their customers for any prescriptions that are dispensed. In the 1970s a number of wholesalers started to offer a batch processing service to pharmacists: Records of customer charges were sent by the pharmacist to the wholesaler, the records were processed using a central computer, and individualised statements were prepared for customers. The wholesaler could then provide the pharmacist with information on all prescription and non-prescription medications sold over a given period.

At the same time, the cost of prescriptions was increasingly being met, not by the customer, but by "third parties", including private insurance plans, state operated Medicaid programs, labour unions and senior citizen organisations. Extra administrative work was thus created for pharmacists, who had to charge these third party payers. It was realised that automation of claim preparation by pharmacists would save considerable time and money[2]. The first types of computer system to be used in a significant number of American pharmacies were known as "shared systems". These systems had facilities for the automation of third party claims. Groups of pharmacists, each with a terminal connected to a central main-frame computer, shared the database and programs of that central computer. Prescription records could be transmitted to the central computer and converted into the claim form format specified by the third party payer. The claims, in electronic form, were then sent to the third party payer for processing and payment[3]. The shared computer systems also allowed pharmacists to produce computer labels for dispensed medicines and to maintain patient medication records.

Hardware constraints meant that "stand alone" computer systems, able to run independently of a central computer, developed more slowly than the shared systems in the 1970s. At first, stand alone systems were based on minicomputers which, to keep the price competitive, had to be limited in their range of functions. However as microcomputer technology developed and prices dropped in the early 1980s, there was a trend towards greater use of stand alone microcomputers in American pharmacies. A survey in 1983 carried out by "American Druggist", found that 6700 retail pharmacies were computerised. A follow-up survey in 1984 showed that the number had jumped to 11500 - approximately 23% of all retail pharmacies in the United States[4]. 85% of the pharmacy computers were stand alone systems. 6300 were in independent pharmacies (19% of all independent pharmacies) and 5200 were in chain pharmacies (31% of all chain pharmacies). The 1983 survey showed that over 90% of pharmacy computers in independent pharmacies could generate labels, maintain patient medication records, process third party claims, retrieve patient, doctor and drug records, provide patients with tax information, update prescription product prices and generate controlled substance reports[4].

A further rise in the percentage of community pharmacists in the United States with computers was revealed by a survey performed in February 1986, this indicated that 67% of large independent pharmacies had a computer system as did 58% of chain pharmacies[5]. In 1988 the American Pharmaceutical Association (APA) recognised the importance of computers to community pharmacists and adopted the following recommendations of its Policy Committee on Professional Affairs:

1. The APA endorses the development and application of computer and/or automation technology by pharmacists to enhance pharmacy services.
2. The APA recommends that pharmacists maintain responsibility for drug use control in the utilisation of computerised and/or automated pharmacy systems[6].

A recent development in American pharmacy computerisation is the introduction of on-line transaction processing technology (OLTP)[7]. This was introduced in 1988 and is a solution to the problem of rejected claims from third party payers. OLTP is utilised by banks in the form of automatic teller machines. In a similar way, patients who are a member of a prescription drug plan or Medicaid, carry a card which can be used by the pharmacist to verify the cardholder's eligibility and to approve the prescription order before dispensing it. OLTP use can range from verification of cardholder eligibility to complete data capture and claim adjudication. In 1990 it was estimated that over 70 million prescriptions (out of 600 million covered by a prescription plan or Medicaid) were being handled through OLTP, and it has been predicted that this figure will rise exponentially over the next few years. OLTP systems could theoretically be extended to provide pharmacists with a variety of information such as new product announcements, product recall notices, and queries on drug availability.

1. 2. 2 Computers in Europe

Two European countries in which computers for use in community pharmacy were adopted at a relatively early stage were Sweden and Holland. In Sweden, all the privately owned pharmacies were merged into one company, the Apoteksbolaget or National Corporation of Swedish Pharmacies, in 1971. Apoteksbolaget began developing a pharmacy computer system soon after it was created. The first, experimental system involved 10 terminals in pharmacies connected to a mainframe computer. It had a broad range of applications including label printing, dose checking and treatment costing[8]. After experience with this system it was decided to change to a simple minicomputer system which carried out prescription labelling, costing and invoicing. Each participant pharmacy was equipped with a minicomputer and 1-4 terminals. This was later adapted to incorporate an on-line link to facilitate electronic ordering of goods, and transmission of prescription and OTC data to a central computer for analysis[9]. In 1984 it was predicted that within 4-5 years all Swedish pharmacies would be computerised[10]. Community pharmacists in Sweden also have access to the Swedish Drug Information System (SWEDIS). This was developed by the Swedish Department of Drugs, the National Board of Health and Welfare, and Uppsala University data centre, and introduced in 1976. SWEDIS is an on-line database that can be accessed from pharmacies, information centres, universities, hospitals and the drug industry. It contains various kinds of information all relating to drugs, from tablet identification to adverse drug reactions[11].

In Holland, by 1981, three pilot projects involving computer systems in community pharmacies were being undertaken, and the KNMP (Royal Dutch Association for the Advancement of Pharmacy) had established a committee to investigate the application software[12]. Two of the pilot projects involved terminals in pharmacies connected to mainframe computers, the third project involved smaller, stand-alone computers in around 20 pharmacies. The software utilised in the third project provided facilities for labelling, maintaining patient medication records, maintaining a patient register, monitoring for drug interactions, costing treatment, preparing accounts and issuing receipts. KNMP developed a drug data base containing pharmacotherapeutic data and economic data in the late 1970s. KNMP now distributes computer-readable drug files with trade data, labelling data and medical surveillance data (doses and drug interactions) to pharmacies (roughly 1000 out of 1350 in 1989) every month. These files can be fed into an individual pharmacy's computer, providing reliable drug data.

In France, the concept of patient-held medication records, where the patient's medical data is stored on a card in electronic form has been enthusiastically embraced. The microcomputer card or "smart card", was developed in France by Roland Moreno in 1974[13]. Smart cards consist of a memory chip and a microprocessor embedded inside a credit-card sized piece of plastic. A number of well-established smart card systems are now in operation in France, some involving community pharmacies (see chapter 2).

In Italy, an information network was installed in the Italian pharmacy system in the late 1980s[14]. Consisting of microcomputers in the provincial and regional offices of the pharmacist associations associated to Federfarma, the aim of this network was to improve the flow of information between these pharmacy associations and to eventually link up with regional and local health authorities.

1. 2. 3 Computers in Australasia

Computers began to be adopted by significant numbers of Australian pharmacists in the first half of the 1980s. In 1981 one observer predicted that in 2 years time 10% of pharmacies would be computerised[15], while another predicted that 40% of pharmacists were currently assessing computerisation in their pharmacies[16]. Many new systems were marketed at that time, most including patient medication records[16]. In addition a number of electronic point of sale (EPoS) systems were available.

A survey of Australian pharmacists in 1986 indicated that about 60% of pharmacies had computers[17]. In 1989 it was estimated that this had risen to just under 80%[18]. Computers available to Australian community pharmacists incorporate labelling, patient medication records, drug interactions and some have an electronic point of sale facility. From July 1987 all Australian pharmacists were given the option of submitting their prescription reimbursement claims to the Department of Health on a floppy disc, for which they would receive an extra 2½ cents per prescription[19]. With recent squeezing of Australian community pharmacists' incomes, it has become increasingly important for pharmacists to manage the retail sections of their businesses efficiently, this has been used as an encouragement for more pharmacists to invest in EPoS systems[20].

In New Zealand all pharmacists now transmit prescription information from their computers to the Department of Health's computer which then prices the prescriptions for payment to the pharmacist and collates prescribing information[21]. This enables pharmacists to be paid more quickly and provides a database of information which the Department of Health can use in price negotiations and to analyse prescribing and usage patterns. In 1989 all pharmacy computers available from suppliers in New Zealand incorporated software for patient medication records as well as labelling and drug interaction monitoring.

1. 3 Computers in Great Britain

Electric typewriters were used in British pharmacies in the late 1970s. These were used for producing dispensed medicine labels, and were a forerunner of computerised labellers[22]. At the same time, some pharmaceutical wholesalers developed computerised stock ordering systems[23,24]. These systems consisted of portable microcomputer terminals which could store orders and transmit them direct to the wholesaler via the telephone line. These "portable data capture units" were leased to pharmacists at a cost of between £20 and £30 per month and gave many pharmacists their first taste of computers.

In the early 1980s there was further development of pharmacy computers by pharmaceutical wholesalers such as Unichem and Vestric. The systems developed included dedicated labellers and complete pharmacy computer systems which could produce prescription labels, maintain patient medication records, check for drug interactions and incompatibilities, compile prescription statistics, and perform a number of business functions[25,26,27,28,29].

As the availability of cheap microcomputers increased in the early 1980s, a number of individual pharmacists began to write software for use in their own pharmacies. In 1981 and 1982 there were many reports in the pharmaceutical press of systems that had been developed independently of wholesalers both by individual pharmacists and by companies. All of the systems produced labels, some could also handle book keeping and simple stock control functions. Prices were in the range £1000-£3000. A paper by Dawson et al[30], included the first listing of a computer program, which other pharmacists could copy and use, to be printed in the Pharmaceutical Journal.

In November 1982, the Council of the Pharmaceutical Society announced that all labels on dispensed medicines should be typed or mechanically printed as from January 1st 1984[31]. This decision further encouraged the development of new computerised pharmacy labelling systems. The Pharmaceutical Journal printed a special supplement in June 1983 entitled "Prescription labelling systems"[32]. This included a catalogue of prescription labelling systems with photographs, sample labels, hardware used, space occupied, costs, and proposed developments. Listed in this catalogue were 28 microcomputer based labelling systems, 5 dedicated micro-processor labelling machines, and 3 dispensary management systems.

After 1984, the number of new systems coming on to the market decreased while the established computer system suppliers improved and updated their products. There was a trend away from programming in simple languages such as BASIC, to machine code and other faster languages, this made the production of "home made" systems less easy and the number of these reported in the Pharmaceutical press decreased.

Another statement made by the Pharmaceutical Society's Council that influenced the development of pharmacy computer systems, was that from 1st January 1987, it should be considered good professional practice for many prescribed medicines to bear the additional cautionary and advisory labels subsequently published in the British National Formulary[33]. As a result, pharmacy computer labelling systems were developed which could automatically add the appropriate warnings to labels.

The second half of the 1980s saw the development of pharmacy computer systems incorporating modems for order transmission[34,35]. These systems were thus able to generate orders while labelling, automatically replacing the items dispensed without the need for a separate portable data entry unit.

The increasing uptake by pharmacists of computer systems incorporating patient medication records was also a feature of the late 1980s. The White paper "Promoting better health", which was published in November 1987, proposed the introduction of an allowance payable to those pharmacies who maintained a substantial number of patient medication records relating to elderly or confused patients on long-term medication[36]. In addition, the falling price of powerful computer hardware encouraged the uptake of PMR systems.

In 1989 the Royal Pharmaceutical Society of Great Britain issued a set of guidelines on pharmacy computer systems which encompassed recommended information to be included in a PMR. These guidelines are discussed in more detail in the following chapter.

Chapter 2. APPLICATIONS OF COMPUTERS IN COMMUNITY PHARMACY

Following the brief summary of the history and development of computers in Great Britain in the previous chapter, this chapter will discuss the impact of computers on specific activities carried out in community pharmacies.

2. 1 The activities carried out in community pharmacy

In the early 1980s a project, financed by the Department of Health and sponsored by the Pharmaceutical Society of Great Britain, to determine the priority areas in the continuing education of pharmacists, was undertaken[37]. One of the aims of this project was to determine the competencies regarded as necessary to practice in community pharmacy. The researchers used a method called the Delphi technique, which involved interviewing a panel of experts in the field, to build up a consensus on the competencies required to practice community pharmacy. The list of competencies obtained was validated using a critical incidence survey, in which community pharmacists, medical practitioners, district nurses and members of the public were asked to recall any incidents in community pharmacy in which they thought the pharmacist involved had done well or not so well. The competencies identified by the critical incidence survey were matched against those identified by the panel of experts, to give 70 competencies which were required by a pharmacist practising in community pharmacy.

In 1983 an independent committee was set up by the Nuffield Foundation to consider the structure of the practice of pharmacy, their report, The Nuffield Report of 1986[1], suggested an expansion of the community pharmacist's role away from traditional dispensing activities towards other activities which have become known as the "extended role". Subsequent government Green and White papers on primary health care[36,38] built on the findings of the Nuffield Report and outlined some of the features of this "extended role".

Combination of the Nuffield Report's "extended role" activities with Dunn and Hamilton's competencies gives a comprehensive list of the activities carried out in a community pharmacy today. Figure 1 summarises these activities and groups them into 4 categories. The figure is intended as a guide with which to illustrate the extent and potential for computerisation in community pharmacy, which is discussed in the rest of this chapter.

URE 1 The activities carried out in community pharmacy

ꞮIPTION PROCESSING

ꞁ and interpreting the prescription

ng prescription containers

ning prescription records

ıg for ADRs, drug interactions,
·indications

, endorsing and collecting
ption fees

ıling prescription items

ȝ with patients and prescribers
rescription queries

PATIENT CARE

Advising patients on the administration or use of their medicines

Advising patients on minor ailments

Advising patients on general health matters

Giving help and advice in emergencies

Advising prescribers on drug therapy, economic prescribing and handling complex substances

Identifying unknown medication

Referring patients to other health professionals

Providing diagnostic testing services

MUNITY PHARMACY

MACY MANAGEMENT

management

management

t control

ɜining legal and ethical
ıtions

vising Pharmacy
ine sales

ling staff guidelines

EXTERNAL ACTIVITIES

Provision of domiciliary services

Supervision of medicines in residential homes

Participation in continuing education programs for pharmacists and other health professionals

Providing pre-registration training

. 2 Computerisation of prescription processing activities

number of activities involved in processing prescriptions have been computerised. The majority of computers in community pharmacies today are used to produce labels for prescription medicines. Pharmacy computers can also be used to check for drug interactions, contra-indications and unusual dose instructions. These functions are especially useful when computerised PMRs are held, which an increasing number of community pharmacists are now doing. Computers have been used experimentally to read and interpret prescriptions written electronically onto "smart cards". They have also been used experimentally in the process of prescription pricing, and to provide information which could be used to assist pharmacists in liaising with patients and prescribers about prescription enquiries. A pharmacy computer is now available which can endorse NHS prescriptions. Computers have not been used for assembling prescription items except in the form of tablet counters.

2. 2. 1 Labelling

Labelling of dispensed medicines by community pharmacists is of prime importance, as it is a means of communicating to the patient how a medicine should be taken. The advantages to patients of computer produced labels is that they are consistent, well presented and easy to read. The advantages to the pharmacist are that the computer can store product names and dosage instructions in coded form, if these codes are known, it is not necessary to enter drug names or dosage instructions in full when producing the label, thus speeding up the labelling process. Similarly the computer can store details of the recommended warnings for each product, these will be automatically printed onto the label.

2. 2. 1. 1 Early computerised labellers

The first machines used to produce labels automatically for dispensed medicines were electric typewriters. In a report of the use of an automatic typewriter in a community pharmacy, the authors described the time consuming selection and entering of dose codes for use on their system[22]. However, they reported that label production was faster than with manual typing and recommended pharmacies with busy dispensaries to investigate such machines.

Some of the first computer systems incorporating a labelling facility, were developed by pharmaceutical wholesalers. An evaluation of the labelling functions of two early systems developed by the wholesaler Unichem, Pride 1 and Pride 2, was performed in a Welsh pharmacy between 1982 and 1983[27]. The evaluators measured times taken to prepare labels manually, with Pride 1 and with Pride 2. Their findings for the average labelling times were:

* Manual labelling - 27 seconds
* Pride 1 - 34 seconds
* Pride 2 at installation - 32 seconds
* Pride 2 after one year's use - 22 seconds.

At the end of one year using Pride 2 all the dispensary staff were proficient and none expressed a wish to return to manual labelling, it was calculated that a 9% increase in dispensing had occurred during 1982 and had been dealt with by the same number of staff without any undue strain. One of the conclusions made by the authors was that computerised label printing improved label presentation and speed of production.

These two reports suggest that early automatic labelling systems were quicker than manual labelling. Since then the speed of computerised labelling has increased because of hardware developments resulting in faster response times, and because of improved software.

2. 2. 1. 2 The development of computerised labellers in the second half of the 1980s

The requirement that all dispensed labels should be typed or mechanically printed from the beginning of 1984[31] resulted in a large number of pharmacists investing in computer labellers. In addition, the Pharmaceutical Society's recommendation that dispensed medicines should bear the appropriate cautionary and advisory labels[33] led to the development of labelling packages that would add such labels automatically, thus making computerised labelling faster than typed labelling and so more attractive.

In the late 1980s the increasing use of labelling software in conjunction with patient medication records allowed repeat prescriptions to be produced without having to re-type the drug name or dosage instructions.

2. 2. 2 Patient medication records

Maintaining a record of a patient's drugs, age, sex and sensitivities, is advantageous for the community pharmacist as it allows:

1. Identification of prescription errors including:
   - interactions of clinical significance between drugs;
   - contra-indications between drugs and certain conditions;
   - drugs prescribed for allergic patients;
   - unusual dosage instructions.
2. Ability to supply missing prescription information.
3. Increased speed of dispensing.
4. Ability to add notes to a patient's record.

2. 2. 2. 1 Manual patient medication records

Manual patient medication records (PMRs) have been kept in some British pharmacies for many years. One such system was used in a North London pharmacy between 1977 and 1980. Records were kept for 1366 patients, for three years, during which time 86 potential drug interactions were detected, as well as 76 errors on prescriptions. This illustrated the benefits of having a PMR system[39]. Maintaining manual patient medication records requires considerable time, especially in the initial stages - patient details have to be obtained and entered onto record cards. When that patient returns, the card must be retrieved and an updated entry made. Computers, however, capable of storing and retrieving large amounts of data, offer a means of keeping patient medication records without such a large input of time and labour. Patient details still have to be obtained and entered, but retrieval and updating of the records can be done automatically as a by-product of the labelling process. Also a large number of records can be stored without the system becoming bulky. Thus, as computer technology developed rapidly in the late 1970s and early 1980s community pharmacy saw the emergence of computer systems incorporating patient medication records.

2. 2. 2. 2 Early computerised patient medication record systems

In 1978 a minicomputer with label printing, stock control and patient medication facilities was set up by a community pharmacist, Idris Hughes, in his pharmacy. Hughes described trials of the PMRs on his system as "disappointing" and commented that, although nursing home staff and patients derived great benefit from PMRs, the time saved by computerised labelling and stock control was offset by the time required to manage and use the PMRs[40].

Unichem's Pride system, launched in 1979, also incorporated a PMR facility[25]. The system was evaluated by Stevens and Crabbe in 1982[27]. They found that, to run the PMR software as well as the labelling and stock control software, seven 8 inch floppy discs were required. In addition, the retrieval of data from the discs was very slow. For these reasons they did not use the PMR function in the trial, however they did conclude that a sophisticated computer like Pride was under utilised if only used for labelling and detection of drug interactions - without functions such as PMRs and stock control, the capital outlay involved was too high. Pride 2, the replacement for Pride introduced in 1982, did not incorporate PMRs and a survey of Pride users carried out by Unichem in 1983 indicated that less than 5% were interested in PMRs[27].

A working party on computers, reported to the Council of the Pharmaceutical Society in July 1983[41]. The working party stressed the importance of computerisation of the professional aspects of community pharmacy including patient medication records. The following year the Pharmaceutical Society gave financial backing to two pilot projects to assess the value of patient medication records[42]. One of these projects was the "Medlock" trial involving patient held medication records which is discussed in section 2. 2. 3. The other project, which was carried out in a pharmacy in Hull by Roger King, involved a fully computerised record system including details of a patient's current and past medication and drug interactions as well as details of products bought over the counter.

2. 2. 2. 3 Development of computerised patient medication record systems

The impetus for the more widespread uptake of microcomputer-based PMRs throughout the profession came from several directions. Technological developments came about, which made greater use of PMRs easier, firstly the introduction of hard discs with greater storage capacity, secondly increases in the speed of operation of computers. These changes together with a fall in the cost of computers, resulted in a decreased price to computing power ratio. The White paper "Promoting Better Health"[36], on primary health care, was published in November 1987. In it, the government proposed to introduce an allowance for pharmacies that maintained a substantial number of records relating to medicines used by elderly patients on long term medication, thus providing a financial stimulus for pharmacy held patient medication records.

The Royal Pharmaceutical Society of Great Britain issued a set of guidelines on pharmacy computer systems in March 1989[43] in which they recommended the information to be recorded about the patient, the doctor and the dispensed medicines in a PMR. The recommended patient, doctor and medicine information is shown in Table 1.

Table 1 RPSGB's guidelines on the information to be recorded in a Patient Medication Record (PMR)

Patient information	**Doctor information**	**Medicine information**
Full name	Name	Date
Address	NHS number	Quantity of medicine
NHS number	Telephone number	Name of product
Sex	Practice address	Form
Date of birth	Practice telephone number	Dose
Telephone number		Batch number
Name of GP		Manufacturer information
Drug sensitivities		
Allergies		
Chronic conditions		
Medicines purchased		
Any other patient specific notes		

The Society recommended that all pharmacy computer systems should:

1. Be multitasking (able to undertake several tasks at once).
2. Be able to link with on-line services.
3. Have a hard disc of minimum 32 megabyte capacity.
4. Have a tape streamer on which to back up data.
5. Be password protected.
6. Mark records with the date and time of creation.

They also urged pharmacists to consider: the supplier's reputation; IBM compatibility of the system; speed of operation; and ease of transfer of data to other systems.

These guidelines and the accompanying Pharmaceutical Journal features on computers in community pharmacy, provided timely information to pharmacists considering investing in such equipment. They also encouraged pharmacy computer suppliers to upgrade their systems to the recommended standards.

2. 2. 2. 4 Security of computerised patient medication records

The Data Protection Act 1984[44] laid down rules governing the holding of computerised information on individuals. The Act makes it obligatory for anyone keeping personal data on individuals in a computerised form to register with the Data Protection Registrar and to ensure that the data is:

1. Collected and processed fairly and lawfully.
2. Held only for lawful purposes described in the register entry.
3. Adequate, relevant and not excessive in relation to the purpose for which they were held.

4. Accurate and, where necessary, kept up to date.
5. Held no longer than necessary for the registered purpose.
6. Surrounded by proper security.

The Act also gives a statutory right to individuals (data subjects) to a copy of all personal data held about them by the data user, an exception being made in cases where disclosure of the data is likely to cause serious harm to the physical or mental health of the data subject or another person[45]. In order to comply with the Data Protection Act, therefore, a pharmacist had to register with the Data Protection Registrar and maintain accurate, up to date records in a secure environment.

Maintaining a secure environment for PMRs is of great importance. Most pharmacy held PMRs are kept on hard disc for day to day operation. However in this form they may be damaged, for example during a power failure, this could result in loss of the records. To prevent such loss of data, pharmacists have been advised to make regular back-up copies of their data files and to store these back-ups in a secure place. Unauthorised access to the data can be prevented by using password protection for the PMR facility, whereby a prospective user must enter a password before being able to access a PMR[43]. An RPSGB Council statement was issued in August 1988 reminding pharmacists of Section 4 of the Code of Ethics which states: "A pharmacist shall respect the confidentiality of information relating to patients and their families. Such information shall not be disclosed to anyone without the patient's or appropriate guardian's consent except where it is the best interest of the patient to do so"[46].

2. 2. 2. 5 Patient medication records held on central computers

The vast majority of computerised PMRs used by pharmacists in Britain are kept in the pharmacy and stored on a microprocessor. However there are other ways in which PMRs may be held. In Sweden and the USA patient medication records have been held on central mainframe or minicomputers connected to terminals in a number of different pharmacies. A large measure of co-operation is required to set up such shared systems. In Sweden this could be achieved because all pharmacies are owned by the Apoteksbolaget (National Corporation of Swedish Pharmacies) following nationalisation. In the USA it was often multiple pharmacy stores who shared the same central computer. In this country, the largest multiple community pharmacy outlet, Boots the Chemist Ltd., announced in 1989 that the company was in the final stages of designing a new technology base for use in all its pharmacies that would allow PMRs to be transferred between branches[47]. The system has, however, not yet been put to that use.

2. 2. 3 Smart cards and other patient-held medication records

Computerised patient-held medication records (patient data cards) include magnetic stripe cards, memory cards and smart cards. These devices can store large amounts of data, such as health records, in a portable form, which can be accessed using card readers. Patients carrying cards on which their own health record is stored, act as a networking agent between health care professionals who can access the data as required.

The smart card has been defined as "a portable data storage device with intelligence and provisions for identity and security"[48]. True smart cards have a memory chip and a microprocessor embedded within them. Magnetic stripe cards, such as those used to withdraw cash from bank automatic teller machines, contain a strip of magnetic tape which can store data. Magnetic stripe cards are cheaper than smart cards and are already widely used, however they have a limited data storage capacity and are less secure than smart cards. The first memory card was the "LaserCard", produced by Jerome Drexler in 1981. These cards contain a reflective layer of silver particles, data is stored as a series of minute, non-reflective pits embedded in the silver layer. The storage capacity of LaserCards is large: a credit-card sized device can hold the equivalent of up to 800 A4 pages of text, this makes them suitable for bulk storage applications. The production costs of LaserCards are in between those of magnetic stripe cards and smart cards. One disadvantage of a LaserCard is that the non-reflective pits which carry the information are created with a laser, and once a card has been encoded with information, it is difficult to add further data. Thus it would not be so easy for health care professionals to write information onto LaserCards, as it would be for other card technologies.

Patient data cards have the potential to computerise a number of the activities comprising prescription processing. A card onto which a prescriber has "written" details of the items to be dispensed for a patient, effectively becomes a prescription which can be inserted into a card reader in a pharmacy for interpretation. Checks on drug interactions, contra-indications and unusual dosages could be made from the information on the card and a label produced. Details of the items dispensed and the appropriate prices to be reimbursed to the pharmacist could be recorded on the pharmacy computer or on the card. In practice a number of patient data card trials have taken place in Great Britain but none have carried out all these functions successfully. In Europe there have also been a number of patient data card trials.

2. 2. 3. 1 Patient data cards in Europe

Recognising the increased demand for good communications across Europe, between health care users, among doctors and other health care providers, and among health administrators and third party payers, the European Community adopted as a research programme the AIM (Advanced Informatics in Medicine) workplan in 1988. One of the tasks included in this workplan was the assessment of the needs and organisational impact of Patient Data Cards (patient held medication record cards). The objectives of this task were to harmonise the development and implementation of data cards and associated technologies in Europe, and to examine their impact in the wider context of an Integrated Health Environment in the Community[49].

A number of smart card trials have taken place in Europe. In France there are several well established systems in operation[50]. One system which involves pharmacists, known as the "Biocarte" system, was introduced in 1986 in the Pas de Calais region and was later expanded to cover over 100 doctors and 150 pharmacies. Pharmacists could read patients' cards to check for incompatibilities and add details of the medicines received by the patient. In Italy, Olivetti, working in conjunction with the Italian Ministry of Health announced the "Individual health booklets" project on the island of Sardinia in which 20000 patients will be issued with LaserCards[51]. In Spain there was a trial of a magnetic stripe card for patient identity, registration and record linkage. The "Pamem" card is now being extended to the entire Spanish population[50]. Magnetic stripe cards as aids to patient identification and billing are also being introduced for the entire populations of Portugal and West Germany and the Canadian provinces of Saskatchuan and British Columbia[52].

Although the trials have allowed greater understanding of the logistics of patient-held records and of the limitations of the trials themselves, none have produced an evaluation that shows cost-effectiveness or an improved outcome of care. Such evaluations need to be carried out in order to determine whether the concept of patient held records is practically as well as theoretically sound.

2. 2. 3. 2 Patient data cards in Great Britain

In this country the first smart card trial, known as the "Medlock" trial, took place at Rhydefelin near Cardiff, Wales[53]. The trial had financial backing from the Pharmaceutical Society and the first phase of the trial started in Spring 1984. It was pharmacy based and involved 50 patients who were issued with a data key device carrying patient identifier information, a record of four dispensed drugs, and details of repeat prescriptions for those four drugs. The data key was replaced by a card with greater memory capacity in the second phase of the trial. These cards were issued to 100 patients and their use monitored over a six month period. It was not until the trial's final phase that doctors became involved, 2500 cards were issued to patients registered with one group practice of six doctors. Five out of six doctors in the practice used the system during patient consultation to add prescription details to the cards, while the surgery receptionists added repeat prescription data. Staff in the surgery and the pharmacy observed a time saving in prescription processing and a reduction in prescription errors, whilst 30% of the patients thought the card had improved their relationship with the practice[54]. At the end of the three year trial period, staff in the Rhydefelin pharmacy and the majority of participating patients were in favour of the concept of using the patient retained cards[55]. 59% of patients who responded to a questionnaire did not want the card to carry more information about them. The use of the cards by younger patients was low but for patients over 55, around 88% of cards were accessed during the trial. Thus it seems that the cards used in this trial were beneficial to staff in the surgery and pharmacy, patients who used the cards were also favourably disposed to the cards. However this may not be a true representation of patients' views in general as not all patients used the cards.

In 1989, a trial sponsored by British Telecom involving LaserCards was carried out in the West London hospital maternity unit. 547 patients were recruited and assigned either to a group carrying medical notes on an optical card or to a group carrying notes in a booklet. Patients perceived the computer system to be quicker and more efficient but less useful to them and more likely to be lost[56].

The largest trial of patient-held medical records in this country was the Exmouth Care Card trial which took place from 1989 to 1990 and was sponsored by the Department of Health[57]. It involved 8500 patients of two general practitioner practices, plus nearly all the diabetics in Exmouth. The sites at which health professionals could access the cards included two general medical practices, eight community pharmacies, one dental practice, Exmouth hospital and the Royal Devon and Exeter hospital (the district general hospital). The trial aimed to establish computer readable, patient-held medical records, which could be transferred between health care professionals. It was also designed to investigate the acceptability of patient-held medical record cards, to establish any benefits of such a system and to establish what further work would be required to develop the concept. There was near unanimous support among professional users for the concept of a patient held medical card but the Care Card itself was criticised for:

1. Slow access times.
2. Lack of and/or faults with the reading/writing equipment at individual sites.

3. High card failure rate at the beginning of the trial.

The main lesson of the trial was felt to be the importance of developing a product which meets basic performance criteria, defined in terms of users' time and convenience. Both pharmacists and dentists expressed their desire and need to "write" to the cards, the former with details of OTC medications and the latter with prescription details. Unfortunately, the patient base used in the trial proved to be too low, this led to under utilisation of the cards and so hampered the evaluation. However, the trial detected no fundamental objection amongst patients to the principle of the cards. The pharmacists involved in the trial were enthusiastic about patient retained records but found that the information provided by doctors on the cards was often incomplete and that average card access times were excessive. Because of the low patient base there was little impact on day to day pharmacy running and pharmacists tended to create PMRs independently with their own pharmacy computer systems, which detracted from the trial aim of improving communications between health professionals via the smart card[58].

2. 2. 4 Checking for adverse drug reactions, drug interactions, contraindications and unusual dose instructions

A drug interaction has been defined as "an unusual pharmacological response which cannot be explained by the action of a single drug but is due to two or more drugs acting simultaneously"[59]. The effects of drug interactions vary widely according to the drugs and the patient involved. The likelihood of drug interactions occurring is increased by factors such as polypharmacy, self-medication, use of drugs with narrow therapeutic indices and involvement of more than one doctor with a patient, all of which are features of modern medicine. The elderly are particularly at risk from drug interactions. They are often taking several drugs, increasing the possibility of interactions occurring. In addition, there is an age-related narrowing of the therapeutic index of many drugs leading to increased sensitivity to certain interactions. In a study of medicines prescribed for, and taken by, a nationally representative sample of 805 people aged 65 or over, 70% were taking one or more prescribed medicine. 4% of patients were identified as taking two prescribed drugs which duplicated each other's actions indicating some confusion or error in the prescribing, whilst 17% were identified as taking medicines with potentially harmful interactions.[60]

Community pharmacists maintaining patient medication records are well placed to monitor interactions between the medications prescribed for their customers. It is possible to build up a chronological patient history which the pharmacist can review when a new drug is dispensed, so checking for potential drug interactions. In a study of manual medication record cards kept in a North London pharmacy over a three year period, 86 potential drug interactions were detected. In 53 of these cases the general practitioner changed the prescription after being contacted by the pharmacist, while in 15 cases advice was given to the patient by the pharmacist[39].

The introduction of computers into community pharmacy created an opportunity for automatic screening for drug interactions during the processing of prescriptions. In a 1985 survey of community pharmacists, participants were asked to put a list of possible future applications of pharmacy computers in order of priority. Of those who answered the question, the highest percentage selected drug interaction monitoring as their first choice[61]. Now many pharmacy computer systems incorporating drug interaction detection facilities are available. Some systems simply check for drug interactions between the medicines being dispensed, others also check for interactions with medicines dispensed on previous occasions (from 6 months to two years previously), records of which are stored in a PMR.

A number of evaluations of computerised drug interaction detection facilities have been carried out. In a study of the Pride pharmacy computer system in one pharmacy, the frequency of drug interaction detection was 2.1% of 22029 total items, a third of which were classified by the authors as of "major" clinical significance[27], while a 1990 study, in the same pharmacy, of the Interlex drug interaction software package, revealed that 1% of the 5000 items dispensed during one month were interactions requiring contact with the patient's GP[62]. In an American survey of Michigan pharmacists, the differences between the various drug interaction programs available was highlighted: the users of one computer system detected and followed up on interactions more frequently, and were more likely to report improved knowledge of drug interactions than non-users. However frequencies of drug interaction detection and other related measures reported by the users of the second computer system were similar to non-users[63].

In 1989 the Royal Pharmaceutical Society of Great Britain issued a set of guidelines on computer systems for use in community pharmacies. These guidelines included the following points for computerised drug interaction detection[43]:

1. Drug interaction information should be obtained from a reputable source with a guarantee that it is regularly updated.
2. Data on all drug interactions should be stored on the computer, but positive warnings should only be given for the two highest levels of interaction. These warnings should require a conscious decision to be made so that the labelling procedure can only be continued by the use of a password to unlock the system.
3. The minimum period for searching information should be three months, but for elderly and confused patients this should be extended to two years.

The use of drug interaction information from a reputable source is essential if patients are not to be put at risk, as is regular updating of that information. The second of the above guidelines requires the classification of drug interactions according to their seriousness. At present the suppliers of pharmacy computer systems incorporating drug interaction facilities use a variety of methods to classify interactions according to seriousness. To avoid the potential confusion resulting from these differences a standard system of drug interaction classification should be set by an authoritative body such as the Royal Pharmaceutical Society. There has been much discussion about the third guideline on the minimum period for searching records for drug interaction information. Some feel that two years is too long a period as medications which patients are no longer taking could be included.

A number of commercially available pharmacy computer systems are also able to check for contra-indications ie. alert the pharmacist to incompatibilities between a patient's condition and the medication they are taking (see chapter 9). In addition, a subset of these systems are able to display usual dose ranges for a drug on the screen as labelling is taking place, this enables a pharmacist to check that the dose on the prescription is usual for a particular drug. Computers have not been used in community pharmacy to aid in the detection of adverse drug reactions. An adverse drug reaction is "any response to a drug which is noxious and unintended and which occurs at doses used in man for prophylaxis, diagnosis or therapy"[64]. At present pharmacists do not have an official role in reporting ADRs, which may explain the lack of software in this area.

2. 2. 5 Prescription pricing and endorsing

National Health Service (NHS) prescriptions dispensed in community pharmacies are normally endorsed where necessary with the product name and pack size of the item supplied. They are then sent from the pharmacy at which they were dispensed, to the Prescription Pricing Authority (PPA) monthly for pricing and subsequent reimbursement. A report of a study of the use of computers in the administration of the

Family Practitioner Services, by the management consultants Arthur Andersen and Co. was published in 1984[65]. The report envisaged that by the 1990s the majority of pharmacists would have computers which they would use to store details of the NHS prescriptions they dispensed. Those details would then be transmitted directly to a computer at the Prescription Pricing Authority (PPA). According to the report, such electronic transfer of prescription data would reduce the amount of time pharmacists spent on administrative duties. Endorsing prescriptions could be automated and their monthly sorting and counting would be eliminated. In addition, the number of administrative staff at the PPA could be cut and pharmacists would receive their payments for dispensing services more quickly.

A pilot trial testing the feasibility of computer links between pharmacies and the PPA was run, by Arthur Andersen and Co., from September 1986 to March 1987. It involved ten pharmacies using software provided by John Richardson Computers Ltd.[66]. After favourable evaluations of the pilot trial, work began on a system for pharmacists nationally, however, the proposals were shelved by the Department of Health in January 1989[67] on the basis that:

1. It took longer to capture data in trial pharmacies than at the PPA.
2. Payment of pharmacists for entering data was expected to result in overheads being higher than under the existing arrangement.
3. Data entry by the pharmacists in the trial was less accurate than at the PPA.

4. No audit facility was available for a pharmacy based data entry arrangement[68].

In New Zealand there is an electronic data transfer system in operation whereby all pharmacists' computers transmit dispensed prescription information direct to the Department of Health's central computer. Detailed prescribing information is collated by the central computer allowing analysis for cost and prescribing control statistics[21]. Similarly, in Australia, pharmacists can submit dispensing data which has been collected as a by-product of labelling and is stored electronically on disc. As an incentive to take part in computerised claims transmission, it was announced in 1987 that Australian pharmacists using the system would be paid an extra 2½ cents per prescription[19].

An automated prescription endorsing facility was introduced as a feature on a British pharmacy computer system in September 1991[69]. This system incorporates a second printer dedicated to endorsing, the pharmacist is required to select the dispensing procedure to be followed, which results in the appropriate endorsement of the prescription.

2. 3 Computerisation of patient care activities

The provision of advice and information is a central part of the pharmacist's patient care role. Computers are well suited to storing large amounts of data, and retrieving and displaying it, thus there is potential for the involvement of computers in patient care by pharmacists. Pharmacy computers have been used to supply advice direct to patients about their medications, in the form of information leaflets. They have also been used experimentally to aid pharmacists and patients in dealing with symptoms of minor ailments, and to provide advice direct to patients on general health matters. Computerised data bases containing a variety of information have been made available to community pharmacists. Information from such data bases has the potential to be used by pharmacists in advising both patients and prescribers. Computers have been used to identify unknown medication but in this country only in a hospital setting. Computerised equipment for testing cholesterol, pulse and blood pressure levels has been used in community pharmacy but computers have not been used to refer patients to other health professionals.

2. 3. 1 Provision of advice to patients on their medicines

It has been estimated that about 40% of patients do not comply with doctors' advice on treatment[70] and lack of information has been identified as a major reason for this[71]. A number of studies on patients' knowledge of their medicines have been performed[72,73,74]. Over 90% of patients leaving one hospital pharmacy[72] knew how often and how much of their medicines they should take but only 51% knew the best way to take the medicine. 55% of 8831 Boots customers who were questioned as they collected their medicines, did not know exactly how or when they should take their medicines, or whether the medicines should be taken with food or on an empty stomach[74].

2. 3. 1. 1 Patient information leaflets

Pharmacists are well placed to provide their patients with information and advice on medicines when prescriptions are collected, however this may not be possible if the patient does not collect the medicine personally, or the pharmacist is too busy. In addition, verbal instructions can be forgotten by patients. The provision of written information to reinforce oral communication could overcome these problems and so improve patient compliance and treatment outcome.

Studies have suggested that when followed up at a later date, patients who receive an information leaflet with their dispensed medicines have better knowledge of those medicines than patients who received no information leaflet. These studies have involved hospital outpatients[75,76,77,78] and patients collecting prescriptions from community pharmacies[79,80,81]. In a large trial involving 254 community pharmacies[79], leaflets were issued to patients at 136 pharmacies who had been prescribed three classes of drugs. Postal questionnaires were sent to those patients who had received leaflets. Questionnaires were also sent to patients who collected the study drugs, without leaflets, from 118 control pharmacies. Of the 3410 patients who completed questionnaires, significantly more of those who had received leaflets knew they should take their medicine with fluid, were aware of what to do if a dose was missed and knew what side effects might be experienced. Patients who received leaflets were also more likely to experience certain side effects than those who had not. The authors suggested that this increased side effect reporting was due to improved recognition of "true" side effects. The potential harm done to patients by telling them about possible side effects has been used as an argument against patient information leaflets. However, a review by Morris in 1982 showed that only 1 out of 8 studies produced evidence of increased side effects. Other studies have shown that fore-warning patients about side effects may actually enhance adherence to treatment[82].

With the increasing storage capacity of microcomputers, it is possible for a pharmacy computer to store a comprehensive range of patient information leaflets in electronic form. If this leaflet data can be linked to computer labelling software it is possible to generate personalised patient information leaflets as a patients' prescription details are entered during the labelling process. A program to produce "medicine information charts", developed at a Leeds hospital was reported in 1988[83]. The American Society of Hospital Pharmacists supplies community pharmacists with a software package and database called Consumer Drug Information on Disk. This can be used to print out personalised drug monographs for pharmacy customers[84]. In this country, a community pharmacy computer system capable of generating patient information leaflets was developed by two pharmacists in the late 1980s it is now marketed by Hadley Hutt Computing Ltd. and is at present used in around 300 pharmacies. By 1991 the pharmacy computer suppliers Park Systems Ltd. and John Richardson Computers Ltd. had included a facility for patient information leaflet production in their systems (see chapter 9).

2. 3. 1. 2 Patient package inserts

The European Commission has directed that from 1992 all pharmaceutical products must include a patient information leaflet as a package insert or on the label or container. In France it is compulsory to provide patients with information, either as a patient package insert (PPI) or on the package. In West Germany PPIs are mandatory, and in Italy, Greece, Portugal and Belgium PPIs are provided for patients. In the USA and Sweden patient information is available in the form of compendia[85]. The Association of the British Pharmaceutical Industry (ABPI) set up a working party on the provision of information to patients on medicines in 1984. This resulted in the formulation of 10 points of policy concerning patient information on medicines. These can be summarised as follows:

1. Written information, as patient package leaflets should be given and should be included in original packs on the introduction of original pack dispensing.
2. Information should be as brief and succinct as possible and in a standardised layout, leaflets should state that the information contained is limited.
3. Individual manufacturers should be responsible for preparing the information and should bear the cost of its provision, leaflets should be approved by the appropriate licensing authority.
4. A compendia of patient information leaflets should be compiled for provision to doctors and pharmacists and for reference by patients.

5. The needs of blind and non-English speaking patients should be further considered and the effect of leaflet provision should be reviewed[85].

2. 3. 1. 3 The legal position

Some PPIs are already produced for use in Great Britain, for example detailed leaflets for oral contraceptives have been standard for over a decade. All patient information leaflets produced by pharmaceutical companies must comply with the Leaflet Regulations made under the Medicines Act (1968)[86] which specify form and content. If a manufacturer is negligent in the formulation or presentation of a patient information leaflet and this results in patient injury, it may be a criminal offence under the Act. The Consumer Protection Act (1988)[87] introduced the principle of strict liability. Thus manufacturers are liable for injury caused by a product found to be defective. A defective product is one which does not provide the safety that the public is entitled to expect, taking into account all circumstances including its presentation. Because the test of defectivenesss is essentially a consumer expectation test, written patient information could play an important role in qualifying the patients' expectations and thereby protecting the manufacturer from liability[85]. Computer generated, generic leaflets (leaflets about a specific drug relevant to all proprietary brands) are the joint responsibility of the company producing the computer program and the pharmacist giving out the leaflets. If a defective leaflet was given to a patient resulting in injury, the pharmacy business could probably recover a contribution, either partly or wholly, from the company producing the program if any claims were made[88].

2. 3. 2 Provision of advice on minor ailments

Community pharmacists have traditionally used their professional judgement to recommend the appropriate course of action in response to symptoms described by members of the public. This activity is often termed "responding to symptoms"[89]. Surveys of attitudes of members of the general public towards the pharmacist's role in this area have been conducted, and there is evidence that the number of people willing to take advice from pharmacists is increasing[90].

Investigations of the way in which pharmacists respond to symptoms have been carried out. In a 1986 study, researchers made a total of 200 visits to pharmacies and presented symptoms to the pharmacy staff[91]. The quality and quantity of questions asked by the members of the pharmacy staff were generally regarded by the researchers as being inadequate. A more recent study in Newcastle upon Tyne[92] concluded that pharmacists' advice to parents about children's ailments is not always appropriate. It has been suggested that if pharmacists adopted a structured approach to responding to symptoms there would be an improvement in the findings of such studies[93].

2. 3. 2. 1 Computerised aids to diagnosis

A number of medical computerised aids to diagnosis have been produced[94,95,96,97]. The use of a system in primary care in India was reported in 1988[98]. A computer running the software was installed in a general practitioner's dispensary and operated, first by the GP's medical assistant, and then by a non-medical engineer. Patients were screened by the operator using the computer on entering the dispensary. The majority of prescriptions (74%) given by the computer were found to match what was subsequently given by the doctor, suggesting that for most day to day health problems a computer would effectively reduce doctors' workloads.

In this country computer programs have been developed to help community pharmacists respond to symptoms. One such program, "Medihelp", was developed by a Northampton pharmacist in 1985[99]. The program was designed to help deal with 15 different minor ailments including aches and pains, constipation, coughs and colds, diarrhoea, haemorrhoids, hay fever, indigestion and vitamins/tonics. After appropriate questioning about a patient's symptoms, the system could suggest a certain product or recommend that the patient see a doctor or dentist. The program could be operated by counter assistants as well as by pharmacists in which case the assistant could be recommended to seek the pharmacist's help. "Response" was another computerised aid developed by Dedicated Health Care Systems in 1985[100]. As with "Medihelp" a number of minor ailments commonly presented to pharmacists were covered and the system could suggest suitable medicines where appropriate. In addition "Response" could check for drug interactions between the suggested medicine and any other medicines the patient was taking. A third program designed to improve pharmacists' ability to respond to common cold symptoms was developed and was tested by 11 community pharmacists in 1988[101]. In response to a questionnaire, 6 of the 11 pharmacists said that initially they found use of the program restrictive, but after a few weeks of use, only one pharmacist still found it restrictive. 8 said they thought the program had made some improvement to their assessment of patients presenting with cold symptoms. In 1989 the program was made available as a training tool for pharmacists and pre-registration graduates and was being assessed as a under-graduate teaching tool.

2. 3. 3 Provision of other advice and information

It is very important that the information provided by pharmacists to patients and other health care professionals is up to date. Sometimes the information held in written sources in the pharmacy is insufficient or not current. The ability of computers to communicate with each other provides the means for pharmacists to access current information held in distant sources.

2. 3. 3. 1 Pharmacy information on Prestel

Interactive videotex is the name given to computerised telecommunications systems based on the linkage of a computer, a telephone and a television or remote computer/terminal. Prestel is an interactive videotex system provided by British Telecom. It is supported by a regional network of computers and has hundreds of thousands of pages supplied by a large number of information providers. In addition, users can send messages to other Prestel users. A number of Prestel pages are of interest to health care professionals; these include social security benefit rates, vaccination data, details of conferences and contents of the current issue of the Journal of the Royal College of General Practitioners[102].

Meditel was an information provider on Prestel. One of the information topics it provided was "Medicine in the news", because there was restricted access to this information it was known as a "Closed user group" (CUG). Another CUG was established in 1983 and carried news and reference information pertaining to pharmacy. Called On-Pharm, this experimental national pharmacy information network project ran for around 18 months. The information available included product information, medicine law updates, professional activities, academic issues and social events. A news service, including NPA news was included, as was a BNF update service and a 500 page malaria prophylaxis service. On-pharm was updated daily. The project was extended to run on British Telecom's "Gold" service, however neither this nor Prestel were ideal vehicles for the service. Although around 300 users subscribed to On-pharm, it failed to provide an economic base within 18 months and so was discontinued[103].

2. 3. 3. 2 The Pharmacy Information and News Service

On-line information services allow a user to obtain information from a central computer data base via the telephone network. The Pharmacy Information and News Service (PINS) was an on-line electronic information service for use by pharmacists, run by the RPSGB between September 1986 and December 1990. PINS arose from an experiment within the RPSGB's law department in 1986 which investigated the possibility of improving communications between the Law department and the Society's inspectorate[104]. It became apparent that information could be provided not only to the Inspectorate but also direct to community and hospital pharmacists. PINS allowed pharmacists to obtain information from the Society's System-36 IBM central computer. PINS was formally launched at the British Pharmaceutical Conference 1986 in Jersey and by the end of that year over 200 pharmacists had become subscribers[105]. Part of the PINS philosophy was to improve communications between the Society and its members by providing up to date information and news that could be accessed 24 hours a day. The information provided could often not easily be obtained from other sources. Topics covered by PINS included:

1. Drug recalls and withdrawals
2. Society press releases
3. Society publications and services
4. Legal and ethical advice
5. Aspects of postgraduate education
6. The Society's registers of pharmaceutical chemists and of premises.

Additional sections were later added to PINS, these included one on malaria prophylaxis.

PINS users paid an annual subscription (£10 in 1986, £11.50 in 1990) and telephone charges for each call they made to the PINS computer or to the nearest Packet Switch Stream (PSS) exchange. Unlike many other on-line services, PINS subscribers were not charged for either time connected or quantity of data received.

In 1987 free PINS software was made available, by the pharmacy computer supplier John Richardson Computers Ltd., to every Branch and Region of the Pharmaceutical Society, in an effort to "further the awareness of PINS among pharmacists"[106]. However the uptake of PINS subscriptions by pharmacists remained less than 500. In 1989 the PINS computer history file was analysed for one month by the PINS office staff. It was found that there had been an average of 11 "log-ins" per day, the section most frequently accessed being the News section, followed by drug recalls and register enquiries[107]. One explanation given for the low uptake of PINS was the slow speed of the hardware used[108], other hardware features were also criticised[109], the implication being that the PINS data base should be re-established on a different computer. However the cost of such a solution to the low uptake problem would have been considerable and the future of PINS was under review at that time[107].

In August 1990 it was announced that PINS was to close. The Council of the RPSGB had decided that although support for electronic information services should be retained, PINS should cease operation from December 31st 1990[110]. The decision to bring the PINS project to a close was made in a time of financial pressures in an attempt to effect salary savings.

2. 3. 3. 3 Other on-line information sources

Other on-line information sources exist that are of interest to community pharmacists. VADIS (the ViewData Information Service) was developed by the Lothian Drug Information Service. VADIS is funded by the Scottish Home and Health Department and in March 1990, contained comprehensive information on nearly 300 drugs. Although it was not then available to community pharmacists, plans were being made to make it so[111]. The on-line system hosted at the Surgical Materials Testing Laboratory at Bridgend Hospital has available databases and files of interest to pharmacists and others working in quality control, dressings and medical and surgical fields. It is available for any pharmacist to access[112].

A number of other on-line services are available containing pharmaceutical information. These include Martindale On-line, Medline and Pharmline, and are accessed via host systems eg. Dialog and Datastar. It is unlikely that these sources will be useful to community pharmacists because of the high cost and difficulty of access involved.

2. 3. 4 Identification of medicines

A computer program which will identify most solid oral dosage forms was developed at St. George's hospital in London[113]. The system is called TICTAC, to operate it a user inputs information on 8 parameters such as weight and dimensions. Its use has not been reported in community pharmacy.

2. 4 Computerisation of management activities

Information is an invaluable tool in pharmacy management. Computers, which can store and manipulate large amounts of information therefore have a number of applications in this area of activity. In the area of staff management, computers have been used to store details of the payroll, and as an aid to budget control they have been used to store details of accounts. Computerised dispensary stock ordering and stock control are available on most pharmacy computer systems today, such features aid the community pharmacist in dispensary stock management and budget control. Electronic point of sale (EPoS) systems have been adopted by small numbers of community pharmacists, these have the potential to manage and improve stock control in the whole pharmacy, and could also be used to alert pharmacists when Pharmacy medicines are sold. Computers have been used to provide staff guidelines on OTC sales, this application was described in section 2. 3. 2.

2. 4. 1 Stock management

Pharmacy computers have an important role in stock management, they are well suited to this task as it involves storing and manipulating large amounts of data about stock ordered and stock dispensed. Some of the earliest pharmacy computers in this country were simple portable data capture units which could be linked, via a telephone line, to a wholesaler and were used for stock ordering. In one such system, Unichem's Prosper, orders were placed by keying the codes of products to be ordered into the terminal, connecting the terminal to the pharmacy telephone using an acoustic coupler, and transmitting the order. Price tickets bearing product codes would be delivered with ordered goods to the pharmacy, and could then be affixed to the appropriate items. The Unichem central computer could also calculate "re-order points" (stock levels at which an order is placed) for all goods in a particular pharmacy, based on previous purchases. Similarly, order data could be converted to management information for the user[23]. The portable data capture units eliminated the need for verbal phone calls from wholesalers to pharmacists for ordering. Their advantages to wholesalers were reduced costs of the telephone order office, reduced time spent on the telephone and, consequently the load on the computer. In return, pharmacists who used the terminals could get extra discount on orders and were given periodical management reports showing all purchases made.

Many early pharmacy computer systems used information entered into the computer during the labelling process to determine how much stock was left in a dispensary. This amount could be compared with a pre-defined re-order level and an order generated if appropriate[114]. A number of systems supplied by wholesalers incorporated ordering facilities into the labelling software, so that when a re-order level was reached an order was automatically sent to the wholesaler. However, many labelling systems produced independently of wholesalers, did not send orders automatically, but simply printed out lists of items to be ordered. In a 1985 survey of computer use among pharmacists, Stevens and Crabbe reported that 33% of respondents were using their computers for dispensary stock control while 39% were using their computers for dispensary stock usage reports and 19% for stock ordering[61].

In the second half of the 1980s computer systems were produced which had the ability to transmit orders to any wholesaler. This resulted in more pharmacists using their computers to order stock in preference to portable data capture units.

2. 4. 2 Electronic point of sale

Electronic point of sale, or EPoS, is a process in which information about a product being sold is entered into the cash register or terminal at which the sale is taking place. Sales data compiled in this way can be manipulated, allowing the retailer to see exactly what has been sold, in what quantities and when. Manual methods of sales information collection include the use of removable sale tickets and the use of data entry terminals. Automatic data entry occurs when a device reads information from the product and transfers it directly into the electronic cash register or terminal. The most widely used method of automatic data entry at the point of sale is bar code scanning. A bar code consists of a series of thin and thick lines, or bars, which represent a 13 digit European Article Number (EAN) system code. When a product's bar code is scanned by a light pen or laser scanner, details of that product are transferred into the terminal or computer of the EPoS system, the product's price is retrieved from memory and can be displayed, while details of the sale are recorded.

The major quantifiable benefits of an EPoS system have been described as:

1. Improved stock control which increases stock turnover and so reduces the capital tied up in stock.

2. Provision of sales information which leads to improved product selection, merchandising and promotions, which in turn leads to increased sales.
3. Better use of buying power which leads to improved profit margins[115].

As with pharmacy computers in general, early EPoS systems were more expensive, less reliable and less efficient than their modern counterparts. One major difficulty with early systems was their reliance on manual entry of product information which was time consuming and liable to error. The advent of bar codes improved this situation, however some of the first bar code scanners were not ideal. An early trial undertaken by the wholesaler Vestric, in which light pens were used to read bar codes in 3 pharmacies, was described as a "failure" because the bar codes were often not read correctly first time. Problems arose because of the inferior bar code reading equipment of the day being used on products with difficult shapes and sizes such as soft or small packages[116].

The development of EPoS systems in community pharmacy can be illustrated by looking at the experiences of Boots the Chemist Ltd., the largest retail pharmacy outlet in this country. Boots ran point of sale trials in two of its stores between 1976 and 1979[117]. In one store, 60 tills were involved and products were coded with magnetic labels, in the other store, 4 tills were involved and products were bar coded. These trials were discontinued for two main reasons. First the EPoS hardware required was too expensive, and second it was too costly to produce and affix the magnetic labels. The problem of cost of hardware eased over the next few years as the price of EPoS equipment fell. In order to overcome the labelling difficulty, Boots requested over 4000 of their suppliers to print EAN bar codes on their products by mid-1986. In 1986 Boots set up an EPoS system using bar codes and by June 1990 450 out of its 1096 stores had that system[118].

Use of EPoS in small multiple and independent community pharmacies followed a similar pattern to that of Boots. Independent Retail Computer Systems Ltd launched two EPoS systems in 1981. In one system, consisting solely of an upgraded cash register, the product data collected as sales were made was periodically sent to a central computer for analysis. The other system comprised a stand alone computer linked to the cash register able to perform its own analyses. In both cases reports of products that needed re-ordering, monthly sales and current performance compared to pre-determined budgets could be produced. The price of the cash register was £1550 and a weekly charge of between £29 and £40 was made for use of the central computer bureau. The price of the stand alone system was £5750. The upgraded cash register was tested in 6 pharmacies and was claimed to be "quick and easy for the staff", however no figures were given to support this statement[119]. A small multiple group of 5 pharmacies used the system from 1981 to 1983 but cost/benefit analysis indicated that the system was not cost effective in this setting. In addition many personnel problems were encountered with the introduction of the system, and working practices had to be substantially altered[115].

Community pharmacy has seen the development of a number of systems tailored to its needs within the last five years[120,121,122,123,124]. It seems likely that pharmacy will follow the increasing number of supermarkets and other non-pharmacy high street shops which have installed EPoS systems. In 1989 there were approximately 1500 retail outlets in Britain with fully installed EPoS systems and EPoS users have reported positive dramatic effects on stockholdings, product mix and margins[125]. In 1990, according to the Bar Code Advisory Service, 60-70% of items in the health care sector were bar coded, another estimate puts the number of prescription only medicines bar coded at source as being about 50%[118].

2. 5 Computerisation of external activities

As yet, computers have not been used to aid community pharmacists in their external activities to any great extent. However a number of computer assisted learning (CAL) packages have been used in the continuing education of community pharmacists[126,127,128,129,130,131]. Such packages also have the potential for use in pre-registration training although there have been no reports on the outcome of such use.

Computer software has also been written to assist pharmacists in the supervision of medicines in residential homes[132]. Provision of domiciliary services is a relatively new role for the community pharmacist and involves visiting patients in their own homes to deliver medicines and to ensure that they are not having any problems them. There have been reports of the use of portable computers in other professions who carry out domiciliary visits and such computers have the potential for use by visiting pharmacists[133].

2. 5. 1 Computer assisted learning (CAL)

Computer assisted learning (also known as computer aided learning or CAL) is a technique in which a computer is used to provide instructional material. Learning is accomplished through interactions between the computer program and the user. The computer presents information and queries the student regarding his or her understanding of the material. Correct answers from a student receive reinforcing feedback from the computer. Incorrect answers receive corrective feedback from the computer.

The potential effectiveness of CAL as a medium for the provision of continuing education material for pharmacists was evaluated in a study conducted in the USA and reported in 1984[126]. 38 pharmacists using one pharmacy computer system were sent a criterion referenced test (a test where questions are congruent with specified performance standards) relating to pharmacy management. 16 were then sent CAL material on pharmacy management for two weeks, the remaining pharmacists acted as controls. After the two week period both groups were again sent the criterion referenced test. The group who had received the CAL material achieved significantly better test scores in the second test than the control group. A questionnaire to those pharmacists who had used the CAL program indicated that they found it to be a valid and acceptable method of instruction.

In a survey of British community pharmacists, reported in 1989[127], 18% of respondents indicated that they would be "very likely" to use pharmaceutical continuing education software, while a further 18% felt it was possible that they would do so. Respondents were asked which computers (if any) they used at home and at work, on the basis of their responses, the authors concluded that Acorn BBC and IBM compatible machines were sufficiently widely available, in community pharmacists' places of work or homes, to be worth programming for CAL material. In 1991 the same authors, from Liverpool Polytechnic School of Pharmacy, announced the launch of a CAL package which could run on IBM compatible computers, and was based on case studies which commonly present in community pharmacies[128]. This program, called "Enpharm", included questions on each case study. The user's responses to these questions were assessed by comparison with responses of a peer group panel. The launch of Enpharm was followed by a second CAL package from the Liverpool School of Pharmacy, called "Pharmlex", covering selected areas of the law relating to pharmacy practice[129].

A slightly different approach to CAL delivery was taken by the Welsh Committee for Postgraduate Pharmaceutical Education in 1990[130,131]. They felt that pharmacists would be unlikely to want to use their pharmacy computers for CAL because of the difficulty in finding time to divert the pharmacy computer away from other dispensary activities. They therefore designed a CAL package to run on Apple Macintosh computers, which are not generally used in pharmacy computer systems, but which have a high standard of visual output and are robust and very portable. Macintoshes running the CAL program were delivered to pharmacists on a loan basis (for 3 days) for use whenever convenient. The main disadvantage of this approach was the cost of purchase and delivery of computers, it was hoped that sponsorship from pharmaceutical industry would overcome these problems.

2. 5. 2 CAL for members of the public in pharmacies

In its report on the present and future structure of the practice of pharmacy, the committee of inquiry appointed by the Nuffield Foundation predicted, in 1986, that during the next 20 years there would be an increasing demand by consumers in health care for more information, and to be more involved in their own treatment[1]. Pharmacists provide their customers with verbal and written information on many subjects including: drug therapy; treatment of minor ailments; use of medical and surgical appliances; and general advice on health matters such as smoking, drug abuse, and safe storage and disposal of medicines.

CAL techniques have been developed as a method of patient education in pharmacies. A microcomputer running a series of health-awareness lessons was made available in the waiting room of a health centre in Minneapolis, USA in the early 1980s and after 1 year was found to be acceptable to a non-computer orientated patient population[134]. The following lessons were included: Exercise/weight; Lifestyle; Life expectancy; Birth control; Why do you smoke; Alcohol self-assessment; and Drug IQ quiz. The Drug IQ quiz lesson was evaluated over a 9 month period by including questions in the program which users could answer after having completed the lesson, and analysing users' responses. It was found that users' scores improved by an average of 10% as a result of re-answering questions, 66% of users said that they had learnt something useful or potentially useful from the lesson and 62% liked the lesson.

In this country a 1986 study in Sunderland made available CAL material on antacids and laxatives for use by members of the public in a community pharmacy. Of 354 people invited to use the computer, 241 (68%) agreed. 97% of these found the material easy to use and 72% thought they would use a computer to gain information if one were available. The authors concluded that CAL provided a valuable additional means by which the pharmacist can provide instruction and advice to patients[135].

The use of a computerised counselling program for the instruction of asthmatic children in metered dose inhaler techniques has also been reported[136]. In this preliminary assessment, users of the program were positive about its ease of use and appropriateness, 90% of the asthmatic children who used it thought it would improve their knowledge of asthma, although only 40% thought it would improve their inhaler technique. In addition, the program appeared to be successful at gathering and storing information from users about their asthma.

A number of systems have been developed more recently in the United States providing information such as health education, health monitoring and drug information[137]. The "Carequest" system provides health education information. It consists of a computer linked to a video cassette recorder, "interactive video" programs are run on the system which allow interaction between the user and computer as in a CAL program. Another health education/health monitoring system, called "Healthcheck" offers blood pressure and pulse rate monitoring, individual health risk assessment and video presentations on health and drug education. The "PIC" (sic) system contains a database of information on 5000 prescription and over the counter (OTC) drugs. Users select the drug in which they are interested and the relevant information is displayed, patient information leaflets can also be generated.

2. 5. 3 Supervision of medicines in residential homes

A residential home provides residents with the level of care that would be expected to be provided by a relative. The majority of residents in homes are elderly but they also include the mentally handicapped, mentally ill, and children.

In 1984 the Council of the PSGB established a working party to consider the safe handling and administration of medicines in residential homes[138]. This working party recommended that community pharmacists should regularly visit the homes they supplied with medicines. This would enable them to check the homes' records, provide advice and help on storage of medicines, examine completed medication administration records, assist in the destruction of unwanted medication and provide other information, training advice and assistance as required. They also recommended that pharmacists serving residential homes should maintain patient medication records in the pharmacy and that in the home the following records should be kept:

1. Medicines book - a register of medicines ordered and received.
2. Medication profiles for each resident.
3. Administration records for each patient.

The working party deprecated the re-dispensing of tablets into such containers as egg cups and ice trays and praised the controlled dosage systems in which each dose for a particular resident is sealed into a separate compartment.

Following this report a number of controlled dosage systems became available to community pharmacists. These systems were designed to simplify the drug round in the home, they are filled in the supplying pharmacy and labelled with patient and medication details. Specific computer software can be used in conjunction with a controlled dosage system. This allows generation of labels, medicine information forms, medication administration records and repeat prescriptions as required.

2. 6 Research objectives

This chapter has described the extent of computerisation in the various areas of community pharmacy. Computers have had most impact on pharmacists' prescription processing activities, with many pharmacists using computers for labelling dispensed medicines, monitoring for drug interactions and maintaining patient medication records. Computers have been used by small numbers of pharmacists to provide information to pharmacists which can then be used in patient care activities. Computers are used by some pharmacists to aid pharmacy management. Computers have also been used in some external activities such as continuing education.

The aim of the research presented in this thesis was to further examine the effects of computers and other forms of information technology (IT) on the roles of the community pharmacist in Great Britain. The research first attempted to quantify the level of computer use among community pharmacists and to investigate pharmacists' attitudes towards various aspects of IT. Further work concentrated on analysing pharmacists' use of and attitudes towards the following individual applications of computers in pharmacy: electronic sources of information; a computerised aid to diagnosis; computer generated patient information leaflets; and electronic point of sale technology.

Chapter 3. METHODOLOGY

Both quantitative and qualitative research methods have been used in this thesis. Quantitative methods to build up a picture of computer use among community pharmacists as a whole, and qualitative methods for detailed study of specific computer applications.

Quantitative methods aim to either measure social behaviour by objective criteria, or to explain social behaviour in terms of a cause and effect relationship. The quantitative methods used in this research were surveys, interviews and direct observations.

Qualitative methods aim to examine people's ideas and beliefs, ellicit how people act in their "natural" setting, and examine social actions as they occur. Qualitative interviews have been used in this research.

3. 1 Survey methodology

Surveys are a method of collecting information from large samples of the population relatively quickly and efficiently allowing comparisons to be made between individuals and groups[139]. There are a number of methods (which are not mutually exclusive) of obtaining information, these are mail questionnaires, interviewing, examination of documentary sources, and observation.

The choice of survey method depends on the requirements of the research problem. Large amounts of data are better obtained through interview or observation than through a mail questionnaire, as respondents cannot be expected to spend more than 10 to 25 minutes completing a questionnaire. Similarly in-depth information is best obtained in an interview, where the interviewer can probe deeply. Mail questionnaires are effective for obtaining information from selected groups of people, as the response rate is likely to be higher for a select group with an interest in the topic than for the general population. If the respondents are geographically widely dispersed mail questionnaires should be used as the cost of sending interviewers to each respondent will be prohibitive. Mail questionnaires are most useful when pilot work has already been done allowing the questions to be narrowly defined, and thus easier for the respondent to complete[140,141]. Pilot questionnaires preceeded all main questionnaires described in this thesis. A full comparison of the advantages and disadvantages of mail and interview surveys is shown in Appendix 1.

A number of mail questionnaires were used in this research for the following reasons:

1. The samples under investigation were large and geographically widely dispersed making it impractical to undertake face to face interviews.
2. A good response rate was expected as those questioned were pharmacists who are educated to a high standard and likely to have some measure of interest in the subject covered by the questionnaire.

Telephone and face to face interviews were also used to collect some of the quantitative data presented in this thesis. They were used because:

1. Small numbers of interviewees were involved.
2. The interviewees were not geographically widely dispersed but were present in individual pharmacies.
3. Qualitative data such as anecdotal experiences and attitudes could be collected in the interviews as well as quantitative data.
4. Some of those interviewed were members of the public who may have been less well able to understand the questions had they been sent a mail questionnaire.

Telephone interviews were also used when small numbers of widely dispersed individuals were involved. Telephone interviews have the advantages of allowing collection of qualitative data, and allowing full explanation of the questions being asked.

3. 1. 1 Sampling

One of the first steps which must be taken when carrying out a survey is to define the population to be covered. It is often not possible to survey the whole of a population, because of the large numbers involved. In such cases a sub-section of that population, called the survey population, is studied. The process of selection of a survey population, in accordance with acceptable statistical methods, is known as sampling. If a sample is selected in a random way, bias in selection is avoided and the precision of the results can be calculated. The results of a survey of a randomly selected sample population of sufficient size can be generalised to the whole population[140].

The two methods of sampling used in this thesis are simple random sampling and quasi-random sampling. In simple random sampling, members of the survey population are selected either by arranging the whole population in a numbered list and selecting random numbers from that list, or by using a lottery method of selection. Quasi-random sampling requires every *nth* member of a numbered list of the population to be selected from a random starting point. Quasi-random sampling can be regarded as approximately equal to simple random sampling when the population list from which the sample is selected is arranged by a feature not related to the subject of the survey[140].

3. 1. 2 Scaling methods

An attitude is a general concept and as such can be approached from a number of different angles. Thus attitudes cannot accurately be determined from the answer to a single question. One method of gauging attitudes is to use a set of questions about beliefs pertaining to the attitude under study. Combining the answers to these questions into some sort of average will give a better indication of the attitude of the respondent. Precision will be increased if a measure of the strength with which a belief is held can be obtained instead of a simple yes or no answer, this can be achieved through the use of scaling techniques.

Rating scales are the most simple scaling technique employed in the measurement of attitudes in surveys, and were used in this thesis: Respondents were asked to rate the strength of their own attitudes or beliefs using a scale, usually a list of possible responses to a statement, eg. "strongly disagree" to "strongly agree". Rating scales are easy to construct, easy to respond to, and easy to analyse, they are also more sensitive and informative than yes or no answers. However, they suffer from a number of disadvantages including: reliance on the respondent's ability to assess his or her own attitude; a tendency for respondents to avoid the extreme positions on a scale; and subjectivity[140,141].

3. 1. 3 Non-response

Perhaps the most important disadvantage with surveys is the problem of non-response. In theory a sample selected randomly should not be biased, in practice not all the population members selected will respond to the survey, and those non-respondents may not be representative of the survey population. Non-response bias is thus introduced into the study.

THe following steps were taken to minimise non-response in the mail surveys reported in this thesis:

1. Two mailings were used, an initial one and a reminder enclosing a second copy of the questionnaire. (Further reminders were not sent out because of the impracticality of doing so in terms of time and money involved).

2. Covering letters were used to explain to the recipients the rationale behind the questionnaire. Experience suggests that a convincing covering letter makes a significant contribution to response rate.
3. Pre-paid envelopes were enclosed with the questionnaires so that recipients would not have to pay to return them.

3. 2 Qualitative interviews

Interviews are used in qualitative research, but unlike quantitative survey work which relies on uniformity of questions and answers, qualitative interviewing is unstructured and flexible so that a wide range of views and behaviour patterns can be explored[142]. In depth, semi-structured interviews were used in this thesis so that individuals' attitudes and behaviours could be explored in detail. A semi-structured questionnaire includes some structured questions which have specific answers such as "yes" or "no", it also contain unstructured questions which have no specific answers but ask for a respondent's beliefs, ideas or comments about a particular subject. In the case of the unstructured questions, answers were written down verbatim.

The interviews carried out in this thesis involved small numbers (less than 40 per day) of interviewees and took place in individual pharmacies. Observation of interviewees' behaviour was used to supplement the information obtained by interview.

3. 3 Methods of analysis

The quantitative surveys carried out in this thesis were subjected to statistical analysis. Data were entered from the questionnaires onto a microcomputer-based software package for data entry called Data Entry II[143]. In this form, the data were transmitted to a mainframe computer where they were analysed using the Statistical Package for the Social Sciences (SPSSX)[144].

Descriptive statistics were used to find frequency counts and averages while the chi-squared test was used to analyse differences between groups (see Appendix 2).

Chapter 4. SURVEY OF THE USE OF COMPUTERS IN COMMUNITY PHARMACY

4. 1 Introduction

The information technology equipment available to British community pharmacists is continually being updated and developed. It was therefore decided, at an early stage in the research, that a survey to quantify current usage of IT in British community pharmacies was required. The results could be compared with those of previous surveys and would provide a foundation on which to base further investigations.

Two surveys of computer use in British community pharmacies had previously been reported. Stevens and Crabbe sent a questionnaire to all community pharmacists (around 10000) on the National Pharmaceutical Association's mailing list in 1985[61]. Unfortunately, the response rate was low, replies being received from 856 pharmacies (these all had pharmacy computers). The authors gave no explanation for the low response rate but they did note that respondents returned questionnaires at their own expense which may have deterred some pharmacists from responding. The following data were obtained in this study:

1. Microcomputers with floppy discs were the most common type of system reported.
2. The hardware of just over half of the respondents had been provided by companies specialising in pharmacy computer systems.

3. 849 (99%) respondents' computers were used for labelling while 282 (33%) were used for stock control, 171 (20%) for drug interaction monitoring and 42 (5%) for patient medication records.
4. Over 90% of respondents had observed improved professional image using their system, while 70% felt customer service was faster.
5. The computerised function which most respondents wanted to incorporate into their systems was drug interaction monitoring.

A second survey was carried out by the Society's inspectorate in 1988[145]. Out of around 1150 community pharmacies visited by inspectors throughout the country, 82% had a computer, 11% of the computers were capable of being used to maintain patient medication records, although most could be upgraded to do this.

The two surveys mentioned above did not attempt to elicit information about pharmacists' attitudes towards the use of computers in community pharmacy. Attitude questions were, however, included in the present study in order to highlight the areas of future IT development which pharmacists felt could be of benefit.

4. 2 Choice of method

A questionnaire was used so that quantitative results could be obtained. The questionnaire was administered by mail rather than using interviewers, as this allowed nationwide coverage and avoided the problem of interviewer recruitment. The questionnaire was sent to 2000 pharmacists, roughly one sixth of the total population, this sample size being as large as practically possible in order to maximise the precision of the results.

The questions asked of pharmacists fell into two sections. The first section contained factual questions while the second section dealt with pharmacists' attitudes towards patient medication records (PMRs), smart cards, electronic information services, computerised information for the public and computerised aids to diagnosis: a series of statements were made on each of these topics and respondents were asked to indicate their level of agreement with each statement on a rating scale.

4. 3 Objectives

This investigation had the following objectives:

1. To determine the levels, applications and types of IT equipment used in community pharmacies.
2. To determine respondents' satisfaction with their pharmacy computers.
3. To explore respondents' attitudes towards: patient medication records; smart cards; electronic information services in the pharmacy; provision of computerised information to the public; and computerised aids to diagnosis.

4. 4 Hypotheses

Chapters 1 and 2 outlined the development and increasing use of pharmacy computer systems in this country. On the basis of this evidence, the following hypothesis was formulated:

Hypothesis 1: "The level of IT use among community pharmacists is increasing."

When the results of the Stevens and Crabbe study[61] were compared with those of the 1988 study carried out by the Pharmaceutical Society's inspectorate[145], a rise in the number of pharmacy computer systems used for maintaining PMRs was seen. In addition there has been a trend for pharmacy computer system suppliers to supply fewer dedicated labellers but more multifunction systems. The following hypothesis was therefore formulated:

Hypothesis 2: "The number of pharmacy computer systems being used for functions in addition to labelling is increasing."

A third hypothesis was also formulated on the basis of the evidence mentioned above:

Hypothesis 3: "Community pharmacists are willing to update and improve their pharmacy computer systems."

4. 5 Method

In March 1989 a pilot questionnaire was mailed to 41 pharmacies in England selected from the Annual Register of Pharmaceutical Chemists[146]. The method of selection of the pharmacies was quasi-random sampling, with every 200th pharmacy from the Register of Premises being selected. A total of 19 questionnaires (46%) were returned. On the basis of these returns some minor changes were made to produce the final questionnaire and covering letter which are shown in Appendix 6.

For the main questionnaire, mailed in May 1989, an up to date list of all registered pharmacy premises in Great Britain was obtained from the Royal Pharmaceutical Society in the form of address labels. Random number tables[147] were used to select 2000 pharmacies from this list. No Boots pharmacies were included as it had been confirmed that the company was in the process of developing a new dispensary computer system to be used throughout all their branches. A questionnaire, signed covering letter and pre-paid envelope were then sent to each of the pharmacies chosen. One month later a second copy of the questionnaire, follow-up covering letter and pre-paid envelope were sent to those pharmacies from which no reply had been received.

Data from the returned questionnaires were entered into a software package for data entry called Data Entry II[143], and then analysed using the Statistical Package for the Social Sciences (SPSS) program[144].

4. 6 Results and discussion

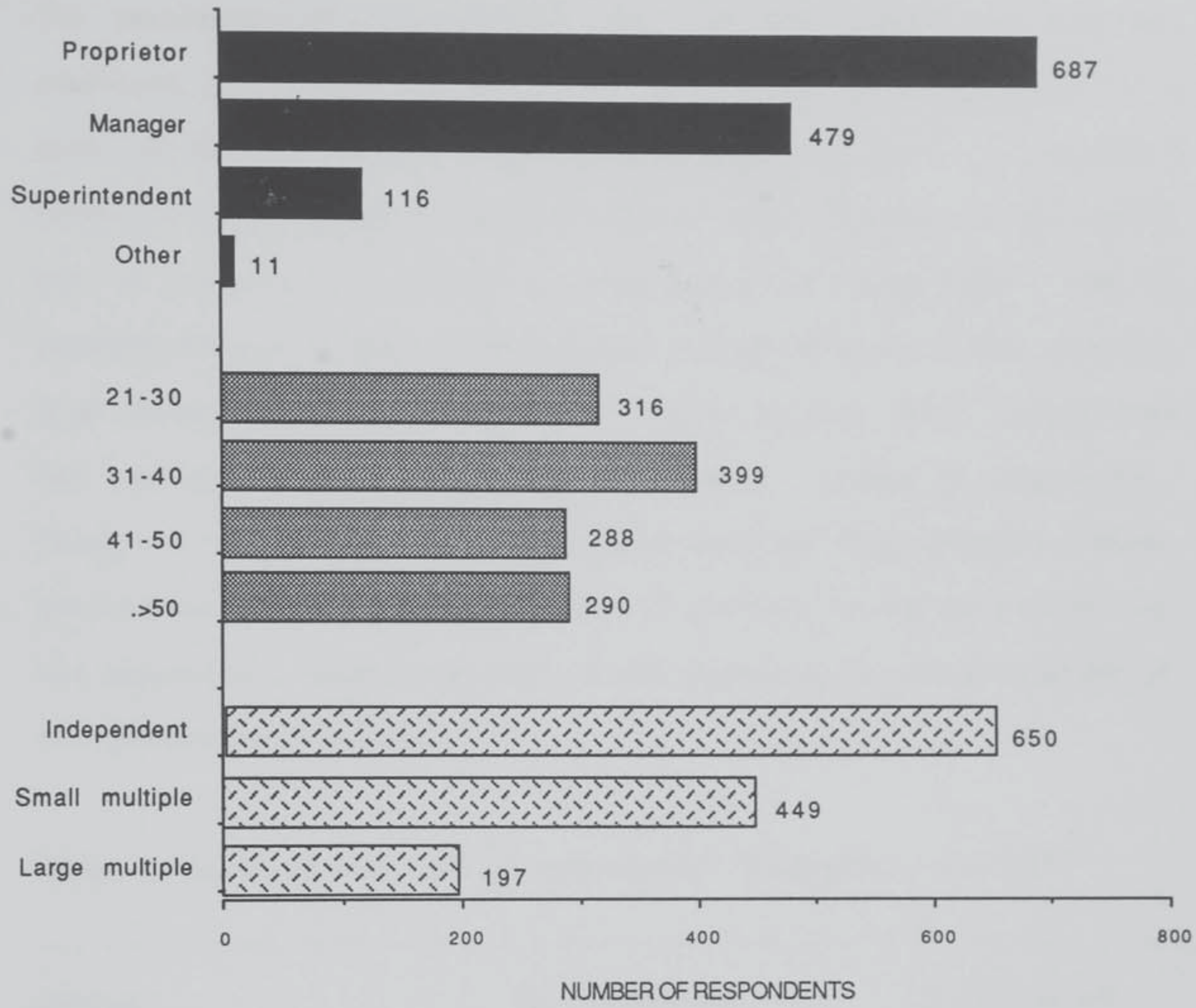
4. 6. 1 Response rate

1326 questionnaires (66%) were returned. It was possible to analyse 1297 questionnaires (65%), the remaining 29 having been returned incomplete or too late for inclusion in the analysis.

4. 6. 2 The Respondents

Figure 2 shows respondents' ages, the types of pharmacies in which they practised and their job descriptions.

Figure 2 Profile of respondents showing their job descriptions, ages and the type of pharmacies in which they practiced n = 1297



4. 6. 3 Respondents' use of information technology

1228 (95%) of the respondents who returned completed questionnaires had a computer in their pharmacies. In addition, many pharmacies had various other IT devices as shown in Table 2. The chi-squared test was used to compare pharmacists who had computers with those who did not. No association was found between either: type of pharmacy; age of pharmacist; or job description of pharmacist, and the presence of a computer in the pharmacy using the chi-squared test.

The percentage of respondents (95%) in this survey who reported computers in their pharmacies was higher than that reported in a previous survey[145] (82%). The two results are not directly comparable because different sample populations were used, however an increasing use of computers by community pharmacists is suggested. 70% of respondents had modems which reflects a high level of direct ordering from wholesalers. Videos, electronic point of sale (EPoS) systems and fax machines were only present in a small number of pharmacies. Using the chi-squared test it was found that the distribution of these devices was not related to the type of pharmacy or age or position of the pharmacist, suggesting that it was dependent on the enthusiasm of the pharmacist involved.

Table 2 Level of I.T. use in respondents' pharmacies n = 1297

Device	**No. pharmacies**	**% pharmacies**
Computer	1228	95
Modem	905	70
Video recorder	58	5
EPoS	56	4
Fax machine	29	2

Of the 1228 computers reported, 249 (20%) were Amstrads; 142 (12%) were BBCs; 128 (10%) were Sanyos and 111 (9%) were Panasonics. The remainder comprised a variety of other hardware types.

56% of respondents had been supplied with hardware by one of the three major pharmacy computer suppliers in this country ie. John Richardson Computers, AAH or Park Systems. Similarly, the largest number of systems incorporating patient medication records were supplied by John Richardson Computers (142 systems), AAH (72 systems) and Park systems (23 systems).

For 974 of respondents' pharmacy computer systems (79%), the software was supplied with the hardware. Of the remaining systems, 9% included software obtained from a source different to that of the hardware and 8% included software that had been written as part of a "home-built" system. Thus, the majority of respondents used custom built pharmacy computer systems.

4. 6. 4 Computer applications

Respondents were asked to indicate what they used their computers for, the results are shown in Table 3.

Nearly all the computers reported in respondents' pharmacies were used for labelling, this was expected as pharmacy computers developed primarily for this purpose. Less predictable was the 23% of respondents' pharmacy computers that were used for maintaining patient medication records. In the 1985 Stevens and Crabbe survey[61], 5% of respondents used their computers to maintain patient medication records, and in the Pharmaceutical Society's inspectorate survey of 1988 11% of pharmacy computers were found to be capable of maintaining PMRs. Although the results of these studies are not directly comparable with the results from the present one, such a large difference in PMR numbers does suggest an upward trend in PMR use among community pharmacists.

Table 3 Pharmacy computer applications n = 1228

Application	**No. computers**	**% computers**
Labelling	1211	93
Stock ordering	523	40
Stock control	378	29
Drug interaction monitoring	366	28
Patient medication records	303	23
Word processing	220	17
Accessing PINS	92	8
Market research	27	2
Other	111	9

N.B. the "other" category included financial uses such as accounting and prescription pricing, professional uses such as printing dispensed medicine labels and a variety of other uses such as EPoS, database management and desk top publishing.

Although 70% of respondents had modems, only 40% of their pharmacy computers were used for stock ordering, this suggests that many of the modems reported were connected to portable data capture units.

4. 6. 5 Previous computer use

As shown in Table 4 over a third of respondents' computer systems reported had been installed since 1988, 17% in 1987, 13% in 1986 and 33% before 1986, suggesting a rise in computer installations with time. Out of the 303 respondents maintaining PMRs, 237 (78%) had had their computers installed since January 1988. This marked increase in PMR aquisitions is likely to have been influenced by the publication in the preceding year of the government's White Paper "Promoting Better Health"[36] with its proposal of an allowance payable to community pharmacists who maintained PMRs for elderly (over 60 years of age) and confused patients.

Table 4 Dates of installation of respondents' computers n = 1228

Year	No. computers	% computers
1989	140	11
1988	283	23
1987	212	17
1986	164	13
pre 1986	405	33

42% of respondents had had at least one previous computer before they purchased their present one, indicating a willingness by respondents to replace and update their machines. A possible reason for this becomes apparent when respondents' satisfaction with their computers is analysed.

4. 6. 6 Respondents' satisfaction with their computers

Table 5 Respondents' satisfaction with their computers

Level of satisfaction	No. respondents	% respondents
Very satisfied	286	22
Satisfied	682	53
Indifferent	159	12
Unsatisfied	77	6
Very unsatisfied	10	1

The majority of respondents were satisfied with their computers as shown in Table 5. Satisfaction with computer was found to be associated with the date of computer installation, satisfaction being greater for those computers installed most recently (chi-squared test, $p<0.001$, see Appendix 2. 1)

910 computer users (74%) had a maintenance contract covering their pharmacy computer and around three quarters of these were satisfied

with that maintenance contract. 318 did not have any kind of maintenance, which indicates that many pharmacists are vulnerable to computer breakdown.

4. 6. 7 Future computer use

338 (26%) of respondents (including 30 of those without a computer), thought it likely that they would purchase a new computer within the next 12 months. 437 (36% of those with computers) thought it likely that they would purchase new software within the next 12 months. When asked what features they would like to see on their new computers/software, the responses shown in Table 6 were given. (Note that a positive response to a feature was only counted if the pharmacist did not already have it on his/her present system). Other "wants" mentioned by respondents but not shown in the table included: spreadsheets; accounts systems; drug databases; incorporated fax machines.

Table 6 Respondents wants on their new computers or software n = 1297

Feature	No. respondents	% respondents
Patient medication records	485	37
Drug interaction monitoring	406	31
Access to PINS	243	19
Word processing	168	13
Stock ordering	144	11
Stock control	77	6
Other	79	6

Patient medication records and drug interaction monitoring were the facilities that the largest number of respondents said they would like to have on their new computers or software. These results again represent a commitment by many pharmacists to update and improve the quality of their computers, keeping up to date with the latest advances made.

4. 6. 8 Respondents' attitudes towards patient medication records

Table 7 Respondents' agreement with statements about patient medication records n = 1297

Statement	No. pharmacists giving response				
	1	2	3	4	5
Keeping patient records would allow me to offer a better service to my prescription customers	363	696	132	78	18
PMRs held in my pharmacy would be a useful source of information for other health professionals such as GPs, hospitals and the emergency services	255	649	228	124	30
PMRs are of little interest to me because of the time involved in creating and maintaining them	40	119	178	653	284
PMRs are only of use in pharmacies with a large number of regular prescription customers	96	518	144	432	97

1 = strongly agree; 2 = agree; 3 = indifferent; 4 = disagree; 5 = strongly disagree

As shown in Table 7, over 80% of respondents agreed that patient medication records (PMRs) would allow them to offer a better service to their prescription customers and over 70% agreed that they would be a useful source of information for other health care professionals. Respondents who already kept computerised PMRs were much more likely to agree with these statements than those who did not (chi-squared test $p<0.001$, see Appendix 2. 1) but it is not possible to say whether this positive attitude resulted from the experience of keeping PMRs or was the reason for installing a PMR system. Only 12% of respondents felt that PMRs were of little interest because of the time involved in creating and maintaining them. Some reservations were expressed with nearly half (47%) of the respondents agreeing that PMRs would only be useful where a pharmacy had a large number of regular prescription customers.

4. 6. 9 Respondents' attitudes towards smart cards

Table 8 Respondents' agreement with statements about smart cards

n = 1297

Statement	No. pharmacists giving response				
	1	2	3	4	5
I would like to see the introduction of smart cards as a method of transferring patient data between health care professionals	157	614	333	144	31
As a pharmacist, I should be able to add information on OTC medicines to a smart card	136	682	295	140	23
Smart cards would be well accepted by most of the customers at my pharmacy	56	487	382	297	48
Smart cards would do nothing to improve my business	44	328	431	399	70
Doctors will not want pharmacists to add data to smart cards	109	567	317	248	18

1 = strongly agree; 2 = agree; 3 = indifferent;
4 = disagree; 5 = strongly disagree

As shown in Table 8, 60% of respondents said they would like to see the introduction of smart cards. Interestingly, only 42% thought that smart cards would be well accepted by most of their customers. 63% of those questioned felt that they should be able to add information on OTC medicines to a smart card but 52% felt that doctors would not want them to do so. The attitudes of respondents towards smart cards were less positive than those towards PMRs. This may have been because a lack of knowledge about smart cards or because the cards were not perceived as being as beneficial to community pharmacists as PMRs, for example in making patients more likely to return to the pharmacy.

4. 6. 10 Respondents' attitudes towards electronic sources of information

As shown in Table 9, the majority (80%) of respondents agreed that information provided electronically in the pharmacy via a modem, eg. PINS and Prestel, would be a useful source for improving pharmaceutical knowledge. 79% felt that access to electronic information would put them in a better position to advise patients while 79% felt that such access would put them in a better position to advise other health professionals. Only 6% felt that electronic sources of information have no place in community pharmacy at present. In view of these positive attitudes to electronic information in pharmacies, it is surprising that only 8% of respondents with computers used them to access the Pharmacy Information and News Service (PINS), an electronic information service for pharmacists provided by the RPSGB (see table 3). This apparent contradiction could indicate that PINS did not meet pharmacists' needs, or that there was a lack of information about the service, and is followed up in the next chapter.

Table 9 Respondents' agreement with statements about electronic sources of information n = 1297

Statement	**No. of pharmacists giving response**				
	1	**2**	**3**	**4**	**5**
Information provided electronically in the pharmacy would be a useful source for improving my pharmaceutical knowledge	181	852	188	57	6
Access to electronically provided information sources would put me in a better position to advise patients	169	851	182	76	7
Access to electronically provided information sources would put me in a better position to advise other health care professionals	184	834	189	68	10
Printed information currently available is sufficient to satisfy my pharmaceutical knowledge requirements	33	418	319	481	31
Electronic sources of information have no place in community pharmacy at present	11	69	231	659	225

1 = strongly agree; 2 = agree; 3 = indifferent; 4 = disagree; 5 = strongly disagree

4. 6. 11 Respondents' attitudes towards computerised information for the public in community pharmacies

As shown in Table 10, the majority of respondents did not concur with the statements about making computerised information available to the public in their pharmacies. Only 30% of respondents agreed that customers would appreciate being able to access a computer to obtain health care information while 33% felt such a facility would be an effective means of offering simple health advice to the general public. 58% of respondents did not believe that making computerised information available to the public would lead to a reduction in the number of requests for advice they received, indeed some commented that they believed the number would increase. Respondents, therefore, did not feel their customers would appreciate computerised information sources. This may be because many pharmacy customers are elderly and so unlikely to be familiar with computers, which may make them less likely to want to use a computerised source of information.

Table 10 Respondents' agreement with statements about computerised information for the public in community pharmacies n = 1297

Statement	No. pharmacists giving response				
	1	2	3	4	5
Customers will appreciate being able to access a computer to obtain health care information in my pharmacy	40	346	344	465	83
Providing customer access to a computer would be an effective means of offering simple health advice to the general public	30	398	255	488	110
Public access to computerised information in the pharmacy would lead to a reduction in the number of people consulting me for advice on health care matters	49	257	223	659	93

1 = strongly agree; 2 = agree; 3 = indifferent; 4 = disagree; 5 = strongly disagree

4. 6. 12 Respondents' attitudes towards computerised aids to diagnosis in community pharmacy

As shown in Tble 11, 57% of respondents agreed that a computer program to help when counter-prescribing (responding to symptoms) would be a useful addition to the pharmacy. When asked whether they thought their customers would object to their use of such a program, 30% agreed, 27% were indifferent and 41% disagreed. This indicates a large degree of uncertainty by respondents on this topic which may be due to their lack of knowledge about the effects of such a program.

Table 11 Respondents' agreement with statements about computerised aids to diagnosis n = 1297

Statement	No. of pharmacists giving response				
	1	2	3	4	5
A computer program to help me when counter prescribing (responding to symptoms) would be a useful addition to my pharmacy	110	629	256	241	42
Most of my customers would object to my use of a computer program when responding to their symptoms	72	317	353	482	44

1 = strongly agree; 2 = agree; 3 = indifferent; 4 = disagree; 5 = strongly disagree

4. 7 Summary

This study attempted to estimate the level of IT use among British community pharmacists using a mail survey. The majority of respondents had computers and modems suggesting a high level of IT use. Nearly all respondents' computers were used for labelling, 40% were used for stock ordering and 23% were used for maintaining patient medication records. In comparison with earlier surveys[61,145] we see a higher level of IT use and more computers being used for functions other than labelling. Most significant is the apparent rise in the number of computers being used to maintain PMRs. A large increase in the number of respondents purchasing PMR systems coincided with the increased interest and awareness of computerised PMRs among community pharmacists as a result of the 1987 government White Paper "Promoting Better Health". The results indicate a trend away from dedicated labellers in community pharmacies, to pharmacy computer systems incorporating a number of functions including PMRs, drug interaction monitoring, stock ordering and stock control.

Respondents showed a willingness to replace and update their pharmacy computer systems in order to keep up with technological advances. When questioned about their attitudes towards a number of possible future applications of pharmacy computers, the majority of respondents were found to agree

* that PMRs would improve the service they offered to customers and provide a useful source of information for patients and prescribers.
* that they would like to see the introduction of smart cards.
* that electronic sources of information in the pharmacy would be a useful source of knowledge and put them in a better position to give advice.
* that a computer program to aid response to symptoms would be useful.

The majority of respondents did not have positive attitudes towards the provision of computerised information for the public in community pharmacies.

Two of the following chapters in this thesis follow up certain results obtained in this study. Chapter 5 investigates why, when a large majority of respondents expressed positive attitudes towards electronic sources of information in pharmacy, only 8% subscribed to the Pharmacy Information and News Service. Chapter 6 investigates a computerised aid to diagnosis.

4. 8 Conclusions

Hypothesis 1: "The level of IT use among community pharmacists is increasing."

The following evidence to support hypothesis 1 was found in this investigation:

1. In this study, the percentage of respondents who had computers in their pharmacies was greater than the level reported in a survey carried out by the Pharmaceutical Society's inspectorate in 1988[145]. This indicates that the number of pharmacists who have become computer users has risen over time.
2. The percentage of respondents installing computer systems rose from 1986 to 1988.
3. Nearly half of those respondents without computers thought it likely that they would purchase one within the next 12 months.

Hypothesis 2: "The number of pharmacy computer systems being used for functions in addition to labelling is increasing."

The following evidence to support hypothesis 2 was found in this investigation: The Stevens and Crabbe survey of 1985[61] found 5% of respondents maintaining computerised PMRs, and 20% using their computers to monitor for drug interactions. In the present study, 23% of respondents maintained computerised PMRs and 28% monitored for drug interactions. Indicating upward trends in the use of computers for functions other than labelling. In addition, the majority of respondents with PMRs in this study, had had them installed since 1988.

Hypothesis 3: "Community pharmacists are willing to update and improve their pharmacy computer systems."

When discussing hypothesis 2 it was noted that an increasing number of community pharmacists appear to be using their computer systems for functions other than labelling. This suggests a willingness to update and improve these systems. In addition, 42% of respondents in this study had had at least one previous computer before they purchased their present one, and 26% of respondents thought it likely that they would purchase a new computer within the next 3 months.

On the basis of the results of this investigation, therefore, we can conclude that:

1. There appears to be an upward trend in the use of IT by community pharmacists.
2. Pharmacy computer systems are increasingly being used for maintaining PMRs and monitoring for drug interactions.
3. Community pharmacists are willing to update and improve their pharmacy computer systems.

Chapter 5. INVESTIGATION OF THE PROVISION OF ON-LINE ELECTRONIC INFORMATION TO COMMUNITY PHARMACISTS

5. 1 Introduction

One of the findings of chapter 4 was that pharmacists appeared positive about the use of electronic sources of information in the pharmacy. Over 75% (973) of respondents in the study had agreed that information provided electronically in the pharmacy would be a useful source for improving pharmaceutical knowledge and would put them in a better position to advise both patients and other health care professionals. Surprisingly, therefore, only 8% of respondents in the same study accessed the on-line electronic information service provided by the Pharmaceutical Society, known as the Pharmacy Information and News Service (PINS).

PINS was an electronic information service for use by pharmacists, run by the RPSGB between September 1986 and December 1990. PINS allowed pharmacists with a computer running the appropriate software, a modem and a telephone link, to obtain on-line information from the Society's System-36 IBM central computer via the telephone network. PINS users paid an annual subscription (£11-50 in 1990) and telephone charges for each call they made to the PINS computer or to the nearest Packet Switch Stream (PSS) exchange. Unlike many other on-line services, PINS subscribers were not charged for either time connected or quantity of data received.

In 1987 free PINS software was made available, by the pharmacy computer supplier John Richardson Computers Ltd., to every local Pharmaceutical Society Branch and Region, in an effort to "further the awareness of PINS among pharmacists"[106]. However the uptake of PINS subscriptions by pharmacists remained less than 500. In 1989 the PINS computer history file was analysed for one month by PINS office staff running the service. It was found that there had been an average of 11 "log-ins" per day, the section most frequently accessed being the News section, followed by drug recalls and register enquiries. The majority of those logging in had looked at more than one section[107]. In the same year a survey of 84 PINS users was carried out by the PINS office. The questionnaire was to be sent to users who were known to have experienced difficulties with PINS from all sectors of pharmacy and there was a response rate of just over 50%. The results provide a useful qualitative picture of PINS users' views. Users were asked to comment on technical aspects of PINS and on the content of PINS. The highest proportions of negative comments were on the topics of:

1. Linking to the PINS computer.
2. Logging on and logging off.
3. Ease of use once within the system.
4. Using the register search programs.
5. The electronic mail facility.

The aims of the present part of the research were to discover why pharmacists who were positive about electronic sources of information did not take up PINS, what sources of information they did use, and what PINS users thought of the service they received.

5. 2 Choice of method

Pharmacists who participated in the study detailed in chapter 4, had been asked to indicate their willingness to take part in a follow up study, 540 (42%) replies had been positive. It was possible, therefore, to identify two cohorts of respondents, both of which were willing to be followed up:

1. Those who had positive attitudes towards electronic sources of information in the pharmacy but who did not subscribe to PINS.
2. Those who did subscribe to PINS.

These groups were surveyed again using mail questionnaires, the most suitable method of collecting quantitative data from a widely dispersed sample.

As the two follow up groups were not random samples it was not possible to say how representative of the total population the results would be. Therefore another study involving all community pharmacist PINS users was performed using a mail questionnaire based on the one sent to the follow up cohort of PINS users.

5. 3 Objectives

This investigation had the following objectives:

1. To discover why many pharmacists with positive attitudes towards electronic sources of information in community pharmacy did not become subscribers of the Pharmacy Information and News Service, PINS, and to analyse the information sources they did use.
2. To assess PINS subscribers' use of, satisfaction with and attitudes towards the service.

5. 4 Hypotheses

The majority of respondents in chapter 4 had positive attitudes towards electronic sources of information in community pharmacy. However, only a small percentage of the same respondents subscribed to PINS. Two hypotheses were drawn from these findings:

Hypothesis 4: "There is no perceived need amongst community pharmacists for a service such as PINS."

Hypothesis 5: "Lack of information about PINS deterred many community pharmacists from becoming subscribers."

As mentioned in the introduction to this chapter, research done by PINS office staff indicated a low level of use of PINS among subscribers. It also appeared that some subscribers were not satisfied with some aspects of using PINS. It was therefore hypothesised that:

Hypothesis 6: "Subscribers did not use PINS to its fullest potential because they found it difficult to use."

5. 5 Method

244 pharmacists who had taken part in the study detailed in chapter 4 were identified, they fell into two groups:

1. Those with positive attitudes towards electronic sources of information in pharmacy, but who were not PINS subscribers (212);
2. PINS subscribers (32).

Each group was sent a follow up questionnaire, covering letter and pre-paid envelope in Spring 1990. The returns from the survey of the 32 PINS subscribers were used as a pilot study on which to base a longer mail questionnaire which was sent to all community pharmacist PINS subscribers in May 1990. (The questionnaire and covering letter sent to the 212 pharmacists with positive attitudes electronic sources of information are shown in Appendix 7).

For the main PINS study a list of all individual subscribers was obtained from the PINS office in the form of address labels. It was not possible to distinguish community pharmacist PINS users from other PINS users, therefore each person on the list was sent a copy of the questionnaire, together with a covering letter and reply paid envelope. The questionnaire and covering letter are shown in Appendix 8. A filter question at the start of the questionnaire asked community pharmacists who currently subscribed to PINS to complete the remainder of the form. One month later a reminder letter and questionnaire were sent to those subscribers from whom no reply had been received.

Data from the questionnaires were entered into Data Entry II[143] then analysed using the Statistical Package for the Social Sciences (SPSS)[144].

5. 6 Results and Discussion

5. 6. 1 Survey of pharmacists with positive attitudes towards electronic sources of information who were not PINS subscribers

5. 6. 1. 1 Response rate

Of the 212 follow up questionnaires mailed, 158 (75%) were returned.

153 (72%) could be analysed the remainder being returned too late for inclusion in the analysis.

5. 6. 1. 2 Information sources used by respondents

The written information sources present in respondents' pharmacies are shown in Table 12. Note that it was assumed that all pharmacies would have a copy of the British National Formulary (BNF). The mean number of information source books per respondent was 4.79 and 69% of respondents had between 3 and 6 books.

Table 12 Written information sources present in respondents' pharmacies n = 153

Source	No. pharmacies	% pharmacies
Chemist and Druggist price list	147	96
Martindale 28th edition	82	54
Pharmaceutical handbook	76	50
Pocket medical dictionary	62	41
Martindale 29th edition	60	39
MIMS latest edition	57	37
Drug interactions textbook	46	30
First aid handbook	45	29
Drug & Therapeutics bulletin	45	29
Pharmaceutical Codex 1979	42	28
Responding to symptoms textbook	40	26
Clinical pharmacology textbook	31	20

In addition to written information sources, most respondents said they had contacted a number of external information sources by phone during the last year, these are shown in Table 13. From the figures in this table, it can be calculated that the average number of calls made to external information sources per pharmacy was at least 10 to 11 in a year. This suggests that respondents did have a perceived need for information in addition to what was available in printed sources, it also shows that respondents were willing to make telephone calls in order to obtain the information they required.

Table 13 Respondents' use of external information sources n = 153

	Number of respondents contacting source with frequency shown (times per year)			
Source	**1 - 3**	**4 - 5**	**> 5**	**Total**
NPA	44	31	45	120
PPA	49	25	34	108
Pharmaceutical company	63	28	29	120
Local hospital	58	12	17	87
RPSGB	60	3	10	73
PSNC	21	6	8	35

5. 6. 1. 3 Respondents' views about PINS

The majority of the respondents (134, 88%) with positive attitudes towards electronic sources of information, had heard of PINS. The reasons given by respondents for not becoming PINS subscribers are shown in Tables 14 and 15. Nine respondents had experience of accessing on-line information sources: 7 used Prestel and 2 used British Telecom Gold.

Table 14 Factors which deterred respondents from becoming PINS subscribers n = 134

Reason	**No. deterred**	**% deterred**
Lack of information about the service provided by PINS	58	43
The cost of becoming a PINS subscriber	57	43
Lack of information about PINS hardware requirements	56	42
The cost of accessing PINS	51	38
Lack of suitable hardware	45	34

Table 15 Responses given to the question "What has been your main reason for not becoming a PINS subscriber?" n = 134

Reason	**No. deterred**	**% deterred**
Not perceived as necessary/ relevant/useful	28	18
Lack of information	25	16
Cost	21	14
Not in a position to make the decision	18	12

It seems that lack of information about the service was the major reason for respondents not becoming PINS subscribers. This is likely to have been the result of poor advertising and marketing of PINS. Surprisingly, the subscription cost had deterred 43% of respondents even though the subscription was never more than £11-50 p.a. It is probable that lack of information about subscription costs may have lead some respondents to assume that it would be too high for them.

When asked, in open question, what information they thought would be useful on an electronic information source such as PINS, the respondents gave the answers shown in Table 16. As can be seen, the subject that the most respondents felt would be useful in a source such as PINS was drug information. This suggests that some of the sources of written drug information used by respondents may not have been adequate for their needs, possibly because they were not up to date. Interestingly, a number of respondents considered that new product information, travel prophylaxis information and news relevant to pharmacy would be useful on a source such as PINS - these three topics were actually included on PINS at the time, again implying lack of knowledge about the service.

Table 16 Information which respondents felt would be useful on an electronic information source such as PINS n = 153

Information	No. respondents	% respondents
Drug information	83	54
New product information	35	23
Items allowed on the Drug Tariff	19	12
Travel prophylaxis information	15	10
News relevant to pharmacy	10	7
Drug availability information	7	5

5. 6. 2 Survey of pharmacists subscribing to PINS

5. 6. 2. 1 Response rate

Of the 492 questionnaires sent out to all individual PINS subscribers, 356 (72%) were returned. 181 of the returned questionnaires were from community pharmacists currently subscribing to PINS and of these, 179 were returned in time to be analysed. The remaining 174 returned questionnaires were from pharmacists who were either not practising in community pharmacy, or who had not renewed their subscriptions to PINS by the 1990 deadline. The 179 community pharmacists whose responses were analysed are hereafter known as the respondents.

5. 6. 2. 2 Other electronic information sources accessed

39 respondents (22%) said that they accessed other on-line sources in addition to PINS. The sources accessed included Prestel, bulletin

boards and electronic banking systems. This is a much higher percentage than reported by the pharmacists with positive attitudes towards electronic sources of information (see previous section), suggesting that many PINS subscribers were more enthusiastic about using such sources than pharmacists in general.

5. 6. 2. 3 Respondents' use of PINS

Table 17 shows the most popular responses given to the question "What led you to become a PINS subscriber?". Other responses given included interest in computers, curiosity and enthusiasm.

Table 17 The most popular reasons given by respondents for becoming PINS subscribers n = 179

Reason	No. respondents	% respondents
Article in pharmaceutical press	61	34
Need for more information	19	11
Subscription given free	15	8

133 respondents (74%) said that the type of information provided by PINS was what they had expected while 127 (71%) said the quality of the information provided was what they had expected. However, 126 (70%) said that they used PINS less than they had expected to. It seems therefore that most respondents correctly anticipated the type of service that PINS would be, but not how often they would use it.

Respondents' estimated frequency of use of PINS, and average session length are shown in Table 18. 59% accessed PINS less than once a week which ties in with the large percentage who said they used it less than they had expected to, and suggests deterrents to more frequent use.

Table 18 Frequency and duration of respondents' PINS sessions

n = 179

	No. respondents	% respondents
Frequency (times per week)		
Once	36	20
Less than once	106	59
More than once	21	12
Duration of session		
< 5 mins	38	21
5 - 10 mins	65	36
> 10 mins	45	25

Respondents were asked to rate the usefulness of each option on PINS by rating it as either: very useful; useful; of little use; or of very little use. Table 19 shows the ten options that the greatest number of respondents found useful (the usefulness ratings of all 21 options are shown in Appendix 4). At least half of the respondents felt that the following options were either "useful" or "very useful": the News section; malaria prophylaxis; register enquiries; product recalls; and

PINS news. The facts that less than half the respondents found the other 16 options useful, and that there was a large non-response rate for all the options, suggest that respondents had never used or were not interested in many of the options. This raises the question of what respondents actually used PINS for.

Table 19 The PINS options that the greatest number of respondents found useful n = 179

Option	Percentage of respondents rating each option		
	1	2	3
News section	62	11	27
Malaria prophylaxis	60	13	27
Register enquiries	58	16	26
Product recalls	50	19	31
PINS news	50	15	36
New medicinal products	44	22	34
Legal and ethical	44	19	37
RPSGB press releases	40	28	32
CSM section	40	21	40
Blacklist additions	35	31	35

1 = Useful/Very useful
2 = Of little use/Of very little use
3 = Not answered

Over half of the respondents (56%, 101) answered "yes" to the question "Would you say that you use PINS mainly as a general interest source of information ie. for browsing?" , while 58 (33% cent) said "yes" to the question "Would you say that you use PINS mainly as a source of information when specific problems arise in the pharmacy, ie. for acute problems?". The respondents who said they used PINS mainly as a general interest source rated the usefulness of the various PINS options differently to the respondents who said they used PINS as a source of information for specific problems. The percentages of "browsers" who thought that the News, Drug recalls and Malaria prophylaxis sections were either "useful" or "very useful" were higher than the corresponding percentages of "specific users". On the other hand, the "specific users" rated Register enquiries, the Legal and ethical advice section and the Medicines and Poisons lists as more useful than did the "browsers". It appears therefore, a respondent's use of PINS was influenced by his/her reasons for accessing the service both in terms of which sections that user looked at and of the frequency of use.

5. 6. 2. 4 Respondents' attitudes towards PINS

Respondents were asked to indicate whether they agreed or disagreed with a number of statements about PINS, the results are shown in Table 20.

109 respondents (61%) agreed that their use of PINS was limited because it interrupted labelling in the dispensary. However, there was no significant difference in frequency of PINS use between those who agreed and those who disagreed with this statement (chi-squared test $p<0.4$, see Appendix 2. 2 for full table). This suggests,

therefore that those who found PINS interrupted labelling in the dispensary tended to use PINS at quiet times of the day. As noted previously, 44% of respondents said they were most likely to access PINS after the shop had closed, and for 33% the most likely time was the afternoon.

Table 20 Respondents' agreement with a number of statements about PINS n = 179

Statement	Number of pharmacists giving response		
	Agree	Disagree	Don't know
My use of PINS is limited because it interrupts lab -elling in the dispensary	109	37	5
I am surprised more pharmacists do not subscribe to PINS	64	51	31
I generally only use PINS to consult the register	38	103	7
I do not think PINS is user-friendly	104	45	9
I am put off using PINS because of the telephone charges	49	95	5
PINS information is always up to date	76	25	42

As shown in Appendix 2. 2, the respondents who agreed with the statement "I generally only use PINS to consult the Register of Pharmaceutical Chemists" were less likely to use PINS more than once a week than the other respondents (chi-squared test $p<0.001$). Again we

see that respondents' use of PINS was influenced by the reason for accessing the service, those primarily using PINS to consult the Register needing to do so infrequently.
As might have been expected, respondents who agreed with the statement "I do not think PINS is user-friendly" were less likely to use PINS more than once a week than those who disagreed (chi-squared test $p<0.0001$, see Appendix 2. 2 for full table).

Interestingly, 95 (53%) disagreed with the statement "I am put off using PINS because of the telephone charges" indicating that the majority of respondents were prepared to pay for the service but were not prepared to put up with difficulties in its use.

Comments were invited from the PINS subscribers at the end of the questionnaire. The most common comments were criticisms of three aspects of PINS: logging on, noted by 24 respondents (13%); the slowness of PINS (18%, 33 respondents) and the inconvenience of having to change passwords so often (6%, 11 respondents). These comments again underline the problems users found with operating the PINS service. In addition, difficulties with or lack of PSS connections were mentioned.

Suggestions for ways of improving the service were also included by some respondents, these included:

1. Providing better instructions on PINS use in the form of manuals and an on-screen help facility.

2. Improving the on-screen layout of PINS by better indexing and short cuts to the main menu.
3. Allowing users to down-load PINS screens either onto local computer screens or onto paper.
4. Making the service more of a bulletin board based system.

5. 7 Summary

The study described in this chapter comprises two elements. First, a survey of pharmacists who did not subscribe to PINS but who had positive attitudes towards electronic sources of information. Secondly a survey of pharmacists who subscribed to PINS.

Those respondents who did not subscribe to PINS had an average of 4.79 reference books in their pharmacies out of a suggested list of 12. They also made an average of 10.3 phone call per year to external information sources. Although most respondents therefore had access to several written sources of information, over half said they would find drug information on an electronic information source such as PINS useful.

The first part of this study also highlighted the lack of information available to community pharmacists about PINS which seems likely to have contributed to the low subscription levels. This must have resulted form poor advertising and marketing of the service.

The second part of the study showed that frequency of PINS use was less than once a week for most subscribers. It also indicated a number of problems that PINS users experienced with the service which might explain this low frequency of use. The most important problem was the lack of user-friendliness of the PINS service. In addition many users were deterred from using PINS because it interrupted labelling. If PINS had been more user-friendly, and easier to access use of the service is likely to have been greater.

It was found that a number of options on PINS were not thought to be useful by the majority of respondents calling into question the rationale behind their inclusion.

5. 8 Conclusions

Hypothesis 4: "There is no perceived need amongst community pharmacists for a service such as PINS."

18% of the respondents who had expressed positive attitudes towards electronic sources of information in pharmacy in chapter 4, said they had not become PINS subscribers because they had not perceived the information as necessary or relevant. However, over half of the same respondents said they would find drug information on an electronic information source such as PINS useful. The findings suggest that the majority of respondents did not need PINS for providing essential information, but might find it useful as a source of additional back up information.

Hypothesis 5: "Lack of information about PINS deterred many community pharmacists from becoming subscribers."

43% of respondents who had expressed positive attitudes towards electronic sources of information in pharmacy in chapter 4, said they had not become PINS subscribers because of lack of information about the service. In addition 43% said they had been deterred by the subscription cost, as this was only £11-50 in 1990 it seems that lack of information about the subscription costs may have lead some respondents to assume that it would be too high. Also the answers to the question "What information would you find useful on an electronic information source such as PINS?" suggested that the respondents had little knowledge of what was actually on PINS. It seems therefore, that PINS suffered from poor marketing and advertising.

Hypothesis 6: "Subscribers did not use PINS to its fullest potential because they found it difficult to use."

This investigation yields much evidence to suggest that PINS subscribers found PINS difficult to use. 58% of PINS respondents did not think the service was user-friendly, and when asked to comment on PINS, 13% of respondents criticised the logging on process, and 18% criticised the service's slowness. There is also evidence to suggest that PINS users did not use the service to its fullest potential: 70% of respondents said that they used PINS less than they had expected to and 59% used PINS less than once a week. It appears that PINS subscribers did not use PINS to its fullest potential because they found it difficult to use, respondents who did not think PINS was user friendly were less likely to use PINS more than once a week than respondents who disagreed.

On the basis of the results of this investigation, therefore, we can conclude that:

1. Lack of information about PINS deterred many community pharmacists from becoming subscribers.
2. Subscribers did not use PINS to its fullest potential because they did not find it easy to use.

Chapter 6. INVESTIGATION OF A COMPUTERISED AID TO DIAGNOSIS IN COMMUNITY PHARMACY

6. 1 Introduction

In the study described in chapter 4, 57% of respondents agreed that a computer program to help when counter-prescribing (responding to symptoms) would be a useful addition to the pharmacy. This suggested that the majority of pharmacists would be positive about using such an aid.

Because of the support given to the pharmacist's role in responding to symptoms in the Nuffield Report[1] and the government's White Paper "Promoting Better Health"[36], and because of the lack of knowledge about the effects of computerisation on this process, it was decided to investigate the use of a computerised aid to diagnosis. The program chosen for the study was written by Roger King, a practising community pharmacist with long standing interest in pharmacy computerisation. The program had been incorporated into a pharmacy computer system supplied by Channel Business Systems Limited (CBS). The CBS system comprised four modules: a prescription labelling module; a patient medication records module (incorporating drug interaction detection); a patient counselling module; and a stand alone drug interaction detection module produced by Exeter Data Base Systems (EDBS). The "patient counselling module" was the computerised aid to diagnosis investigated in this chapter.

A 1988 study attempted to analyse the effect of a computer program on pharmacists' response to symptoms of the common cold[101]. 13 pharmacists who replied to an advertisement in the Pharmaceutical Journal, used the program for two weeks, they were then sent a questionnaire asking about their use of the program. Over half of the respondents said that when they used the program for the first time, they found it restrictive compared to the technique they had previously employed. However, after two weeks, only one respondent still found it restrictive. Most respondents said they thought the program had made some improvement in their assessment of patients presenting with cold symptoms. Several respondents commented that they thought the program would be more suitable as an aide-memoire and for teaching than for use in the presence of the patient. The conclusions that can be drawn from this study are limited because the software was used by the pharmacists for a short period of time and because the questionnaire was the only method of analysis used. The present study attempted to overcome similar difficulties: it lasted over a year and used qualitative and quantitative methods of analysis.

6. 2 Choice of method

As the software chosen for use in this study was produced by a commercial company, and the software was given free to participants, the number of pharmacists involved had to be limited. It was therefore decided to involve a small group of pharmacists in a detailed study lasting one year.

In order to obtain qualitative data, semi-structured interviewing, observation and mail questionnaire techniques were used. Most of the trialists were visited in their own pharmacies (by RMF).

6. 3 Objectives

This investigation had the following objectives:

1. To assess the feasibility of using a computerised patient counselling module as an aid to counter prescribing in a community pharmacy.
2. To assess pharmacists' and patients' attitudes towards computerised patient counselling.

6. 4 Hypotheses

On the basis of Balon's study[101] in which users of a computerised aid to diagnosis found it restrictive at first but less so after a few weeks, the following hypothesis was formulated:

Hypothesis 8: "Pharmacists may initially find working with a patient counselling module restrictive but this will decrease with time."

The majority of pharmacists in Balon's study said that use of the computerised aid to diagnosis improved their ability to respond to symptoms of the common cold. It was therefore hypothesised that:

Hypothesis 9: "Use of a computerised patient counselling module will improve pharmacists' abilities to respond to symptoms."

6. 5 Method

In September 1989 an advert, asking for pharmacists interested in taking part in a trial of a community pharmacy software package, was placed in the Chemist and Druggist magazine. Those pharmacists who replied to this advert and had suitable hardware were invited to one of two introductory meetings. These were held in November 1989, one at Aston University, the other at the Grosvenor Hotel, London. They were designed to introduce prospective trialists to the Channel Business Systems (CBS) and Exeter Data Base Systems (EDBS) software and to explain what would be involved in the trial: participants would be given free software for one year and in return they would be involved in assessing the impact of the software in their pharmacies.

Between January and April 1990, ten pharmacists who were using the trial software in their shops were visited and interviewed using a semi-structured questionnaire.

Throughout the trial regular telephone contact was maintained with all the participant pharmacists. In December 1990 a letter was sent to each of the trialists thought to be still using the CBS/EDBS software. A short questionnaire was included with this letter which asked trialists about their views on the patient counselling module.

6. 6 Results and Discussion

6. 6. 1 The trialists

Enquiries from 25 pharmacists were received in response to the initial advert. Of these, 5 attended the meeting at Aston University and 3 the meeting in London. 8 pharmacists who were unable to attend either of the introductory meetings were sent copies of the software and all the relevant paperwork.

4 pharmacists who had been given software dropped out of the trial soon after its start. Of the 10 pharmacists visited and interviewed, 7 had problems with the software initially. Most of the problems were to do with label production and as a result 3 more pharmacists had pulled out of the trial by May 1990. Also during this period two pharmacists stopped using the CBS labelling software but continued with the CBS patient counselling software only.

At the end of the first six months of the trial, 9 pharmacists were still participating: 6 were using both the labelling and counselling modules; 3 were using the counselling module only.

6. 6. 2 Pharmacy visits

The 10 pharmacies visited were situated in a variety of locations: city centres, town centres, suburbs and a village. In 9 pharmacies the patient counselling modules were not being used on a regular basis, in some they were not being used at all. The comments made by the pharmacists visited are shown in full in Appendix 5, a summary of those comments follows:

> *"In this shop it is not practical, the dispensary is quite a way back from the counter .... The patients should be able to see the screen .... I would use the package as a learning aid".*
>
> *"... The main disadvantage of using it while the patient is in the shop will be the time factor. It would be very useful as a learning tool".*

"Patients have seen it as a novelty...... I do not use it very often for the following reasons: the patient has to come into the dispensary; the shop is small; the shop is busy and can be understaffed. The program is easy to use and contains about the right amount of information..... It too time consuming to use regularly".

"It is impractical - my patients expect me to respond to queries on the spot, also the computer is positioned round a corner from the counter, a hand-held version would be good".

"The patient counselling module would be practical if it was separate from the labelling system.... I would like to get patients involved at the screen".

"It is more useful as a learning tool than in the shop situation....".

"Not practical - takes too long and could decrease customer faith in the pharmacist...... there is too much information for the system to be practical for use with customers".

"Members of staff have used it as a learning aid and liked it. It would be most practical in a counselling area and if customers could use it themselves".

The comments of those trialists who were visited all had a common theme: none of the pharmacists had found it practical to use the patient counselling module in their pharmacies. The impracticalities of using the system were:

1. Position of the computer in the dispensary and away from the patient counselling area.
2. The extra time involved in counselling with the module as opposed to without it.
3. The perceived decrease in customers' faith in the pharmacist if the counselling module was used.
4. The need to exit the labelling module in order to access the patient counselling module thus interrupting the labelling and dispensing processes.

A number of the trialists thought that it was a good idea to involve patients during the counselling process, showing them what questions were being asked and what was happening. However in most cases this was only possible during quiet periods as the patient had to go into the dispensary to see the computer.

One trial pharmacist felt that better use of the counselling module would be made if customers themselves operated it. He therefore set up a terminal and keyboard running the module on the chemist's counter in his pharmacy. In April 1990, when the module had been used in this way for around 2 months, the pharmacist commented:

> *"At present 2-3 people per day use the software on the chemists counter. Some customers are interested, others are not, children tend to find it easier to use than old people. Two local doctors have seen it and approve. It is also a potentially useful on-going training aid for staff. It is too slow for a pharmacist to use because it asks questions the answers to which a pharmacist could see immediately eg. age and sex. A terminal on the chemist's counter with information on health care "rolling on" but which can also switch to diagnostics, would be a good idea. Keying OTC products into a person's patient medication record is not practical as it would result in delay"*

To conclude, the visits to and telephone contact with the trialists revealed the serious impracticalities involved with the use of the patient counselling module by pharmacists. As a result use of the module by those pharmacists had been very low. One pharmacist had positioned a computer running the counselling module in the front of his shop where customers could use it for themselves, this appeared to be more successful than use of the module by the pharmacist. The experiences of customers in this pharmacy are described in section 6. 6. 4.

6. 6. 3 End of trial questionnaire: trialists' views of the patient counselling module

In December 1990 when trialists had been using the trial software for about one year, questionnaires were sent to the 9 trialists still thought to be using the patient counselling module in the manner originally intended. 6 questionnaires were completed and returned, 1 was returned uncompleted. The two trialists who did not send back a questionnaire were contacted by phone and asked whether they were still using the trial software.

3 out of 9 pharmacists were using the patient counselling module. The frequencies of use quoted were: four to five times a day; once a week; and once a month. The responses of those pharmacists who completed questionnaires are shown are shown in Table 21.

The results of this end of trial questionnaire confirm those obtained from the initial visits to the trial pharmacies. The majority of respondents felt that the quality of advice offered by the pharmacists improved when the counselling module was used, however use of the module was low because trialists felt it was impractical in relation to position in the dispensary and interruption to dispensing. Although most thought the patient should be involved when the module was used, fewer believed the patients should operate the module themselves. This is surprising considering the relative success of the patient counselling module when used by members of the public in the case study pharmacy. Most respondents did not agree that customer's confidence in the pharmacist was reduced when the patient counselling module was used. The pharmacists who had commented on this problem when visited, did not complete the end of trial questionnaire. Again respondents were positive about the use of the module as a learning aid for pharmacists. Interestingly, the pharmacists in Balon's study[101] also felt that the computerised aid they used was more suitable as an aide-memoire and for teaching than for use in the presence of the patient.

Table 21 Trialists' levels of agreement, at the end of the trial, with a number of statements about the patient counselling module (PCM) n = 6

Statement	Agree	Disagree	Unsure
The patient/customer should be able to see the screen when the pharmacist is using the PCM	5	0	1
The PCM is a good learning aid for pharmacists	4	1	0
The PCM is not practical because of the position of the computer in relation to the counselling area	5	1	0
Using the PCM is not practical because it interrupts labelling	4	2	0
The quality of advice offered by the pharmacist is better when the PCM is used	5	1	0
The number of enquiries from members of the public goes up as a result of using the PCM	0	2	4
The PCM is easy to use	4	0	2
Patients'/customers' confidence in the pharmacist is reduced when I use the PCM to help answer their queries	0	4	2
It is a good idea to let patients/ customers use the PCM themselves	0	3	3

One of the trialists who was using the patient counselling module commented that:

> *"Some patients favour the patient counselling module and others don't. There are too many stages in the patient counselling module as most people are in a hurry. The module would be most useful if the patient and pharmacist both had time and the pharmacist was paid for the service, as the*

patients who have time on their hands want more than a computer chat. Minimum time required for each patient would be 10-15 minutes if customers are to be satisfied".

6. 6. 4 Case study

6. 6. 4. 1 Method and hypothesis

As the trial progressed it became clear that in some pharmacies the use of the patient counselling module was negligible. In fact in the pharmacy which reported greatest use of the module, a computer had been set up outside the dispensary so that the software could be operated by customers. It was decided to use this particular pharmacy for a case study, in which the use of the module by customers would be examined closely for one week. Observation and semi-structured interviewing were the methods chosen for the case study.

The third hypothesis in this chapter was thus formed some months after the start of the trial when use of the patient counselling module by patients themselves had proved more successful than use of the patient counselling module by pharmacists:

Hypothesis 10: "Given the opportunity patients will want to use the patient counselling module themselves."

The case study was conducted in August 1990 at the pharmacy where the patient counselling module was being used by members of the public. A series of interviews with patients/customers were conducted between 20th and 25th August, a few further interviews were conducted by a pharmacy student in early October. Interviewees were either:

1. People who had used the computerised patient counselling module.
2. People who had not used but who had shown an interest in the counselling module.
3. People who asked for the pharmacist's advice on a topic covered by the counselling module.

The interviews were semi-structured, each based on a short questionnaire with space available to record interviewees comments. Two questionnaires were used: one for customers who had used the counselling module and one for customers who had not.

6. 6. 4. 2 Results

The case study pharmacy was situated in the centre of a market town. The shop occupied 2000 square feet of which 700 comprised the dispensary. 2-3 thousand prescriptions were dispensed per month. 30 people who used the counselling module were interviewed, 8 people who did not use the counselling module were also interviewed.

Table 22 Profile of the interviewees

	Users n = 30		Non-users n = 8	
	Yes	No	Yes	No
A regular customer	24	6	8	0
Used computers at home/work	21	9	3	5
Had seen/heard of program before	5	25	NA	NA

As shown in Table 22 most interviewees were regular customers. The majority of those who used the patient counselling module had used computers at home or work only a minority of those who had not used the module had used computers at home or work. This implies that those familiar with computers were more likely to use the module, probably because they felt more confident and relaxed about doing so.

When those people who had used the counselling module were asked "Why did you use the computer here today?", 19 said it was out of curiosity or general interest, 6 used the module for advice about a specific problem and 3 were prompted to use the module by a member of staff. The fact that the majority used the module out of curiosity indicates that it was generally seen as a novelty in the pharmacy. If customers had been familiar with the module and known what its function was, more people might have used it to obtain advice about specific problems.

Table 23 Some of the responses given by interviewees in the case study pharmacy

Question	Positive response	Negative response
Users n = 30		
Did you find the counselling module easy to use?	27	2
Were the questions asked easy to understand?	25	4
Was the information given at the end of the session easy to understand?	22	4
Were you satisfied with the information given at the end of the session?	22	4
Would you use the counselling module again if you had the opportunity	26	3
Would this module attract you back to a pharmacy where it was installed	17	11
Do you think it is a good thing for chemists to offer this sort of service in their shops	25	2
Non-users n = 8		
Would this module attract you back to a pharmacy where it was installed	2	5
Do you think it is a good thing for chemists to offer this sort of service in their shops	5	2

Table 23 shows the views of the interviewees towards the patient counselling module. The majority of those who used the patient counselling module found it user-friendly and were satisfied with the information given. Most said they would use the module again given the opportunity but fewer said they would specifically go to a pharmacy where such a module was installed. The majority felt it was a good thing for pharmacists to offer this sort of service in their shops. Most of those who had not used the counselling module said they would not be attracted back to a pharmacy where one was installed, although most thought it was a good thing for chemists to offer the service.

These results indicate a positive attitude towards the module by most customers, especially among those who had used it. However, as most people who used the module did so out of curiosity, the value of the module as a means of providing advice on minor ailments was not properly tested. The module would have to be an established and recognised piece of equipment in the pharmacy for a significant number of people to use it as an advisory tool. This study did however demonstrate the willingness of customers to use computers in the pharmacy. Other types of information could be included on similar computers for patients to use. These could take the form of simple health education lessons which would be easier to operate than the counselling module. To increase the numbers of patients using such an information source, some kind of message scrolling down the screen while not in use would have the effect of alerting and increasing awareness among customers.

6. 7 Summary

This study comprised two parts, a study of the use of a computerised aid to diagnosis by pharmacists, and a study of the use of the same computerised aid to diagnosis by pharmacy customers.

In the first part of the study 16 pharmacists who responded to an advert asking for volunteers, started on a trial of a computerised aid to diagnosis. One year later only 3 of the 16 were still using the software. All had experienced difficulties using it. The main problem was the impracticality of using the software whilst counselling a patient. This was a result of the location of the computers running the software away from the patient counselling areas, and because of the extra time involved in counselling with the module.

In the second part of the study a computer running the aid to diagnosis software only, was positioned on the chemist's counter of a community pharmacy so that members of the public in that pharmacy could use it. Interviews with people who used the program and some who did not were conducted. The main stimulus to using the program was found to be curiosity rather than need. Most users found it easy to use and were satisfied with the results, the majority said they would use it again given the opportunity.

6. 8 Conclusions

Hypothesis 8: "Pharmacists may initially find working with a patient counselling module restrictive but this will decrease with time."

The pharmacists involved in this trial did find using the patient counselling module restrictive because the computer was always positioned away from the chemist counter area where counselling usually took place, and because of the extra time required to counsel patients using the module. This perceived restrictiveness did not appear to decrease as the trial progressed. This may have been because trialists did not use the module enough to familiarise themselves with it. Restrictiveness was the main reason for so few trialists using the module at the end of the trial.

Hypothesis 9: "Use of a computerised patient counselling module will improve pharmacists' ability to respond to symptoms."

In general. those trialists who were visited did not feel that they were better able to respond to symptoms when using the patient counselling module because of the impracticalities involved with its use. However, at the end of the trial 5 out of 6 agreed that the quality of advice they offered was better when they used the module. It appears then that although the patient counselling module was felt to improve the advice given by pharmacists when responding to symptoms, the low level of use of the system negated this improvement.

A number of pharmacists commented that they felt the module would be useful as a means of continuing education for pharmacists. Similarly at the end of the trial, 4 out of 6 trialists agreed that the module was a good learning aid for pharmacists. Therefore the patient counselling module may indirectly improve pharmacists' ability to respond to symptoms, although this link was not proven in this investigation.

Hypothesis 10: "Given the opportunity, patients will want to use the patient counselling module themselves."

In the case study pharmacy, the patient counselling module was set up on the chemists counter and used by a small but steady stream of customers. Of those people who used the module and were interviewed about it, 26 out of 29 thought they would use the module again if they had the opportunity.

On the basis of the results of this investigation, therefore, we can conclude that:

1. Pharmacists find working with a patient counselling module restrictive.
2. Use of a computerised patient counselling module may improve pharmacists' ability to respond to symptoms but only indirectly through its continuing education function.
3. Given the opportunity, patients will want to use the patient counselling module themselves.

Chapter 7. INVESTIGATION OF THE USE A COMPUTER SYSTEM WITH THE ABILITY TO PRODUCE MEDICATION INFORMATION LEAFLETS FOR PATIENTS IN COMMUNITY PHARMACIES

7. 1 Introduction

The provision of advice and information to patients is an important and central role for the community pharmacist. One subject on which advice is given, is that of drug therapy. Patients need to know when and how to take their medicines, what other medicines or foods to avoid and what possible side effects might occur.

One method by which a pharmacist can give patients drug information and advice is to provide information leaflets with dispensed medicines. This ensures all patients receive uniform advice which they can refer to at any time.

As mentioned in chapter 2, a number of experiments have investigated the effects of patient information leaflets (PILs) on patient compliance, patient knowledge, pharmacists' attitudes etc. The leaflets in these studies have all been pre-printed, away from the pharmacy or doctor's surgery where they were distributed. This has limited each investigation to the study of a small number of leaflets only. Leaflets stored on a pharmacy computer and automatically produced when required have a number of advantages over pre-printed ones:

1. Large numbers of leaflets do not have to be kept in the pharmacy.
2. Leaflets can be personalised.
3. It is less likely that the pharmacist will forget to include a leaflet with the medicine.

The first pharmacy computer system to incorporate a leaflet production function in this country was produced by Mike Hadley Ltd. (which later became Hadley Hutt Ltd.). Called "PILLS" (Patient records, Interactions, Labelling and Leaflets), this system stored detailed leaflets (450 at the time this study started) on a word processing package. The leaflet information was based upon the relevant "United States Pharmacopoeia Drug Information - Advice for the patient"[148] entry and the relevant product data sheet. A leaflet was automatically produced whenever a new drug was dispensed for a patient. When the system was first launched its price was higher than most other PMR systems available, however the price differential has since decreased. In addition other commercially available systems now incorporate leaflet production facilities.

This study comprised an investigation of the Hadley Hutt PILLS system. Two aspects of the system were looked at. First the characteristics of the pharmacists that used this innovative computer system, and second the effects of the leaflets on both pharmacists and patients.

7. 2 Choice of method

This investigation had two parts: a comparison of pharmacists who used

PILLS with pharmacists who did not use PILLS; and a study of the views of patients who had received leaflets.

It was decided to use both quantitative and qualitative methods. The comparison of PILLS users and non-PILLS users was done quantitatively by mail questionnaire. This method was chosen because a good response rate was expected from the pharmacists, also it allowed all PILLS users to be surveyed. The non-PILLS users were chosen randomly. In order to assess respondents' job satisfaction, a set of scaled questions on different aspects of the job of a community pharmacist were asked[149]. Similarly, in order to assess respondents' attitudes towards patient counselling, their agreement with a number of statements about counselling was ascertained[150].

From these questionnaires it was possible to identify three pharmacies in the Birmingham area where patients receiving information leaflets could be interviewed. In these three case study pharmacies, the attitudes of patients towards the computer generated patient information leaflets were examined in detail. In two pharmacies tape recorded interviews with patients who had already received leaflets were used. In the third pharmacy, patients were receiving leaflets for the first time. Questionnaires were sent to patients' homes after they had had an opportunity to read their leaflets.

7. 3 Objectives

This investigation had the following objectives:

1. To compare pharmacists who used a computer system capable of producing patient information leaflets, with those who did not.
2. To assess pharmacists' and patients' attitudes towards computer generated patient information leaflets.

7. 4 Hypotheses

Pharmacists who supply patient information leaflets are likely to believe that patients require information about their medications. In turn, pharmacists who believe that patients require information about their medications are likely to have positive attitudes towards patient counselling. On the basis of this link, the following hypothesis was made:

Hypothesis 11: "Pharmacists who purchase a PILLS systems are more likely to have positive attitudes towards patient counselling than pharmacists who do not."

An American study of out-patient pharmacists in a Health Maintenance Organisation showed that some aspects of their job satisfaction improved while some deteriorated, following the computerisation of their working environment[151]. This indicates that computerisation does affect job satisfaction. The PILLS pharmacy computer was the only one available, at the time of this study, that generated patient information leaflets. It was also able to maintain patient medication records and check for drug interactions. It was therefore decided to compare the job satisfaction of PILLS users with that of a group of control pharmacists. The following hypothesis was formulated:

Hypothesis 12: "Pharmacists who are using a PILLS system are more likely to be satisfied with their job than pharmacists who are not."

In a national survey of patients' understanding of their medicines through Boots pharmacies[75], 90% of those surveyed wanted further information on side effects and only 6% felt that the provision of side effect data would worry them. It was therefore hypothesised that:

Hypothesis 13: "Patients want to be told about the possible side effects of their medicines."

7. 5 Method 1 - the mail surveys

In October 1990 two pilot questionnaires were prepared. 5 copies of one questionnaire were sent to PILLS users, chosen at random from a list supplied by Hadley Hutt Computing Ltd. 30 copies of the other questionnaire were sent to a random sample of pharmacies chosen from an up to date list of all registered pharmacy premises in Great Britain, obtained from the Royal Pharmaceutical Society in the form of address labels.

3 pilot questionnaires were returned from PILLS users and 22 were returned from second group of pharmacies (referred to as the controls). On the basis of these returns, final questionnaires for PILLS users and controls were prepared.

For the main study, mailed in November 1990, a questionnaire, signed covering letter and pre-paid envelope were sent to 91 PILLS users and 298 controls. One month later a follow-up covering letter together with a second questionnaire and pre-paid envelope was sent to those pharmacies from which no reply had been received. Copies of the questionnaires and covering letters are shown in Appendices 9 and 10.

Data from the returned questionnaires were entered into Data Entry II[143] then analysed using the Statistical Package for the Social Sciences (SPSS)[144].

7. 6 Results 1 - the mail surveys

7. 6. 1 Response rate

74 questionnaires were returned from PILLS pharmacies (81%) and 234 were returned from control pharmacies (79%). Of these, 225 control questionnaires and 73 PILLS questionnaires were returned in time to be analysed.

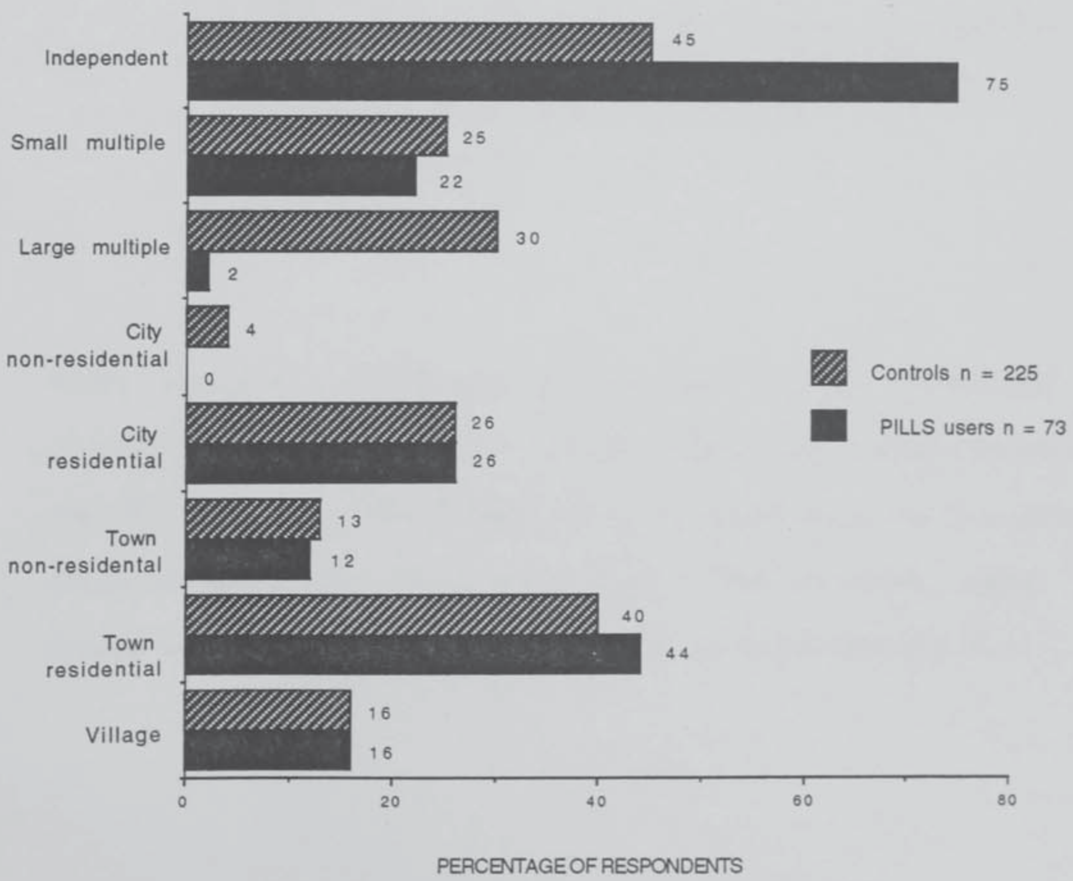
7. 6. 2 The respondents

As shown in Figure 3, three-quarters of the pharmacists using the PILLS system worked in independent pharmacies, in contrast, less than half of the control pharmacists did so. 78% of the PILLS users were owners of their pharmacies, whereas 45% of the controls were owners and 44% were managers. It seems, therefore, that PILLS users were more likely to be owners of independent pharmacies than pharmacists in general. Fewer multiple pharmacies may have invested in PILLS systems because of the expense, the innovative nature of the systems and the belief that not all branches in a chain would benefit from such a system.

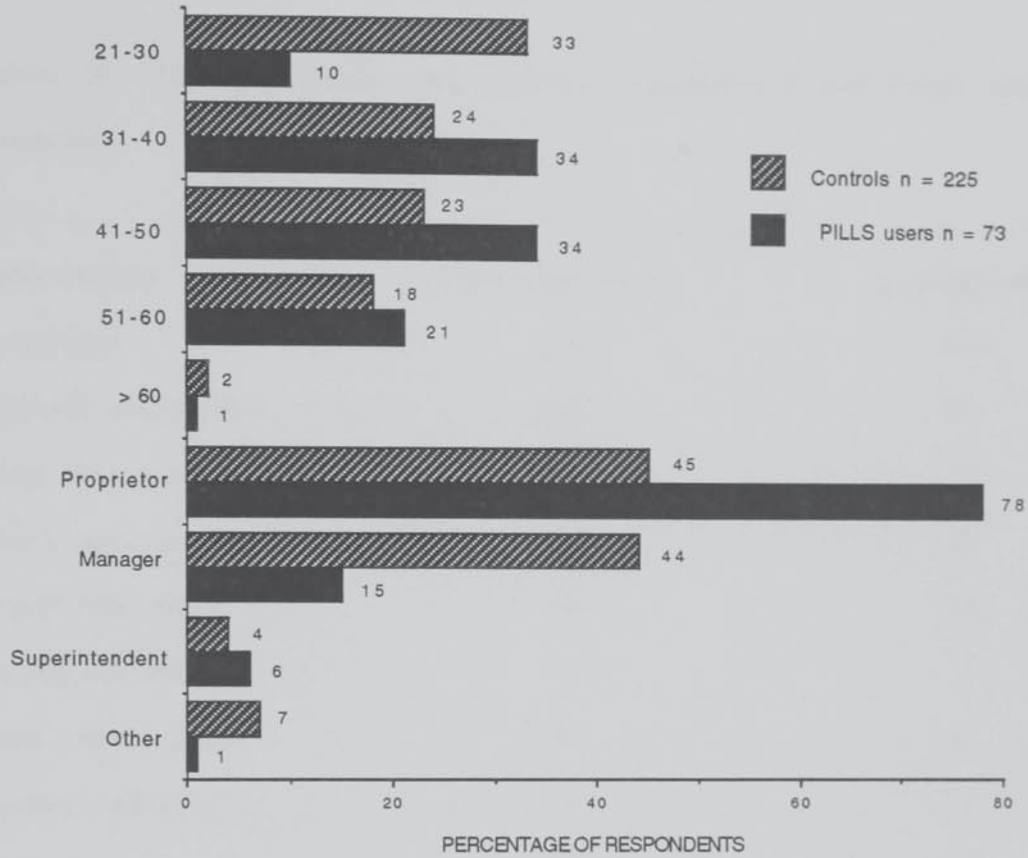
33% of control pharmacists were aged between 21 and 30, whereas 10% of PILLS users were in this age category. 47% of controls were aged between 31 and 50, compared with 68% of PILLS users. Similar percentages in both groups were aged over 51. Thus we see that PILLS users were less likely to be under 30 years old than controls. This is probably linked to the fact that more PILLS users than controls owned their own pharmacies. Young pharmacists are less likely to be pharmacy owners and so less likely to be PILLS users.

Figure 3 Comparison of PILLS users and controls

a) The types and locations of respondents' pharmacies



b) **Respondents' ages and job descriptions**



There were no significant differences in the locations of the respondents' pharmacies (city residential, city non-residential, town residential, town non-residential or village) when the two groups were compared using the chi-squared test. The greatest number in both groups worked in the residential areas of towns and cities.

7. 6. 3 Computer use by the control group

221 respondents (98%) from the control group had at least one computer in their pharmacies and 57 (25%) had two. The uses to which these computers were put is shown in the following Table:

Table 24 Uses to which the control respondents put their pharmacy computers n = 221

Application	No. computers	% computers
Labelling	221	100
Patient medication records	133	60
Drug interaction monitoring	109	49
Stock ordering	125	57
Stock control	68	31
Accessing PINS	9	4
Word processing	33	15
Market research	6	3
Accounts	37	17

The numbers of computers used for the functions shown in Table 24 are higher than those obtained in the survey described in chapter 4. Although the results are not directly comparable, because two different sample populations were used, the large differences in the proportions of respondents' pharmacy computers being used for PMRs, drug interaction monitoring and stock ordering must represent an upward trend in the use of these functions (for a discussion of this see chapter 8).

When asked who had supplied their computers, 65 (29%) of the control respondents answered John Richardson Computers, 48 (22%) said AAH and 27 (12%) said Park Systems.

7. 6. 4 The PILLS users

Of the 73 respondents with the PILLS system, 18 (25%) had kept computerised PMRs previously, suggesting enthusiasm for and positive attitudes towards computers in pharmacy.

55 (75%) of the PILLS systems had been installed in 1990, 17 (23%) in 1989 and 1 in 1988. 55 PILLS respondents (75%) had systems incorporating a leaflet printer. Thus a quarter of PILLS users bought the system for a reason other than its ability to produce patient information leaflets. Indeed, when asked what the main reason for their purchasing a PILLS systems had been many different reasons were given, the most common being the ability of the system to produce leaflets (34 respondents), 14 answers mentioned patient medication records, and 5 the ability to produce Manrex administration sheets.

40 of the respondents with systems incorporating leaflet printers gave leaflets to all prescription patients. The remainder gave leaflets to certain groups of patients only, such as regular customers.

7. 6. 5 Effects of the PILLS systems

Figure 4 shows PILLS pharmacists' responses to questions about changes to their practices that they felt had occurred since starting to give out PILLS leaflets.46 out of 55 respondents experienced a rise in the number of enquiries received from patients about their drugs indicating that many patients who read the information leaflets they were given were prompted to query some of that information over the phone. This suggests a lack of detailed knowledge of their drugs on the part of many patients who then phoned the pharmacy for clarification. It could also mean that many patients were worried by what they had read and phoned their pharmacist in order to allay those fears.

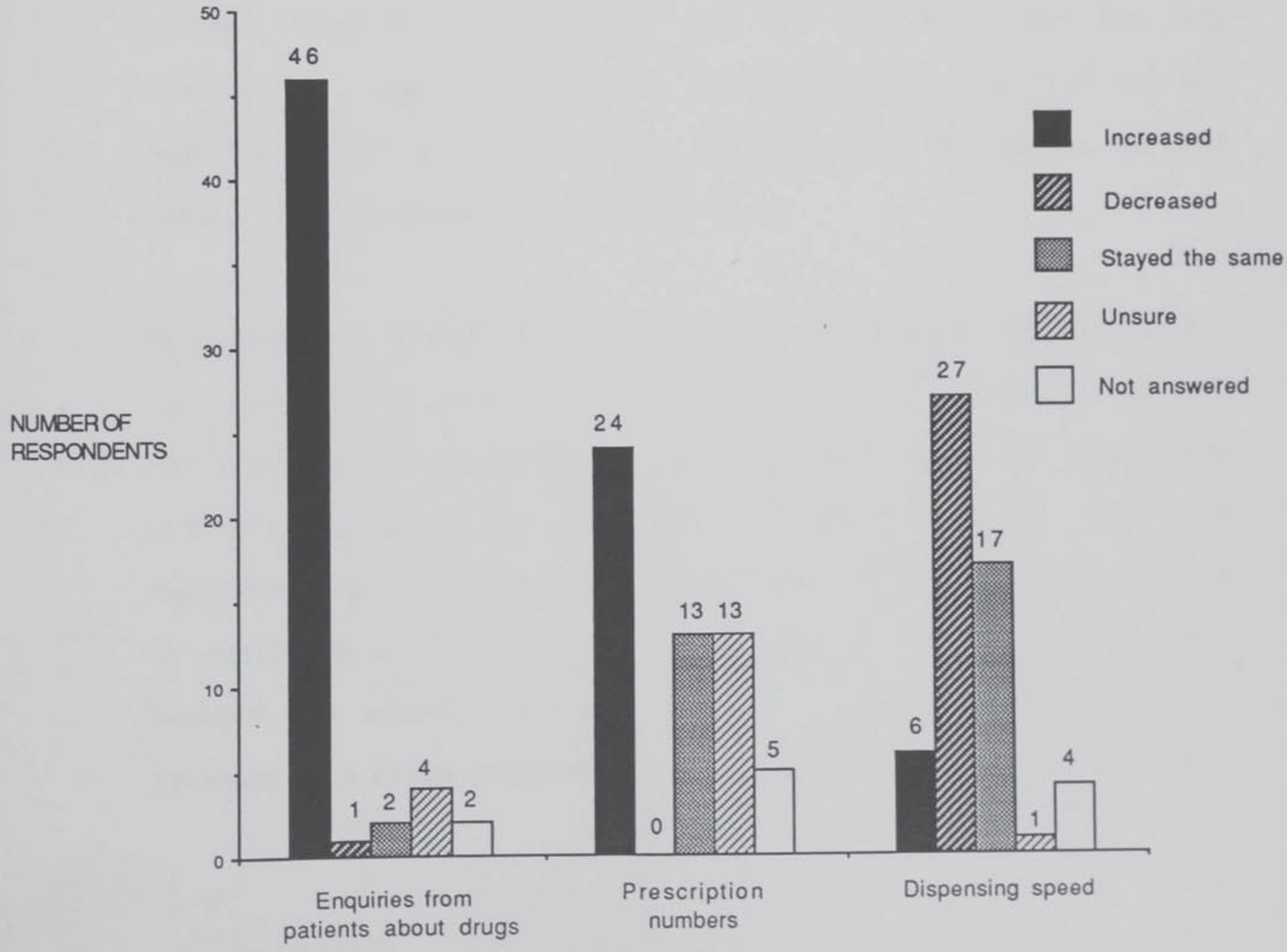
24 out of 55 respondents experienced a rise in prescription numbers after starting to give out PILLS leaflets. This suggests that the leaflets attracted customers to PILLS pharmacies. There are two possible ways in which this could have happened:

1. Patients who received PILLS leaflets would be more likely to return to the pharmacy where they had received the leaflet if they found that leaflet beneficial or thought they were receiving better patient care
2. New customers would be attracted to a pharmacy giving out leaflets when they heard about it, either because of personal recommendations or curiosity.

27 out of 55 respondents reported a decrease in dispensing speed since starting to give out PILLS leaflets. This seems likely to have been

due to the extra time required to print out the information leaflets. Decreased dispensing speed could cause patients to become less satisfied with the service they were receiving. However, such potential dissatisfaction may be negated if patient felt they were receiving improved patient care as a result of the leaflets. As mentioned above, introduction of PILLS systems increased prescription numbers in nearly half of respondents' pharmacies. It seems this occurred despite decreases in dispensing speeds, and indicates that such decreases had a negligible effect on prescription processing and patient care activities in the PILLS pharmacies.

Figure 4 Changes to pharmacy practices which occurred after starting to give out PILLS leaflets n = 55



7. 6. 6 Job satisfaction

Both control and PILLS pharmacists were then asked how satisfied they were with the following aspects of their job:

1. Use of pharmaceutical skills and knowledge.
2. Development of pharmaceutical skills and knowledge.
3. Level of responsibility.
4. Tasks performed.
5. Status in the community.
6. Status amongst other health professionals.
7. Financial reward/effort ratio.
8. Sense of achievement gained.
9. Ability to maintain personal standards.
10. Ability to achieve personal ambitions.

The responses of all pharmacists with PILLS and of all pharmacists without PILLS were combined to give two sets of totals for very unsatisfied, unsatisfied, unsure, satisfied, very satisfied and not answered. The chi-squared test was then used to compare the two groups of respondents (see Appendix 2. 3).

No significant difference between the job satisfaction ratings for the two groups was found. When the individual questions on job satisfaction were analysed it was found that the only significant difference between the two groups occurred with the "level of responsibility" question: respondents with PILLS were less likely to be satisfied with this aspect than respondents without PILLS (chi-squared test $p<0.01$, see Appendix 2. 3). It seems unlikely that the presence of a PILLS computer could have been responsible for the lower level of satisfaction with responsibility among PILLS pharmacists. A more likely explanation is that particular characteristics of PILLS users were contributing factors. For example more PILLS pharmacists were pharmacy owners and were aged between 31 and 50 than the controls.

The responses of PILLS pharmacists who gave out leaflets were then compared with those of PILLS pharmacists who did not, again no significant difference was found between the two groups. When the control respondents who maintained computerised patient medication records were compared with the controls who did not, no significant differences were found in the ratings of any job satisfaction questions by these two groups.

Thus it seems that pharmacists using a PILLS system are no more likely to have high job satisfaction than pharmacists who do not use a PILLS system. Similarly pharmacists maintaining PMRs are no more likely to be satisfied with their jobs than pharmacists who do not. These results differ from those obtained in a cost benefit analysis of pharmacy computer systems[152] when a significant association was found between the presence of a computerised PMR in the pharmacy and the pharmacist's job satisfaction. The reason for the difference may lie in the different methods of asking about job satisfaction: in the cost benefit analysis, one general question was asked, but in this study there were several questions about various aspects of job satisfaction.

7. 6. 7 Attitudes towards patient counselling

Control and PILLS groups were then asked how likely they thought it was that the following statements about patient counselling were true:

1. It requires more pharmacist time.
2. It increases the accuracy of patients' drug taking.
3. It requires training I don't have.
4. It improves my image as a health professional.
5. It is considered a waste of time by patients.
6. It helps patients understand their therapy.
7. It increases my legal liability.
8. It results in increased return business.
9. It requires an environment of privacy.
10. It increases the effectiveness of patients' drug taking.
11. It requires two-way communication between patient and pharmacist.

Again, when the chi-squared test was applied no significant differences between PILLS users and non-PILLS users were found in the answers to these questions (see Appendix 2. 3). Similarly when the control respondents who maintained computerised PMRs were compared to the controls who did not, no significant differences were found. These results suggest that pharmacists using certain kinds of pharmacy computer systems are no more likely to have positive attitudes about patient counselling than other pharmacists.

It appears that PILLS users did not invest in their systems because of their positive attitudes towards patient counselling. Other possible reasons for choosing a PILLS system include:

1. Realisation of the difficulties involved in counselling every patient in a pharmacy, and of the possibility that a PILLS system could overcome such difficulties.
2. Attempt to increase patient loyalty by giving out patient leaflets.

7. 6. 8 Comments

Additional comments were invited from PILLS users at the end of the questionnaire, 49 comments were made of which 27 were positive comments about the system in general, while 5 respondents commented that the leaflets were expensive to generate.

4 respondents said that the leaflets needed altering to reduce or change the side effect information. 3 respondents commented that their patients liked the leaflets while 3 said that their patients had been worried by the leaflets. 5 said their local GPs did not like the leaflets, however 2 said their local GPs did like them. These comments indicate differences in opinion about the leaflets, in particular over the side effect information, among pharmacists and doctors. They also suggest that patients' reactions to the leaflets vary widely.

7. 7 Method 2 - the case studies

Three pharmacists in the Birmingham area, who were using PILLS systems, and who had indicated in their responses to the surveys detailed in section 7. 6 that they would be willing to take part in further studies, were contacted. They were asked whether a researcher (RMF) could visit their pharmacies and interview customers who had received patient information leaflets generated by the PILLS system. All three pharmacists contacted agreed to co-operate.

In two of these "case study" pharmacies patients had been receiving PILLS leaflets for some time. In these pharmacies patients collecting prescriptions were asked whether they had been given a leaflet in the past and, if so, whether they would agree to answer some questions about that leaflet.

In the other "case study" pharmacy, patients had only just started to receive PILLS leaflets. Each patient who received a leaflet with their dispensed medication was asked whether they would agree to be sent a questionnaire about the leaflet a week later.

Each set of interviews was carried out during one day at the particular case study pharmacy.

7. 8 Results 2 - The case studies

7. 8. 1 Case study 1

In the first case study pharmacy, 22 people who had received PILLS leaflets on a previous visit to the pharmacy were approached during the course of one day. 21 agreed to be interviewed. 10 interviewees were female, 11 were male.

Table 25 shows respondents' answers to questions about the PILLS leaflets. Note that N varies between questions as not all interviewees were asked each question. As shown in the table nearly all those questioned had read the leaflets they received, indicating an interest in their medicines and a desire for information about them. Only half appeared to have been fully aware of what their medicines were for before receiving the leaflet. Some may not have been properly told about their medicines when they were first issued, some may simply have forgotten the information that they were given. In either case provision of information leaflets provided a written explanation of the medication which could be referred to as and when necessary by the patient. A typical comment was:

> *"I didn't know what my medicine was for in that sort of detail, the doctor told me what the tablets would do but not in the detail that you get in the leaflet. The leaflet told me what I'd got"*

When asked what they thought about the length, layout, ease of understanding and interest of the leaflets all answers given were positive. It seems that although the leaflets were detailed and contained technical information, the respondents did not find this a problem.

Table 25 The responses given by patients who had received PILLS leaflets in the first case study pharmacy

	Positive response	Negative response	N
Did you read your leaflet after receiving it?	19	3	22
Did you know what your medicine was for before you received your leaflet?	9	9	18
Did you like the layout/ amount of information?	21	0	21
Did you find the leaflet easy to understand?	21	0	21
Did you find the side effects information worrying?	1	17	18
Have you experienced any side effects?	4	8	12
Does your doctor know about these leaflets?	5	5 (5 unsure)	15
Would you be likely to go back to a pharmacy that gave out the leaflets?	5	1	6

7. 8. 1. 1 Side effects

One respondents had been worried by the side effect information and commented:

> *"It did make me think well will it? And you do start to look for things that perhaps aren't there, whereas if you were ignorant you wouldn't be any the wiser. I don't know what to think of it really - whether it's best to stop ignorant or be informed"*

In contrast, the majority of respondents had not been worried and most said they would rather be told about side effects. A typical comment was:

> *"I wasn't worried by the side effect information, in fact I did have a bit of a headache so I was able to think, well it is relating to the medication......I think I want to be told about side effects"*

7. 8. 1. 2 Source of leaflets

6 interviewees said they would prefer to get the leaflets from a pharmacy, 1 preferred the doctor and 12 did not mind.

> *"It would be helpful if the doctor could give them, then you could go to any chemist"*

> *"I think from the pharmacy considering the doctors are busy enough as it is .... as soon as you pick up the drugs you get a leaflet which I think is a far better way of doing it. The only trouble is that with every chemist you go into you might end up with too many leaflets"*

These responses indicated that it was acceptable to most respondents for pharmacies to give out information leaflets. It appeared that respondents were more concerned about getting a leaflet rather than where they got it from.

7. 8. 1. 3 Doctors' views on the leaflets

Of the 5 interviewees who thought their doctors knew about the leaflets, 1 commented

> *"I don't think my doctor agrees with doing it because he has said the same thing to me as I have said to you - it can frighten people and you get people phoning up the doctor saying is this or that going to occur?"*

This confirms the comments made by some of the pharmacists using PILLS in the mail survey ie. that the leaflets are not liked by certain doctors because of their detailed side effect information.

7. 8. 2 Case study 2

Table 26 The responses given by patients who had received PILLS leaflets in the second case study pharmacy

	Positive response	Negative response	N
Did you read your leaflet after receiving it?	29	6	35
Did you know what your medicine was before you received your leaflet?	6	7	13
Did you like the layout/ amount of information?	27	0	27
Did you find the leaflet easy to understand?	30	0	30
Did you find the side effects information worrying?	7	25	32
Have you experienced any side effects?	6	22	28
Does your doctor know about these leaflets?	10	12 (9 unsure)	31
Would you be likely to go back to a pharmacy that gave out the leaflets?	23	9	32

In the second case study pharmacy 35 people who had received PILLS leaflets on a previous occasion were interviewed, no-one refused to be interviewed. 27 interviewees were females, 8 were male. The responses given to questions about the PILLS leaflets are shown in Table 26.

As in the first case study pharmacy, most respondents had read their leaflets when they received them. All were satisfied with the layout and amount of information given and found it easy to understand. Again, over half said they had not known what their medicines were for before receiving their leaflets.

7. 8. 2. 1 Side effects

Most respondents said that they had not been worried by the side effect information and again some added that it was reassuring to know what side effects to expect:

> *"I prefer to know what the side effects are then if you have side effects you can go back to your doctor and say (the tablets) don't suit you.....and have your prescription changed"*

> *"I think its nice to know what side effects to expect rather than get them and think there's something else the matter with you"*

However, 2 respondents although not being worried themselves, felt other people might be and 7 people said they had been worried by the side effects information:

> *"It frightened her (respondent's wife) a bit - saying it can cause kidney damage and other things, but if it had happened we would have known so I suppose its helpful in one way but frightening in another"*

One interviewee stopped taking her medicine altogether because of its possible side effects:

"I got a medical book and looked the side effects up, it told me a bit more about it (did you stop taking the medicine?) I did.... because of the side effects"

Thus there was one interviewee out of 56 who stopped taking her medicines because of the side effect information. If this proportion (roughly 2%) is representative of what would happen in the general public, large numbers of patients receiving prescription medicines could become non-compliant if the generation of such leaflets was to become widespread among community pharmacies. On the other hand, by providing patients with information about their medicines and involving patients in their own treatment, the leaflets could be expected to improve the compliance of many patients. In order to ensure that patient information leaflets bring about an overall improvement in patient compliance, it is important that the liklihood of side effects occuring is put into perspective in the leaflets.

The 6 interviewees who had actually experienced side effects had gone back to their doctor and/or stopped taking the offending medicine.

7. 8. 2. 2 Source of leaflets

23 patients said they did not mind whether their information leaflet came from the doctor or the pharmacist, 10 preferred the pharmacist:

"I think its better with the tablets because you automatically read it with the instructions about doses"

Most respondents thought they would be more likely to return to a pharmacy that gave out the leaflets but some did not:

"I suppose I would because at least you know for definite exactly what you are taking"

"I come to this one anyway, its handy - I've always found that if the chemist and the doctor are separate it usually takes 2 days to get your medicine"

7. 8. 2. 3 Doctors' views on the leaflets

None of the 10 interviewees whose doctors knew about the leaflets said that those doctors objected to the leaflets:

"She doesn't mind, what she did say once was that there are always side effects and sometimes it doesn't pay to know what those side effects are"

This comment supports the argument that some GPs had reservations about the PILLS leaflets because of the detailed side effect information.

7. 8. 3 Case study 3

As shown in Table 27, nearly all those questioned had read the leaflets they received, indicating an interest in their medicines and a desire for information about them. Only half appeared to have been fully aware of what their medicines were for before receiving the leaflet. This may have been due to inadequate explanation, alternatively they may simply have forgotten the information that they were given. In either case provision of information leaflets would provide a written explanation of the medication which could be referred to as and when necessary by the patient.

Most respondents had found their leaflets interesting, easy to read, useful and complete, indicating satisfaction with those leaflets. The majority had found the leaflets reassuring rather than worrying although 6 were neutral on this question.

The results of this case study support those of case studies 1 and 2.

Table 27 Patients' views about their PILLS leaflets in the third case study pharmacy n = 21

	Positive response	Negative response	Neutral response	Not answered
Ease of understanding	20	0	1	0
Length	17	3	0	1
Worrying or reassuring*	13	0	6	2
Level if interest	14	0	6	1
Easy/hard to read	15	0	4	2
Usefulness	15	0	4	2
Completeness	17	0	2	2

*Positive response = reassuring; negative response = worrying

7. 9 Summary

This study comprised two parts. First, a survey of community pharmacists using a computer system called PILLS with the ability to generate patient information leaflets. Second, a study of the attitudes towards those leaflets among patients who had received them.

Those PILLS users who responded to the questionnaire described in this chapter were typically independent pharmacy owners aged over 30. They were thus relatively free in their choice of computer system, helping to explain why they had chosen the PILLS system with its innovative leaflet production feature, and largely unproven track record.

Comparison of their job satisfaction ratings with a group of control pharmacists revealed few differences between the two groups. Thus it seems that using a PILLS computer system does not increase job satisfaction. The same test was done comparing pharmacists from the control group pharmacists who had PMRs with those who did not. Again the satisfaction scores were not significantly different, indicating that use of a PMR does not increase job satisfaction. Similarly, no significant differences in attitudes towards patient counselling were found between respondents with PILLS systems and respondents without PILLS systems. It seems that positive attitudes towards patient counselling was not the reason for the majority of respondents becoming PILLS users.

Since starting to give out leaflets, 24 out of 55 PILLS users reported an increase in prescription numbers, 46 reported an increase in enquiries from patients, and 27 reported a decrease in dispensing speed. A number of pharmacists commented that their customers and local GPs liked the leaflets. However others commented that they felt the side effect information was too detailed, that it had worried patients, and that their local GPs did not approve of the leaflets because of the side effect information.

This study thus highlighted the controversial nature of the side effect information in the leaflets. Some health professionals believing that patients would be worried by the information given. In the second part of the study the views of patients who had received leaflets were sought.

The majority of patients interviewed or sent questionnaires had not been frightened by the side effect information. Many were glad to have been given the information and said they found it reassuring by forewarning them of what to expect. However 1 interviewee (out of 56) had discontinued treatment because of the possible side effects of the medicines involved. In addition, a small number of those interviewed did say that their doctors did not approve of the leaflets, confirming that there is a problem with acceptance of these leaflets by the medical profession. To convince the majority of pharmacists and doctors that computer generated leaflets are in the best interests of patients, standards leaflets, agreed upon by representative bodies should be drawn up. These leaflets would contain sufficient information to satisfy patients' needs for information, but also put the relative risk of side effects occuring into perspective so as not to unduly worry patients.

The majority of the patients questioned found the leaflets easy to understand. This indicates that the leaflets form an acceptable means of providing patients with detailed information about their medicines. The fact that this information was previously lacking is evident from the fact that many interviewees claimed not to have known what their medicines were for before receiving their PILLS leaflet. As described in chapter 2, it has been said that increased knowledge about medicines leads to improved patient compliance which can result in improved patient care. Pharmacy produced information leaflets could thus play a part in improving patient care as well as providing information to patients.

7. 10 Conclusions

Hypothesis 11: "Pharmacists who purchase a PILLS system are more likely to have positive attitudes towards patient counselling than pharmacists who do not."

No significant differences were found, between the responses of the respondents with PILLS systems and the responses of the respondents without PILLS systems, to a series of statements made about patient counselling. It seems, therefore, that PILLS users were no more positive about patient counselling than other pharmacists. This suggests that PILLS users did not acquire their systems to aid patient counselling but for some other reason such as to increase patient loyalty or for a function unconnected with leaflets.

Hypothesis 12: "Pharmacists who are using a PILLS system are more likely to be satisfied with their jobs than pharmacists who are not."

No significant differences were found between the responses of respondents with the PILLS systems and the responses of respondents without PILLS systems, to all but one of a series of questions about job satisfaction. This result is in disagreement with that obtained by Di Ponio[152], perhaps because there is no simple, direct relationship between the type of computer used and job satisfaction. Indeed there are likely to be a number of other variables involved.

Hypothesis 13: "Patients want to be told about the possible side effects of their medicines."

The majority of patients in all three case study pharmacies said they did not find the side effects information worrying. In addition many of them commented that would rather be told about side effect information, indicating that most patients do want to be informed on this subject.

On the basis of the results of this investigation, therefore, we can conclude that:

1. Pharmacists who have a PILLS system may not have more positive attitudes towards patient counselling than pharmacists who do not have a PILLS system.
2. Pharmacists who are using a PILLS system may not be more satisfied with their jobs than pharmacists who are not.
3. The majority of patients in the case study pharmacies wanted to be told about side effects of their medications.

Chapter 8. INVESTIGATION OF THE USE OF ELECTRONIC POINT OF SALE TECHNOLOGY IN COMMUNITY PHARMACY

8. 1 Introduction

Information is a vital element of good management in the retail environment. Electronic point of sale technology captures data on all the items sold from a particular shop, this data can then be used by staff to improve product selection, merchandising and promotions, in theory leading to increased sales. The number of general retail outlets in Great Britain with EPoS systems has increased over the last 5 years. A number of these have reported resulting improvements in profit margins[125]. Community pharmacies are also investing in EPoS systems: Boots the Chemist Ltd. had installed systems into 450 of its stores by 1990[118], and, as mentioned in chapter 2, a number of other systems suitable for use in community pharmacy have been reported in the pharmaceutical press. However, the price of an EPoS system is still more than that of a pharmacy computer system and, in the study described in chapter 4, only 4% of respondents used EPoS in their pharmacies. The present study aimed to find out whether this number had increased, and what community pharmacists' attitudes towards EPoS were in general.

The other main aim of this study was to quantify usage of information technology in British pharmacies in a similar way to the study described in chapter 4. This would then enable a comparison of IT use at two different times to be made, and allow any trends to be highlighted.

8. 2 Choice of method

As in chapter 4, a mail questionnaire was sent to a nationwide, random sample of community pharmacists. The questionnaire was sent to 1000 community pharmacists (roughly 1 in 12 of the total population), this number being the highest practically possible so as to maximise precision of the results.

The first half of the questionnaire contained factual questions on respondents' use of IT. The second section asked pharmacists about: their attitudes towards EPoS; the importance they attached to certain features of EPoS systems; and about the possibility of them purchasing a system.

8. 3 Objectives

This investigation had the following objectives:

1. To determine the level of EPoS technology use among community pharmacists.
2. To assess pharmacists' attitudes towards the use of EPoS technology in community pharmacy.
3. To determine the levels, applications and types of other IT equipment used in community pharmacies, allowing a comparison with the results of the study described in chapter 4 to be made.

8. 4 Hypotheses

In chapter 4 it was found that the level of IT use among community pharmacists was higher than in studies carried out in previous years. Because of continued developments of pharmacy computer systems by suppliers, as reported in the pharmaceutical press, it was hypothesised that:

Hypothesis 14: "The number of community pharmacists using electronic point of sale technology will be higher than the level indicated by the 1989 study described in chapter 4."

Hypothesis 15: "The level of IT use and the number of pharmacy computers being used for functions in addition to labelling will have increased since 1989."

It has been stated in the pharmaceutical press that, in order to benefit from an EPoS system, a pharmacy must have a minimum OTC turnover[119,120]. It was therefore hypothesised that:

Hypothesis 16: "Pharmacists from pharmacies with high OTC turnovers will be more likely to have positive attitudes towards EPoS than pharmacists from pharmacies with low OTC turnovers."

8. 5 Method

An up to date list of all registered pharmacy premises in Great Britain was obtained from the Royal Pharmaceutical Society in the form of address labels. A list of random numbers, generated by computer, was used to select the addresses of recipient pharmacies. In summer 1990 a pilot questionnaire was mailed to 100 community pharmacies thus selected. On the basis of the returns to this pilot, a final questionnaire was produced and was sent, together with a covering letter and pre-paid envelope, to 1000 randomly selected community pharmacies in October 1990. One month later, a second copy of the questionnaire, follow-up covering letter and pre-paid envelope were sent to those pharmacies from which no reply had been received. A copy of the questionnaire and covering letter is shown in Appendix 11.

Data from the returned questionnaires were entered into the software package Data Entry II[143] and were analysed using the Statistical Package for the Social Sciences, SPSS[144].

8. 6 Results

8. 6. 1 Response rate

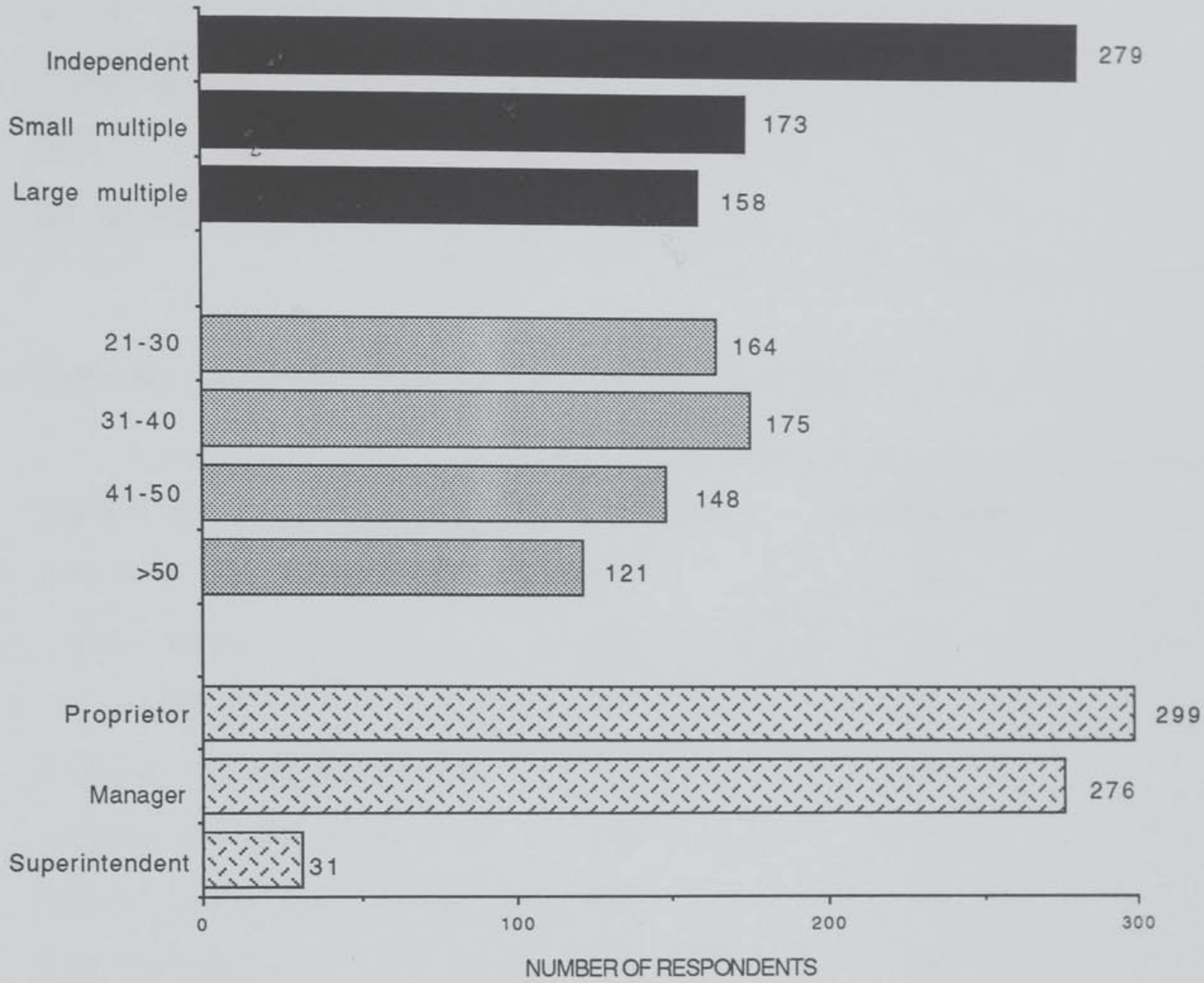
627 questionnaires (63%) were returned of which it was possible to analyse 612 (61%), the remaining 15 having been returned incomplete or too late for analysis.

8. 6. 2 The respondents

Figure 5 shows the types of pharmacies from which questionnaires were returned, and the ages and job descriptions of the respondents.

Of the 436 respondents who answered the question, 21% were in pharmacies where the dispensary made a financial contribution to turnover of less than half, the remaining 79% were in pharmacies where the dispensary made a contribution to turnover of over half.

Figure 5 Profile of respondents (showing type of pharmacies in which they worked, their age ranges, and their job descriptions) n = 612



8. 6. 3 Respondents' pharmacy computers and EPoS systems

79% of respondents had one computer in their pharmacies, while 18% had more than one. Only 3% said they did not have a computer in their pharmacies. As shown in Table 28, a variety of other IT items were also reported. The uses to which respondents put their computers are shown in Table 29.

Table 28 Level of I.T. use in respondents' pharmacies n = 612

Device	No. pharmacies	% pharmacies
Computer	591	97
Modem	462	76
Video recorder	60	10
EPoS	38	6
Fax machine	58	10

Table 29 Pharmacy computer applications n = 591

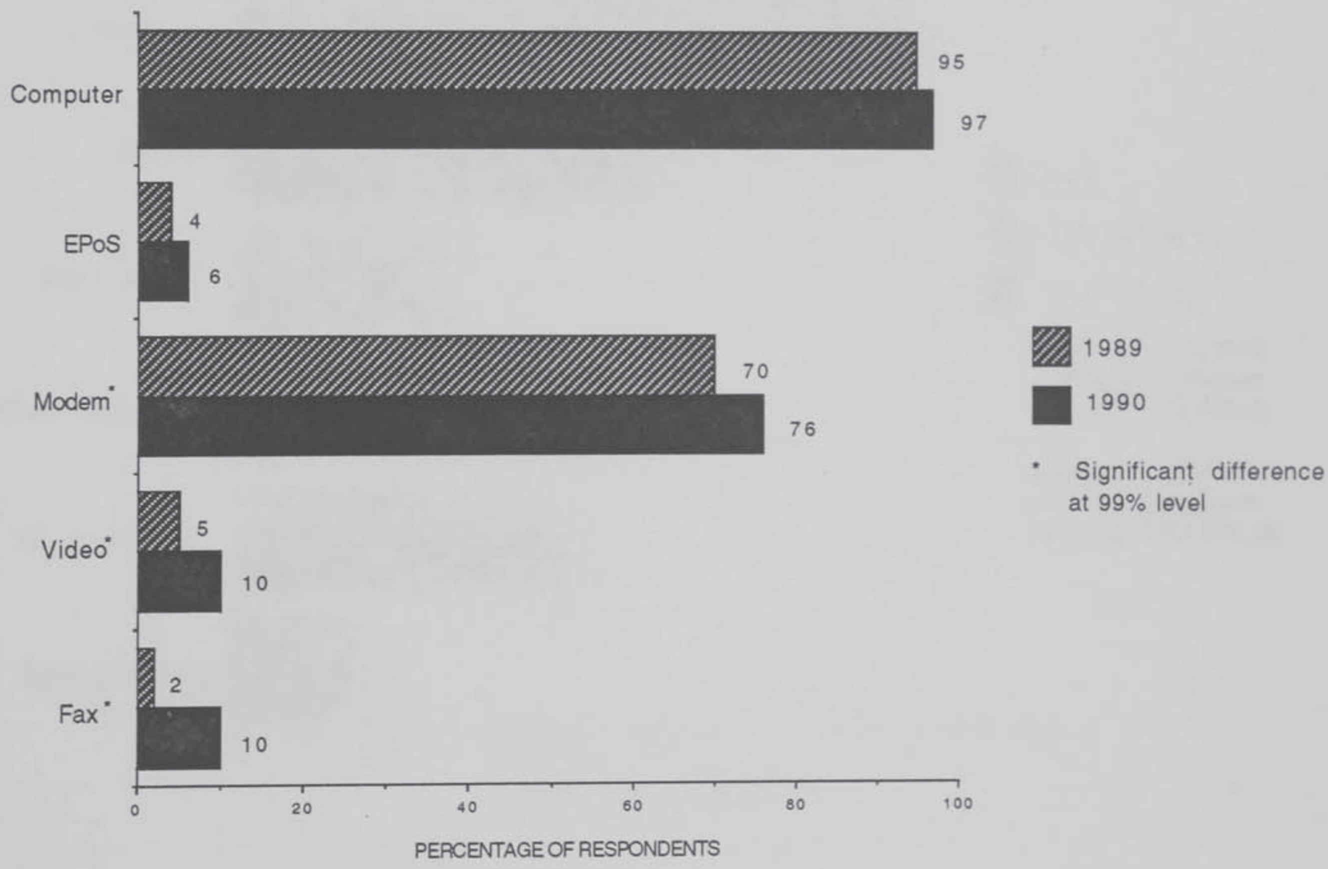
Application	No. computers	% computers
Labelling	587	99
Stock ordering	289	49
Stock control	136	23
Drug interaction monitoring	270	46
Drug interaction monitoring*	114	19
Patient medication records	331	56
Word processing	111	19
Accounts	89	15
Other	111	9

Monitoring for drug interactions between prescribed medicines.
* Monitoring for drug interactions between prescribed and OTC medicines.
N.B. the "other" category included management functions such as sales analysis and payroll, uses involving monitored dosage systems and other miscellaneous uses.

Of the 38 respondents with EPoS systems, 32 worked in large multiple pharmacies, 1 in a small multiple pharmacy and 5 in independent pharmacies. Of the EPoS users who answered the question, 19 had IBM systems, 5 Fairscan systems and 3 were supplied by Logaline Computer Systems. 1 of each of the following systems were also reported: John Richardson Computers Ltd.; Pharmpos; Microspecific; Microsell.

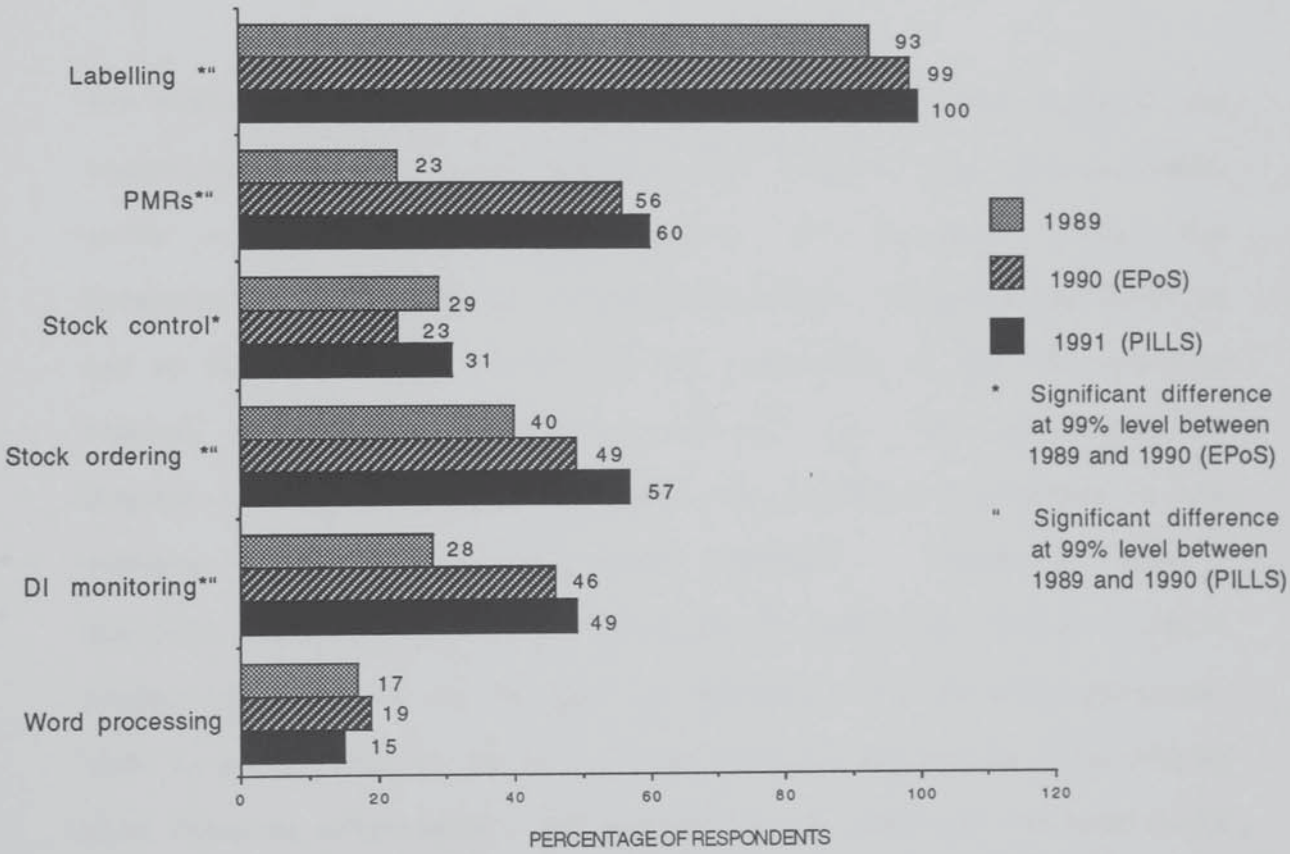
8. 6. 4 Comparison of results - 1989 and 1990

Figure 6 Comparison of the level of IT use in respondents' pharmacies in 1989 and 1990



The percentage of respondents with computers and the percentages of those computers used for various applications, were compared with results obtained in the 1989 study detailed in chapter 4. The comparisons, showing any significant differences in values, are given in Figures 6 and 7. In addition, the percentages of computers being used for various applications was compared with the results obtained in chapter 7. This comparison is also shown in Figure 7.

Figure 7 Comparison of pharmacy computer applications in 1989 and 1990



8. 6. 4. 1 Levels of IT use

The number of respondents with computer systems had risen between the 1989 survey and the survey described in this chapter, but not by a significant amount. As the proportion of pharmacies with computers in both studies was very large this result suggests that computerisation of community pharmacy has reached saturation point. The proportion of community pharmacists with computer systems is so large that any further increases will be insignificant.

The number of EPoS systems had not increased significantly between the two surveys, suggesting that levels of awareness of and interest in EPoS systems had not risen significantly among pharmacists.

The number of respondents with video recorders and fax machines was significantly higher in the present study than in 1989. Fax machines, which send photocopies electronically via telephone wires, are potentially useful aids to a pharmacy business. Although the level of use of fax machines is relatively low, comparison of the 1989 and 1990 results indicates a five-fold increase in the proportion of pharmacists using them. Thus there may be future increases in the numbers of pharmacists using these machines. There was also a doubling in the proportion of respondents reporting videos in their pharmacies. Videos may be used in pharmacies for training purposes, this is most likely to occur in large multiple pharmacies with company wide training programmes. One reason for the apparent increase could therefore be that the 1990 survey included Boots pharmacies whereas the 1989 survey did not.

8. 6. 4. 2 Stock ordering and stock control

Significantly more respondents had modems in 1990 than in 1989. In addition, Figure 7 shows significant increases in the numbers of respondents using their computers for stock ordering. These results suggest a move away from the use of hand-held order pads for stock ordering, to the use of computer systems incorporating a stock ordering facility for this purpose. Use of a stock ordering facility incorporated into a pharmacy computer system allows the generation of orders as a by-product of the labelling process. Thus the need to input codes of items to be ordered into a hand-held unit is removed.

As shown in Figure 7 there was a significant decrease in the number of pharmacists using their computers for stock control between 1989 and the present study. However, a small increase that was not significant between the 1989 results and those of the 1990 PILLS study is also shown. Dispensary stock control is a feature that has been available on pharmacy computer systems for some years. Stock control has the potential to reduce stock holdings and so increase profitability. However these results indicate that there has been a relatively low uptake of this facility by community pharmacists. One possible reason for this is that a pharmacist using computerised stock control needs to enter into the computer re-order levels for each item of stock in the dispensary. These tell the computer when to order more of a particular item and how much to order. Once the re-order levels have been set, the pharmacist's stock ordering work is reduced, however a lot of work is involved in setting the re-order levels. This may have deterred some pharmacists from using computerised stock control.

Another possible reason for the low level of adoption of computerised stock control is that pharmacists felt they would lose control of their stock if they used it. In addition some pharmacists may have felt that the computer would be unable to deal with variations in stock requirements.

8. 6. 4. 3 Patient medication records and drug interaction monitoring

The percentage of respondents using their computers to maintain patient medication records rose significantly in both comparisons. Since the announcement that pharmacists would be paid for maintaining patient medication records for elderly and confused patients[154], more and more commercially available computer systems have incorporated this facility. These results indicate that this has been mirrored by a large increase in the percentage of community pharmacists using computerised PMRs. As well as the financial incentive and the falling price of powerful computer hardware, able to process records speedily, users have experienced benefits from PMRs. One important advantage is that pharmacists can easily access information about a patient such as medication details, drug sensitivities and doctor details. Such information can help the pharmacist in dealing with prescription queries and in checking on the suitability of a patient's current medication. The checking process is made more effective if the computer system incorporates drug interaction monitoring. The percentage of respondents using their pharmacy computers to monitor for drug interactions rose significantly in both the comparisons shown in Figure 7.

8. 6. 5 Respondents' attitudes towards EPoS

Respondents were asked to indicate their level of agreement with a number of statements about EPoS. The results are shown in Table 30. Using the chi-squared test to compare respondents in large multiple pharmacies with those in small multiples and independents, it was found that those in large multiples were significantly more likely to agree with statements 1 ($p<0.01$), 2, 3, 4 and 7 ($p<0.001$) than the other two groups. Also they were significantly more likely to disagree with statements 5, 8 and 9 ($p<0.001$). The chi-squared tests are shown in full in Appendix 2. 4.

Table 30 Respondents' agreement with statements about EPoS n = 612

EPoS would:	Agree	Unsure	Disagree
1. Provide me with useful management information	76	13	7
2. Improve stock control in my pharmacy	72	14	10
3. Improve the image of my pharmacy	41	30	24
4. Make my business more profitable	40	40	15
5. Only be economically feasible for large multiple pharmacies	37	37	21
6. Improve stock security in my pharmacy	36	35	24
7. Decrease the workload in my shop	30	37	27
8. Increase the workload in my shop	24	32	39
9. Slow down counter service in my pharmacy	23	32	40

Respondents in pharmacies where the dispensary made a contribution of between 0 and 49% to turnover, were significantly more likely to agree with statement 4 and significantly more likely to disagree with statement 5, than respondents in pharmacies where the dispensary made a contribution of 50% or more to turnover (see Appendix 2. 4). Thus it appears that respondents in large multiple pharmacies and in pharmacies with a substantial OTC turnover were more positive about EPoS than other pharmacists. An EPoS system will be potentially more beneficial to a large multiple shop with a high OTC turnover because:

1. The higher the OTC turnover the higher the cost savings in terms of better stock control and management.
2. Large multiples will be able to buy EPoS equipment in bulk at a reduced rate.
3. Large multiples will be able to pool management information from the different branches to maximise wholesaler discounts.

Thus, as EPoS systems are potentially more beneficial to large multiples and high non-dispensary turnover pharmacies, it seems logical that pharmacists working in such places will be more positive towards EPoS. These differences in attitudes towards EPoS are again seen when respondents were asked how likely they would be to buy a system.

8. 6. 6 Future use of EPoS by respondents

Of those respondents who did not have an EPoS system, 21% thought it likely that they would buy one, 31% were unsure and 39% thought it unlikely. Respondents who worked in pharmacies where the dispensary made a contribution to turnover of between 0 and 49% were more likely to anticipate buying an EPoS system than those who worked in pharmacies where the dispensary made a contribution to turnover of 50% or more (chi-squared test $p<0.0001$, see Appendix 2. 4). Respondents who worked in large multiple pharmacies were more likely to anticipate buying an EPoS system than those who worked in small multiples or independents (chi-squared test $p<0.0001$, see Appendix 2. 4).

Respondents who did not have EPoS systems were asked to comment on their main reasons for this. 457 comments were made of which 259 said that the reason for not having an EPoS system was that it would cost too much. 57 respondents commented that their pharmacies were too small, and 22 felt their OTC turnovers were too small, to justify having a system.

8. 6. 7 Respondents' preferred EPoS system features

Respondents were then asked to indicate how important they felt each of a list of features was for an EPoS system. The features which the highest numbers of respondents felt were important are shown in Table 31, the results are shown in full in Appendix 5.

Table 31 Respondents' ratings of importance for the following features in an EPoS system n = 612

Feature	Percentage of respondents rating each option		
	Important	Importance not known	Not important
Training on the use of the system is given by the supplier	87	4	1
A telephone helpline is provided by the supplier	86	6	1
Software updates are provided regularly	85	6	1
The system incorporates a battery back up	84	6	2
The system is simple to use	84	8	1

In comparison with a dispensary computer system, an EPoS system is more complex and stores more data. It is thus not surprising that the table highlights the desire of respondents to receive adequate training in the use of EPoS systems. Respondents also wanted a reliable maintenance and backup service should anything go wrong with the system.

Table 32 shows respondents' ratings of the importance of a number of professional features which could be incorporated into an EPoS system.

Table 32 Respondents' ratings of importance for some professional features in an EPoS system n = 612

Feature	Percentage of respondents rating each option		
	Important	Importance not known	Not important
A link to the dispensary PMR system allows detection of OTC drug interactions	62	20	10
Sales of P medicines are automatically brought to the pharmacist's attention	72	12	13
Professional messages can be included on receipts	45	24	23
A bar code reader in the dispensary allows a second check on dispensed items	40	32	16

The professional feature which the highest percentage of respondents felt was important, was the ability of the system to alert a pharmacist to the sale of a Pharmacy only (P) medicine (a medicine that must be sold under the supervision of a pharmacist). This could be achieved if, when a P medicine was scanned prior to selling, an audible sound or a message on the dispensary computer screen was generated. The pharmacist would then be made aware of the sale. Such a method would ensure that the pharmacist was alerted without the direct involvement of the pharmacy assistant or customer.

Another potentially useful application of an EPoS system in the sale of medicines over the counter, is checking for drug interactions between such medicines and prescription medicines. This could again be achieved through scanning a product's bar code as that product is being sold. 62% of respondents felt that this would be an important feature in an EPoS system.

The use of a bar code reader in the dispensary to perform a second check on dispensed items did not receive much support from respondents. This may have been because not all medicines are yet bar coded, the potential of this idea may not be fully realised until there is more widespread use of original pack dispensing for prescription medicines.

8. 7 Summary

This study comprised a survey of community pharmacists which questioned them about their use of computers and Information Technology, in particular about their use of and attitudes towards Electronic Point of Sale (EPoS) systems.

Comparison of the results obtained in this survey with those obtained in surveys detailed in chapters 4 and 7 revealed the following trends:

1. A small increase in the number of pharmacies with computers, bringing that number to just under 100%.
2. No significant increase in the number of pharmacies with EPoS systems.
3. Significant increases in the numbers of pharmacies with modems, faxes and video machines.

4. Significant increases in the percentages of pharmacy computers used to generate labels, order stock, maintain patient medication records and check for drug interactions.

In chapter 4 the increasing use of IT by community pharmacists was discussed. The present study demonstrates further increases. It also indicates that pharmacy computer systems are increasingly being used for a wide range of applications in addition to labelling. Perhaps the most significant of these additional applications is the maintenance of patient medication records. This study indicates that over half of community pharmacists now maintain such records.

The number of respondents with EPoS systems was low and had not risen significantly over the previous 18 months. The most commonly cited factor for respondents not having investing in EPoS systems was their cost. The majority of the EPoS systems reported were used in large multiple (over 10 branches) pharmacies. In addition, respondents in large multiple pharmacies and in those pharmacies with a large non-dispensary (OTC) turnover, were more positive towards EPoS than respondents in small multiple and independent pharmacies, or in pharmacies with a large dispensary turnover. EPoS is more likely to be beneficial to large pharmacies with high OTC turnovers so it is not surprising that pharmacists in these settings were more positive about EPoS.

The results suggest, therefore, that although EPoS systems are claimed to have many benefits these have not been demonstrated adequately to convince the majority of pharmacists of their cost-effectiveness. However as prices fall and if benefits are demonstrated in practice and reported, this situation may change.

8. 8 Conclusions

Hypothesis 14: "The number of community pharmacists using electronic point of sale technology will be higher than the level indicated by the 1989 study described in chapter 4."

4% of respondents in the 1989 study described in chapter 4 reported using EPoS technology in their pharmacies, while in the present study that figure was 6%. However the difference between these two results is not significant. This suggests that there was not a significant rise in the number of community pharmacists using EPoS systems between 1989 and 1990.

Hypothesis 15: "The level of IT use and the number of pharmacy computers being used for functions in addition to labelling by community pharmacists will have increased since 1989."

The levels of modems, videos and fax machines reported in respondents' pharmacies in the present study were significantly higher than the corresponding levels reported in the 1989 study. In addition, the percentages of respondents' computers used for maintaining patient medication records, stock ordering and drug interaction monitoring in the present study were significantly higher than those in the 1989 study, although the percentage of respondents' computers being used for stock control was significantly lower. Again the two studies are not directly comparable because of the bias towards pharmacy manager respondents in large multiple pharmacies in the second study. Even so, the large rises in the numbers of faxes and videos and of respondents' computers being used for patient medication records and drug interaction monitoring, do suggest that the number of community pharmacists who are using their pharmacy computers for these functions are increasing.

On the basis of the results obtained in this study, therefore, we can conclude:

1. The number of respondents using EPoS technology has not risen since the 1989 study described in chapter 4.
2. The level of IT use and the number of pharmacy computers being used for functions in addition to labelling by community pharmacists increased between 1989 and 1990.

Chapter 9. GENERAL DISCUSSION

9. 1 Computerisation of prescription processing activities

PRESCRIPTION PROCESSING
Reading and interpreting the prescription
Labelling prescription containers
Maintaining prescription records
Checking for ADRs, drug interactions, contra-indications
Pricing, endorsing and collecting prescription fees
Assembling prescription items
Liaising with patients and prescribers about prescription queries

The prescription processing routine involves many activities that are repetitive and time consuming if undertaken manually. These activities are thus ideally suited to computerisation, and it is in the area of prescription processing that most applications of pharmacy computers have so far occurred. One result of computerising prescription processing is increased efficiency, tasks such as labelling, maintaining patient medication records and checking for drug interactions, can be completed in less time. This has created more time for pharmacists to perform tasks which they may not have done previously. For example maintaining patient medication records and checking those records for drug interactions with current medications. Computerising the prescription processing routine has thus increased community pharmacists' efficiency and has allowed them to take on extra activities.

9. 1. 1 Reading and interpreting the prescription

Before prescription medicines can be dispensed, the pharmacist must read and interpret the instructions given on the prescription. This is obviously a crucial element of the prescription processing routine.

The use of smart cards, on which prescribers' instructions are encoded in electronic form, could theoretically computerise the "reading and interpreting" stage of the prescription processing routine. Prescription details written onto a card could be read in the pharmacy by card readers which could also generate the appropriate labels. However, as discussed in section 9. 1. 3. 6, no working, cost-effective smart card system has yet been demonstrated and their potential usefulness has not, as yet, been fully realised.

9. 1. 2 Labelling

Labelling of dispensed medicines is a very important pharmacy activity and was the first to be computerised on a large scale by community pharmacists in the 1980s.

The results given in chapters 4, 7 and 8 indicate that computerised label production is now almost universal among community pharmacists. This rapid adoption of computerised labelling into the prescription processing routine occurred because:

1. Computerised labelling is quicker, easier and thus more convenient than alternative methods.
2. Good quality, easily legible labels are produced consistently.
3. It has been easy for community pharmacists to incorporate computerised labelling into existing dispensing routines.

In most pharmacies a substantial proportion of time is spent producing dispensed medicine labels. Computerisation of other prescription processing activities has thus developed around the labelling function. For example, pharmacy stock orders can be generated as a by-product of label production, as can medication details for addition to PMRs. The use, by community pharmacists, of pharmacy computer systems incorporating a program allowing access to on-line information, and a program to aid pharmacists in responding to symptoms, were investigated in chapters 5 and 6. The results of these investigations indicate that computerised activities which cause interruption to computerised labelling will not be favourably received by community pharmacists. Computerised label production will continue to remain a key factor as pharmacy computers develop and compatibility with the labelling process will be a necessary feature of any new pharmacy computer applications.

9. 1. 3 Patient medication records

9. 1. 3. 1 The rising use of patient medication records by community pharmacists

In the late 1980s a number of events raised community pharmacists' awareness of computerised PMRs and provided incentives for their adoption:

1. The introduction of a payment to community pharmacists for keeping PMRs for elderly and confused patients.
2. A fall in the price to computing power ratio of computer hardware.
3. Increased familiarity with computers by pharmacists.
4. The benefits reported by pharmacists already maintaining computerised PMRs.

The results presented in chapters 4, 7 and 8 indicate that between 1989 and 1990 there was a substantial increase in the number of community pharmacists maintaining computerised PMRs, from 23% to over 50%. In addition, chapter 4 indicates that the majority of community pharmacists had positive attitudes towards computerised PMRs, believing they would help them offer a better service to customers and provide a useful source of information to other health care professionals. The results also point to a willingness by pharmacists to update and improve their pharmacy computers. In view of these findings, it seems likely that the number of community pharmacists who adopt computerised PMR systems will increase further. Indeed a number of computer system suppliers now no longer produce computer labellers without patient medication records, pharmacists are thus going to find it increasingly difficult to buy new dedicated labellers.

9. 1. 3. 2 Advantages of computerised patient medication records

Many of the advantages of computerised PMRs stem from the fact that they provide the pharmacist with information about patients, such as previous medication details, drug sensitivities and doctor details. This information, which can be easily and quickly accessed during the labelling process, can help the pharmacist in checking on the suitability of the patient's current medication. The checking process is made more effective if the PMR system incorporates facilities for monitoring drug interactions, contra-indications, and unusual doses. A pharmacist must expend time and effort setting up a computerised PMR system, collecting and entering the necessary information. However, this is compensated for in the time saved due to increased efficiency in prescription checking, the reduction in queries that have to be made regarding omissions on prescriptions, and the increased speed of dispensing repeat prescriptions.

9. 1. 3. 3 Incomplete pharmacy held computerised patient medication records

The major drawback of pharmacy held PMRs is that there is no guarantee of their completeness. Although a recent study found that the majority of patients do regularly attend one pharmacy[155], many take their prescriptions to any number of different pharmacies for dispensing. In such cases checking a patient's records may fail to reveal drug interactions or provide missing prescription information.

This problem of incomplete records could be overcome in a number of ways:

by instituting a system of patient registration at pharmacies;

by using centrally held patient medication records;

or by using patient held medication records, such as smart cards.

The advantages and disadvantages of each of these solutions is discussed in the following sections.

9. 1. 3. 4 Patient registration

Asking patients to select only one pharmacy in which to have their prescriptions dispensed would ensure that patients' medication records were complete. In addition, details of OTC sales could be added to the records, allowing checks to be made on interactions between OTC and prescribed medicines. A system of patient registration would fit well into the dispensing process as it would involve very little change from the present routine. However, problems would arise in the allocation of patients to particular pharmacies, and in cases of people who need to use more than one pharmacy.

At present some pharmacists who maintain PMRs do encourage patients to patronise their particular pharmacy by explaining the importance of the patient medication records that are being kept. It is emphasised that the records need to be kept up to date, by recording details of all dispensed medicines, and that this will result in improved care and increased speed of dispensing. Some pharmacists give patients cards bearing the patient's name and registration number in an attempt to remind them to use that pharmacy. However it has not been conclusively proven that such techniques do result in patients using one pharmacy only.

9. 1. 3. 5 Patient medication records held on central computers

Another possible solution to the problem of incomplete pharmacy PMRs is the use of a centrally held, national database of all patient medication records, which pharmacists could access when necessary. By doing this, pharmacists would have access to complete patient medication records without the need for patients to register at a single pharmacy. Such centrally help PMRs have been used in Sweden.

If such a database were to be set up, an organisation would have to be created to maintain and manage it. Considerable investment in computers and connections hardware for participating pharmacists would be required. On a smaller scale, databases of patient records for patients attending branches of a large multiple pharmacy is a possibility. The same principles would apply except that only the pharmacies in the multiple group would be involved. Boots the Chemist Ltd. have plans to use their company wide pharmacy computer system for transferring PMRs between branches, it remains to be seen whether this scheme will go ahead and, if so, whether it is a success.

9. 1. 3. 6 Patient held medication records

As was demonstrated in the Rhydefelin trial and in the Exmouth Care card trial[53,57], patient held medication records in the form of smart cards can be used as a means of transferring patient data between pharmacists and other health care professionals. The cards can be electronically updated when medications are prescribed, dispensed or sold. This would ensure that all patient medication records were complete and up to date. In chapter 4, 60% of respondents said they would like to see the introduction of smart cards as a method of transferring patient data between health care professionals. In addition, the smart cards could act as "electronic prescriptions", prescription details being written onto the cards by prescribers and subsequently being read in the pharmacy where card readers could generate the labels appropriate to the current prescription.

There are however, a number of problems that would have to be overcome to enable widespread use of smart cards:

1. Patients would have to accept the cards - in chapter 4 less than half of the respondents felt that smart cards would be well accepted by their customers.
2. Health care professionals involved would have to accept the cards - in the Care Card trial, all the pharmacists involved found the label production software inadequate and did not use it. This illustrates how hardware and software problems could undermine the usefulness of a smart card system.
3. Large investments in computer equipment in all sectors of the health care team involved would have to be made.

Smart cards, therefore, are a potential solution to the problem of incomplete pharmacy held PMRs, they could also speed up the labelling process and bring benefits to other health care professions. However, until a working, cost-effective smart card system that brings about improvements in patient care and is accepted by patients and health care professionals can be demonstrated, it is unlikely that the required investment will be made at a national level.

9. 1. 4 Checking for adverse drug reactions, drug interactions, contra-indications and unusual dose instructions

In the prescribing process, the pharmacist is the final contact with the patient and plays a crucial role in checking the suitability of patients' medications. Traditionally pharmacists have checked whether the drugs on a patient's prescription interact with one another, and whether "over the counter" medicines purchased by that patient interact with any prescribed drugs. The ability to perform such checking processes is considerably enhanced if the pharmacist maintains computerised PMRs with an automatic drug interaction checking facility.

The results of chapters 4, 7 and 8 indicate that the number of community pharmacists with computer systems incorporating PMRs and drug interaction monitoring increased between Spring 1989 and Autumn 1990. All commercially available computerised PMR systems now incorporate a drug interaction detection facility. As shown in Table 33, some systems are also able to check for contra-indications (incompatibility of a drug and a patient's condition), drug sensitivities (such as allergic reactions to drugs) and unusual dosages.

Table 33 The facilities provided on some commercially available pharmacy computer systems in summer 1991

Function	SUPPLIER						
	JRC	AAH	Park Systems	Mawdsley Brooks	Hadley Hutt	SSS	Talk Data
PMRs	*	*	*	*	*	*	*
Stock ordering	*	*	*	*	*	*	*
Drug interaction monitoring	*	*	*	*	*	*	*
Contra-indication monitoring	*	*	*	*	*	*	
Drug sensitivity monitoring	*	*	*		*	*	
Dose checking					*	*	*
Access to further drug information		*	*	*			*
Patient information leaflets	*		*		*		
Updates sent at least monthly	*	*	*	*	*	*	*
Multi-user system				*			

* Indicates the facility is present
JRC = John Richardson computers Ltd.
SSS = Simple Software Solutions

These checking facilities have the potential to further increase the effectiveness of the pharmacist in preventing inappropriate prescribing. However if this is to happen it is essential that the information input into the computer (ie. drug interaction, contra-indication and dosage information) must be accurate, obtained from a reliable source and updated regularly, as was stated by the RPSGB in their guidelines on computer systems for use in community pharmacies[43]. At present there is little standardisation of the drug interaction data present on pharmacy computer systems, information is obtained from a variety of sources and the methods of classifying interactions according to their clinical significance differ between pharmacy computer systems. An American survey highlighted the differences in responses of pharmacists to drug interaction alerts according to the type of computer system they were using[63]. This indicates that it is important to have standards on drug interaction, contra-indication and dose checking information for all community pharmacists. Such standards should be set by an authoritative body such as the Royal Pharmaceutical Society. Pharmacists would then be consistent in their responses to drug interaction alerts. The information should also be updated regularly. Many pharmacy computer system suppliers now send monthly updates to their users and this should become standard practice.

9. 1. 5 Pricing, endorsing and collecting prescription fees

The processes of endorsing and pricing prescriptions are suited to computerisation as they are repetitive tasks that could be accomplished as a by-product of the present dispensing routine. A recently developed pharmacy computer system has included an endorsing facility[69]. This system uses two printers, one for label production, the other for prescription endorsing. It thus requires investment by users in a second printer, although this may prove worthwhile if substantial savings are made as a result of correct endorsing.

Pricing prescriptions by pharmacists, who then transmit the information electronically to the Prescription Pricing Authority (PPA), has been found to be less efficient than the present system where prescriptions are priced at the PPA[68]. More information is currently collected from prescriptions at the PPA than is entered into a pharmacy computer during the labelling process. For example doctor information is required by the PPA in order to compile Prescribing Analyses and Cost (PACT) reports. Thus if pharmacists were to become responsible for prescription pricing, extra time would be required to input any additional information needed. This would reduce pharmacists' dispensing speeds although it may result in faster payment.

The use of smart cards encoded with a patients' medication details as well as name and address, doctor's name and other administrative details, could overcome the problem of pharmacists having to enter extra information. The information would already be encoded on the card, and when read by a smart card reader could be transferred to the pharmacy computer for transmission to the PPA at a convenient time.

The collection of prescription fees is potentially computerisable. Again this could be facilitated by the introduction of smart cards or some other form of credit card for deducting prescription fees from a patient's bank or other account. Such a system could minimise fraud and reduce non-payment of fees.

9. 1. 6 Assembling prescription items

With the introduction of bar coding on medicines and the use of EPoS systems, a computerised aid to this process, which checks that the right product has been selected and automatically generates part of the prescription label, is a possibility. In chapter 8 it was found that less than half of the respondents felt that using a bar code reader to check on dispensed items would be an important feature in an EPoS system. Few respondents may have been in favour because not all dispensed medicines in a pharmacy are bar coded. Also EPoS is at present associated with management of the non-dispensary aspects of community pharmacy. If EPoS systems were to become more widely used among community pharmacists, and more medicinal products were bar coded, attitudes towards such a system may change.

9. 1. 7 Liaising with patients and prescribers about prescription queries

Liaising with patients and prescribers is one prescription processing activity that involves personal contact between people. Liaison between pharmacists and patients or prescribers usually involves communication of explanations, instructions or advice. As individuals differ, personal contact is required so that the pharmacist can judge how best to communicate the information to the patient or prescriber. If the two individuals are talking to one another any relevant questions can be asked by either party, leading to more effective communication.

Thus computers, although a useful tool in the provision of information pertinent to pharmacists' communications with patients and prescribers, cannot liaise with patients and prescribers as effectively as pharmacists.

9. 1. 8 Summary

Table 34 Computerisation of prescription processing activities

Activity	Conclusions		
	1	2	3
Reading and interpreting the prescription	*		
Labelling prescription containers		*	
Maintaining prescription records		*	
Checking for ADRs, drug interactions and contra-indications		*	
Pricing, endorsing and collecting prescription fees	*		
Assembling prescription items	*		
Liaising with patients and prescribers about prescription queries			*

* indicates the conclusion reached

1 = It is technically possible for computers to play a role in this activity, further work is required to investigate this.
2 = It is desirable that computers play a role in this activity.
3 = Computers do not have a role to play in this activity

9. 2 Patient care activities

PATIENT CARE
Advising patients on the administration or use of their medicines
Advising patients on minor ailments
Advising patients on general health matters
Giving help and advice in emergencies
Advising prescribers on drug therapy, economic prescribing and handling complex substances
Identifying unknown medication
Referring patients to other health professionals
Providing diagnostic testing services

One important part of the community pharmacist's patient care activities is the provision of advice. Advice is given to patients on the use and administration of their medications, the treatment of minor ailments and on general health matters. The use of computers to provide information to form the basis of such advice has been the theme of two investigations in this thesis. Advising patients on the administration and use of their medicines through computerised generation of information leaflets has been investigated as has a computerised aid to diagnosis. The on-line information source provided by the RPSGB, PINS, has also been investigated. PINS provided a wide range of information which could have been used to advise patients or prescribers.

9. 2. 1 Patient information leaflets

An investigation into the provision of computer generated, patient information leaflets by community pharmacists was described in chapter 7. The job satisfaction ratings and attitudes towards patient counselling of a group of pharmacists using the PILLS (Patient Records, Interactions, Labelling and Leaflets) pharmacy computer system were compared with those of a control group of pharmacists. No significant differences were found. In addition, no significant differences were found between the job satisfaction ratings of pharmacists using and not using patient medication records.

The results of the survey of PILLS users highlighted the advantages and disadvantages of computer generated patient information leaflets. Leaflets were reported to have increased prescription numbers in 24 out of 55 pharmacies and to have increased enquiries from patients in 46 out of 55 pharmacies. It thus appears that they increased patient loyalty in nearly half of respondents' pharmacies and that many patients required further clarification of the medication information they had been given in the leaflets. A number of pharmacists commented that their customers and local GPs liked the leaflets.

On the negative side, leaflets had decreased the speed of dispensing in 27 out of 55 pharmacies, probably because of the extra time required to print out the additional medication information. In addition, some respondents commented that leaflet production was expensive (5), side effect information was too detailed and had worried patients (4), and that their local GPs did not approve of the leaflets because of the side effect information (5).

The most controversial aspect of the leaflets appears to have been the detailed side effect information which they included. This gave rise to fears among some pharmacists and GPs that patients reading the leaflets would become worried and not comply with their treatment regimes. Although the majority of patients interviewed in chapter 7 had not been frightened by the side effect information, and many were glad to have been given it, 1 interviewee (out of 56) had discontinued treatment because of the possible side effects of the medicines involved. This suggests that although the majority of patients welcome and benefit from such leaflets, a small but significant number of patients who receive them will become non-compliant. In order to satisfy patients' desire for information about their medicines, but at the same time control widespread non-compliance, there is a need for a standard source of information to be used in such leaflets, which should be agreed upon by members of the different health care professions.

9. 2. 1. 1 Standardisation of patient information leaflets

There is an increasing body of opinion that says patients should be given full information about the drug treatments they are receiving. A European Commission directive states that, from 1992, all pharmaceutical products must include a patient information leaflet. However there is uncertainty as to what form this information will take and who will be responsible for it. Patient information leaflets have been produced by a number of different organisations such as university departments, hospitals, the BMA[156] and the American Society of Hospital Pharmacists[78]. The potential for problems to arise with standardisation of leaflet contents and liability for their accuracy clearly exists. The views of the ABPI, PSNC, RPSGB, NPA and the Consumer's Association were sought on this issue.

The ABPI expressed concern at the production of patient information leaflets by entrepreneurial pharmacists containing information in conflict with the data sheet and manufacturers' leaflets. They said that they were in favour of the provision of information to patients about their medicines but hoped that such leaflets would be produced by pharmaceutical companies, appropriately approved by the Medicines Control Agency, and introduced into original packs by the end of 1992.

The view of the PSNC was that authoritative sources such as the Data Sheet Compendium, the BNF, Martindale and manufacturers' information leaflets should be used in compiling patient information leaflets. The information contained in the leaflets should be accurate, it should also be brief and omit technical terms. The pharmacist would be liable for any information handed out and may not be able to pass this liability back to the compiler of the leaflets as it could be argued that the pharmacist should have known the information given in the leaflet and been able to pass a judgement as to whether or not it was accurate.

The RPSGB stated that pharmacists are responsible for any information they provide to patients and will assume liability for provision of such information. They felt that it would be the pharmacist's legal/professional responsibility to ensure that the information provided was obtained from reliable sources and was accurate. If a pharmacist had purchased a pre-programmed computer package which contained inaccurate information, he/she would still be responsible but may wish to take action against the company responsible for producing the package.

The Consumer's Association said that, as yet, they had no policy on patient information leaflets but were hoping to move into this area.

In the light of these authoritative comments and the results of chapter 7, it appears that there are two compelling reasons for using a standard and regularly updated information source for compiling pharmacy computer generated patient information leaflets.

1. The need to strike the right balance between insufficient information which will not satisfy patients, and too much side effect information which could result in non-compliance.
2. The fact that pharmacists who provide their patients with computer generated information are, at least partly, liable if that information is incorrect.

The provision of computer generated patient information leaflets such as those produced by the PILLS system, has been shown to be generally well accepted by pharmacists and patients. Such a system, using a standard and regularly updated information source, would be a desirable aid for pharmacists in providing their patients with information about their medications.

9. 2. 2 Provision of advice on minor ailments

The use of a computer program to aid pharmacists when responding to symptoms presented to them by members of the public (patient counselling) was investigated and reported in chapter 6. Pharmacists who took part found the experimental program investigated of little use because:

1. The labelling process had to be disrupted in order to operate it.
2. The pharmacy computer running the program was generally not situated in the area where patient counselling took place.
3. Use of the program prolonged the counselling process.

There is evidence to suggest that a computerised aid to diagnosis would be beneficial to many community pharmacists: 57% of respondents in chapter 4 thought a computer program to help with responding to symptoms would be a useful addition to their pharmacies, in addition, studies have shown that pharmacists' responses to symptoms are not always appropriate[91,92] and thus may benefit from a computerised aid. In the light of the results presented in chapter 6, however, it seems that the type of program investigated here would not be of practical use.

A pharmacist needs to make prompt, accurate decisions when responding to a patient's symptoms. Many judgements, such as age and general well being, can be made simply by looking at and listening to the patient, these would take time to enter into a computer using a question and answer system. A more useful system might involve the provision of diagnosis prompting information which a pharmacist could refer to if necessary, this would allow many diagnoses to be arrived at by the pharmacist alone, but would provide useful back up information in the case of less common symptoms. Of course, such information could also be stored in a text book but this would be bulky, would not contain a search facility and could not be easily updated.

Another type of computer system potentially useful to community pharmacists would be one for decision support. This could provide a reference framework of procedures on which to base decisions to refer patients to doctors. For example, a pharmacist and doctor might agree that patients who presented certain cough symptoms to the pharmacist should be referred to the doctor. Such decision support systems have already been developed, for example as guides for GPs, indicating when they should refer patients with high cholesterol levels to hospital[157].

For a decision support program or a program providing diagnosis prompting information to be of any use to a community pharmacist, it must be easily and quickly accessed from the labelling software of the pharmacy computer. If not, pharmacists are likely to be deterred from using it because of disruption to prescription processing. Alternatively, these programs could be run on hand held computers - this would overcome the problem of dispensing interruption and would also allow pharmacists to operate the programs in the patient counselling area.

9. 2. 2. 1 Continuing education

The use of the computerised aid to diagnosis investigated in this thesis as a continuing education tool has been mentioned. Such an application would not have the associated impracticalities encountered with its use as an aid to diagnosis. It could be used at the pharmacist's convenience when dispensing is not being carried out. It could also be used as a continuing education tool for other members of staff.

9. 2. 2. 2 Use of computers by members of the public in pharmacies

The same computerised aid to diagnosis, used by members of the public in a pharmacy, was also investigated. During a week and a half of observation, a small but steady number of people used the program, most out of curiosity. The majority of people who used the program found it user-friendly and easy to understand, suggesting that computers used in this way could provide pharmacy customers with a useful source of advice and information.

In order to increase the number of people using such a computerised module, some method of attracting the public to its presence and function would have to be used. One possible way in which to do this would be to have a message giving details of the service scrolling across the screen when it was not being used. This would encourage more people with specific problems to use the module, rather than those who were simply curious. Other types of information could also be provided on such an information source, like general health advice. This sort of information, being less specific, would appeal to a wider range of pharmacy customers and might prove popular with those waiting for prescriptions.

In Smith's survey of pharmacy customers who consulted pharmacists for advice[158], 23% had felt at some time that they did not want to trouble the pharmacist, while 45% had at some time felt there was insufficient privacy in the pharmacy to ask the questions they wanted. These findings support those presented in the chapter 6 study which suggest that a counselling program for pharmacy patients would have a valuable role to play in a pharmacy, particularly when people felt too embarrassed to discuss their problems with a pharmacist or when the pharmacist was busy. Surprisingly, therefore, we see that the majority of pharmacist respondents in chapter 4 had negative attitudes towards the provision of computerised information for the public in pharmacies. This suggests that the benefits of providing such information (both to patients and pharmacists) would have to be demonstrated before community pharmacists would be willing to adopt the idea.

In summary, the computerised aid to diagnosis investigated in chapter 6 was found to be ineffective when used by pharmacists. However it was more effective when used by patients as a source of information to access themselves. In this form it could be used as a source of information about minor ailments or about general health matters. Further work should be undertaken to quantify the effectiveness of such a computer application.

9. 2. 3 Provision of other advice and information

Computers can be used to provide pharmacists with reference material. This can be provided on a magnetic disc or can be obtained from a central database via an on-line connection. The information thus provided could be used to advise prescribers on drug therapy, economic prescribing and handling complex substances. It could also be used to provide advice to patients, and on procedures for emergencies and accidents. Such information has the potential to increase pharmacists' effectiveness and efficiency by providing up to date and accurate information more quickly and easily than via alternative channels. However, the usefulness of such information is greatly dependent on accuracy, if the information is not up to date or accurate, or cannot be obtained quickly and easily, such systems lose their value.

The use of the on-line information service for pharmacists, PINS, was investigated in chapter 5. It was found that those community pharmacist subscribers who took part in the study did not use PINS as much as they had expected. They found the service difficult to use and many of its options of little use.

Lack of user-friendliness and convenience, was the main stumbling block with PINS. Difficult and slow access to the service must have discouraged subscribers from using it to obtain information required immediately in the pharmacy, for example malaria prophylaxis information or CSM warnings. Such information could have been obtained quicker elsewhere. Not surprisingly, therefore, 56% of respondents said they used the service as a general interest source of information. Indeed, many of the 33% who used it when specific problems arose in the pharmacy would have done so to consult the Register of Pharmaceutical Chemists, a source of information not usually required for an acute problem in the pharmacy. It is likely that most subscribers used PINS as a source of information for browsing through during quiet periods of the day or when the shop was closed. Lack of user-friendliness would have discouraged these activities which were probably driven by the interest and enthusiasm of the subscribers.

The second important point about PINS is that the percentage of pharmacists who became subscribers always remained very low despite the positive attitudes of pharmacists towards electronic information sources as indicated in chapter 4. Two possible reasons for this exist:

1. Since PINS subscribers were not particularly happy with the service they received, recommendations are unlikely to have passed from them to other pharmacists by word of mouth.
2. There was a general lack of knowledge about PINS among pharmacists. Advertising in the pharmaceutical press did not fully clarify the service offered because of the wide range of options available and because of the variety of software which could be used to access the service. A more successful approach might have been to give pharmacists "hands on" experience of the software, for example at branch meetings and pharmacy computer software training courses.

Although PINS was discontinued at the end of 1990, investigation of the service has brought the following points to the fore which will be of use when any future on-line services for pharmacy are considered:

1. An on-line service for pharmacy should be user-friendly.
2. It should be quick and easy to access from the labelling program on the pharmacy computer.
3. Market research should be carried out to see what information pharmacists would find most useful on such a service.
4. Initially, the number of options on the service (different information subjects) should be limited.

9. 2. 3. 1 Provision of advice and information on disc

The feasibility of providing malaria prophylaxis information on a floppy disc was also investigated. Malaria prophylaxis treatments vary according to geographical location, they are also likely to change over time because of changes in the resistance of the causative organisms. Thus details of appropriate treatment regimes are regularly updated, and it is vital that pharmacists have access to the most up to date information.

It was found that incorporating malaria prophylaxis information into the monthly update disc sent to users of a commercially available pharmacy computer system would be possible. Such information could be accessed by simply pressing one key while in labelling mode. This would therefore overcome one of the main barriers to PINS use, namely the complex routine for accessing information which was incompatible with existing dispensary procedures.

The inclusion of malaria information only on the floppy disc would make it easier to advertise and promote than PINS, which covered many information subjects. Potential users would have a clear idea of what was being offered. Once pharmacists became familiar with this method of information provision further information subjects could be added.

The disadvantages of providing information on floppy disc would be that the information could only be updated by sending each pharmacist a new disc, that there would be limited space on the floppy disc and that there would be no facility for information exchange such as electronic mail. Further research should be done to test the usefulness of such an information source for community pharmacists.

9. 2. 4 Identification of unknown medicines and diagnostic testing

Two other areas of patient care in which computers may have a role to play are identifying unknown medication and diagnostic testing. As mentioned in chapter 2, computerised identification of unknown medication has been carried out in hospital. Suitable identification software should be able to be incorporated into community pharmacy computer systems. Analysis would be required to investigate the effect of such software on the effectiveness of community pharmacists' identification of unknown medication.

Computers have already been used by some community pharmacists to aid with the provision of diagnostic testing services, which include monitoring blood cholesterol levels and pulse rates. In addition to the computerised testing equipment available, results of blood cholesterol level measurements can be added to a patients' PMR. Pharmacists who keep such records of patients' physiological measurements will be better able to recall patients for follow up testing, and to monitor patients whom they have referred to GPs.

9. 2. 5 Referring patients to other health professionals

Computers have not been used for referring patients to other health care professionals. Such a process requires liaison with the other health care professionals involved and, as explained in section 9. 1. 7, if such liaison is to be effective, personal contact is necessary. Computers can provide useful information for pharmacists when referring them to other professionals (for example details of a patient's OTC medications), but the act of referral requires involvement of the pharmacist.

9. 2. 6 Giving help and advice in emergencies

Computers have not been used for giving help and advice in emergencies. Although computers may be useful in providing information pertinent to an emergency, such as advice on poisoning treatments, personal contact between the pharmacist and the persons involved is essential.

9. 2. 7 Summary

Table 35 Computerisation of patient care activities

Activity	Conclusions 1	2	3
Advising patients on the administration or use of their medicines		*	
Advising patients on minor ailments	*		
Advising patients on general health matters	*		
Giving help and advice in emergencies			*
Advising prescribers on drug therapy, economic prescribing and handling complex substances	*		
Identifying unknown medication	*		
Referring patients to other health professionals			*
Providing diagnostic testing services	*		

* indicates the conclusion reached
1 = It is technically possible for computers to play a role in this activity, further work is required to investigate this.
2 = It is desirable that computers play a role in this activity.
3 = Computers do not have a role to play in this activity

9. 3 Pharmacy management

PHARMACY MANAGEMENT
Staff management
Stock management
Budget control
Maintaining legal and ethical obligations
Supervising Pharmacy medicine sales
Providing staff guidelines on OTC sales

Computers are well suited to storing and manipulating large amounts of data such as payroll information, performance appraisals, accounts and invoices used in pharmacy management. Use of computers to manage such functions has the potential to increase the efficiency and effectiveness of community pharmacists as they speed up and ease manipulation of figures.

The information input into a pharmacy computer system during labelling can be used to facilitate dispensary stock control and ordering, eliminating the need for manual stock counting. Use of electronic point of sale extends this principle to the whole of the pharmacy shop. Information can be input into a computer as sales are made, this information can then be used to aid pharmacy stock management.

9. 3. 1 Staff management and the provision of guidelines on OTC sales

Computers can be used to store and manipulate information about staff, such as payroll data and performance appraisals, they can also be used as a staff training tool. As discussed in section 9. 2. 2. 1, a computerised aid to diagnosis was investigated in chapter 6 of this thesis. 3 out of 9 pharmacists who had the program installed in their pharmacies, said that they had used it as a means of educating pharmacy staff. This suggests that computer assisted learning (CAL), in which learning is accomplished through interactions between the computer program and the user, has the potential to be an effective means of training pharmacy staff.

Computers could be used to improve the efficiency and effectiveness of pharmacy staff when selling OTC medicines. A suitable program would include information on what questions to ask, when to refer to the pharmacist etc. This would be similar to the patient counselling module described in chapter 6 and to "Medihelp", the program described in section 2. 3. 2. 1. To be of practical use, such a computer would have to be situated within easy reach of the chemists counter or in a counselling area if one exists.

9. 3. 2 Stock ordering and stock control

Stock ordering was one of the first community pharmacy activities to be computerised, with the introduction by wholesalers of electronic order pads. Now stock ordering facilities are available as an integral part of most pharmacy computer systems. The results of chapters 4 and 8 indicate that the number of community pharmacists using their computers for stock ordering increased between 1989 and 1990 to just under 50%. It seems likely that this percentage will rise as more pharmacists convert from using electronic order pads to using their computer systems for stock ordering.

Dispensary stock control is a feature that has been available on pharmacy computer systems for some years. Stock control has the potential to reduce stock holdings and so increase profitability. However, as indicated in chapter 8, only around 25% of pharmacists use the facility, indeed among respondents from small multiple and independent pharmacies, there was a significant decrease in the numbers using their pharmacy computers for stock control between 1989 and 1990. Possible reasons for the low uptake rate of computerised stock control are:

1. Pharmacists using such a system need to enter re-order levels for each item of stock in the dispensary. These tell the computer when to order more of a particular item and how much to order. Once the re-order levels have been set, the pharmacists' stock ordering work is reduced, however a lot of work is involved in setting the re-order levels, and this may be a deterrent to pharmacists from using computerised stock control.

2. Pharmacists may feel they will lose control of their stock if they use computerised stock control.
3. Pharmacists may feel that the computer would be unable to deal with variations in stock requirements due, for example, to seasonal fluctuations.

It seems, therefore, that the benefits of computerised stock control will have to be demonstrated and communicated to community pharmacists before there is an increase in the adoption of such systems.

9. 3. 3 Electronic point of sale

Electronic point of sale, EPoS, is a process in which information about products being sold is collected at the point of sale. The data so collected provides the retailer with important business information such as what products are selling well, where sales are being lost due to inappropriate stock control etc. A number of EPoS systems specifically designed for community pharmacy have been developed over the last 5 years.

The results of chapters 4 and 8 indicate that the number of community pharmacists using EPoS is low, and that there was no significant rise in the proportion of respondents with EPoS systems from 1989 to 1990. The most common reason given by respondents for not having an EPoS system was cost. It thus seems that the majority of community pharmacists do not believe that an EPoS system would be cost effective in their pharmacies. Supporting this is the fact that, although around three quarters of respondents thought that an EPoS system would provide them with useful management information and improve stock control in their pharmacies, less than half thought an EPoS system would make their business more profitable.

The pharmacists most likely to have EPoS systems in chapter 8 were those in large multiple pharmacies (over 10 branches). Similarly pharmacists in large multiples and pharmacists in pharmacies with a large non-dispensary turnover were most likely to have positive attitudes towards EPoS. In small pharmacies where a large proportion of turnover comes from the dispensing of medicines and the sales of non-dispensary goods are relatively small, the knowledge of pharmacy staff may be sufficient for effective stock management. Small gains may be made if an EPoS system was installed but these would not offset the cost of the system. However, in large pharmacies where a significant proportion of turnover comes from the sales of non-dispensary goods, an EPoS system could increase profitability of those items thus improving the business of the whole shop, thus offsetting the price of the EPoS system.

In summary, EPoS systems were most commonly found in large multiple pharmacies with a substantial non-dispensary turnover. Similarly pharmacists in these pharmacies had the most positive attitudes towards EPoS. It appears that before a significant number of pharmacists in smaller, dispensing orientated pharmacies invest in EPoS systems, their cost-effectiveness for smaller pharmacies will have to be proven.

9. 3. 4 Maintaining legal and ethical obligations

At present community pharmacists are required to keep a number of records in handwritten form. These records include details of controlled drugs sold or supplied as well as the sale of Schedule 1 poisons. Keeping such records in computerised form could save pharmacists time, indeed in pharmacies where patient medication records are kept, computerised records of controlled drug supplies will already be made in addition to handwritten ones.

To be practical, the records would have to be easily accessed from the labelling program to ensure minimal disruption to prescription processing. In addition, there would have to be stringent requirements for copying data from the pharmacy computer onto floppy discs for storage (back-up), so that no records were lost. Indeed, introduction of a system of electronically recorded controlled drug and poison registers could have the effect of improving pharmacists' backing up practices.

9. 3. 5 Supervising sales of Pharmacy only medicines

Sales of Pharmacy only medicines should be made under the supervision of a pharmacist. In practice this means that counter staff have to alert the pharmacist when they sell these medicines. Pharmacists are usually alerted to such sales verbally, this may be embarrassing to the purchasing customer and may not adequately inform the pharmacist of what is being sold. EPoS systems have a potential role to play in improving this situation. The bar code on a Pharmacy medicine could be read (using suitable equipment) and this would transmit a warning signal and/or information about the product being sold, to the dispensary computer to be read by the pharmacist, thus increasing the efficiency of this process.

Successful operation of such a system would require pharmacists to read and take note of information coming up on the screen of the dispensary computer. In chapter 8 nearly three-quarters of respondents felt that it was important that an EPoS system could alert pharmacists to sales of pharmacy only medicines, suggesting that this feature would be well accepted by pharmacists if incorporated into EPoS systems.

9. 3. 6 Summary

Table 36 Computerisation of pharmacy management activities

Activity	Conclusions 1	2	3
Staff management		*	
Stock management		*	
Budget control		*	
Maintaining legal and ethical obligations	*		
Supervising Pharmacy medicine sales	*		
Providing staff guidelines on OTC sales	*		

* indicates the conclusion reached

1 = It is technically possible for computers to play a role in this activity, further work is required to investigate this.
2 = It is desirable that computers play a role in this activity.
3 = Computers do not have a role to play in this activity

9. 4 External activities

EXTERNAL ACTIVITIES
Provision of domiciliary services
Supervision of medicines in residential homes
Participation in continuing education programs for pharmacists and other health professionals
Providing pre-registration training

In the same way that computers can aid the pharmacist in providing pharmaceutical services to patients in the pharmacy, computers have the potential to help community pharmacists in external activities. In providing domiciliary services and services to residential homes, patient medication records and drug interaction monitoring would aid the pharmacist. Computers also have potential in the provision of continuing education material to community pharmacists.

9. 4. 1 Provision of domiciliary services

The NHS and Community Care Act of 1990 aims to encourage and support elderly people to remain in the community rather than moving to residential or nursing home accommodation. There is likely to be, therefore, an increase in the number of elderly people living in their own homes. Some of these will not be able to reach a pharmacy to collect medicines and so will require domiciliary visits from the pharmacist.

Although a pharmacist can use a pharmacy computer to check domiciliary patients' records and prepare their medicines, it would be useful for the pharmacist carrying out domiciliary visits to have a hand-held computer available on these visits. This could be used for providing information to help the pharmacist respond to symptoms, it could also be used to make notes about the patients' prescription and OTC medicines.

9. 4. 2 Supervision of medicines in residential homes

As mentioned in chapter 2, a working party set up by the Pharmaceutical Society in 1984 to consider the safe handling and administration of drugs in residential homes, recommended that pharmacists should visit such homes regularly, and that appropriate records should be maintained by pharmacists. It also encouraged the use of controlled dosage systems for the administration of drugs to residents.

Computers have a contribution to make in improving patient care in residential homes as they can be used to create and maintain medication administration records (MARs) and labels for monitored dosage units. MARs provide a record of each resident's medications, including the appropriate dose and time of administration. They thus simplify the task of administering a large number of drugs for the staff of the homes, they also allow efficient generation of repeat prescriptions, and can be used to check for inappropriate prescribing such as drug interactions.

9. 4. 3 Computer assisted learning

Computers have great potential in the provision of continuing education material to pharmacists and in providing pre-registration training. A number of computer based continuing education programs for pharmacists, have been produced[128,129,130,131] and this appears to be an effective means of providing interactive continuing education to pharmacists in their homes or pharmacies. Such programs can be used at the pharmacists' convenience and in the privacy and comfort of their homes or pharmacies. Progress is made at the pharmacist's own pace, and the program can be used as many times as required for complete understanding of the topic. They can also be used for training other members of staff including pre-registration graduates and dispensers. On the negative side, computer assisted learning techniques lack the opportunity for interaction and discussion with peers or lecturers, and some people may find them less stimulating than lectures.

As demonstrated in Chapter 6, pharmacists and a pre-registration student found the computerised aid to diagnosis a useful source of continuing education material. In addition, a 1989 survey indicated that over a third of community pharmacists would be likely to use pharmaceutical continuing education software[127]. It appears, therefore, that computer assisted learning would be acceptable to and used by many community pharmacists.

9. 4. 4 Summary

Table 37 Computerisation of external activites

Activity	Conclusions 1	2	3
Provision of domiciliary services	*		
Supervision of medicines in residential homes		*	
Participation in continuing education programs for pharmacists and other health professionals		*	
Providing pre-registration training	*		

* indicates the conclusion reached

1 = It is technically possible for computers to play a role in this activity, further work is required to investigate this.
2 = It is desirable that computers play a role in this activity.
3 = Computers do not have a role to play in this activity

9. 5 Discussion summary

Computerisation of the various activites carried out in community pharmacy has been discussed. A number of activites are well suited to computerisation and have been computerised by large numbers of pharmacists. These include labelling, maintenance of patient medication records, monitoring for drug interactions and stock ordering. Computerisation of these activities has fitted well into existing practices and has brought about obvious benefits to pharmacists.

Computers have the potential to aid pharmacists in providing advice to other health professionals and patients. Information stored on computers can be easily and quickly accessed by pharmacists. Such information can then be communicated to others, either directly via information leaflets or a computer screen, or through personal contact between the pharmacist and the individual involved. At present the potential of computers in providing pharmaceutical information has not been fully realised. Work is required to evaluate further the use of computers as sources of information for community pharmacists.

Computers are used in pharmacy management, in dispensary and shop stock managment, and for storing information relating to staff, budgets and other aspects of pharmacy business. Computers have the potential to increase the efficiency of pharmacy businesses, however many pharmacists have not computerised these activites because of the expense involved in doing so, and because the benefits have not been fully demonstrated. Further work is required to investigate the usefulness of computerisation in this area.

Pharmacists are likely to become increasingly involved in activities outside the pharmacy, such as domiciliary visiting and management of medications in residential homes. Computers could play a role in helping them to do this but much research and development needs to be done in this developing area. In addition, computers are potentially a very useful medium for providing pharmacists with continuing education material.

In summary, the use of computers in community pharmacy has benefitted pharmacists by increasing the efficiency and effectiveness with which they perform many activities, particularly repetitive tasks involved in prescription processing. Increased efficiency in computerised pharmacy activities should lead to a situation where pharmacists can devote more time to ativites which require personal contact with other individuals, and which are not suited to computerisation. Such activites include personal face to face patient counselling and liaising with other health professionals.

9. 5 Conclusions

1. There has been widespread adoption of computers among community pharmacists and these computers are being used to perform an increasing number of functions including labelling, maintaining patient medication records, drug interaction monitoring and stock ordering.

2. Computers have the potential to provide community pharmacists with much useful, up to date information. On-line information sources have not yet proved popular with community pharmacists because of their complexity and incompatibility with existing dispensary routines.

3. Computers may be beneficial in helping pharmacists respond to patients' symptoms, but not using a tree-structured question and answer style of program. Use of information databases or decision support systems may be of greater benefit. Computers as a source of information for patients have proved popular and could be a useful means of providing advice on minor ailments and general health care.

4. The provision of medicine information leaflets is popular with patients and may increase patient loyalty to a pharmacy that provides them. However, it may also result in a small number of patients becoming non-compliant with their medication. It is essential that such leaflets be compiled from reliable reference sources and updated regularly.

5. Electronic point of sale systems are at present used by a small number of community pharmacists, the majority of whom practise in large multiple pharmacies where the dispensary makes a small contribution to turnover. Use of EPoS is unlikely to become more widespread until it is demonstrated that such systems are cost effective in small multiple and independent community pharmacies.

7. Some pharmacy activities which require personal interaction between pharmacists and others, have not been effectively computerised. Such activities include: liaising with patients and prescribers; giving help and advice in emergencies; and referring patients to other health professionals. These activities therefore need to be carefully planned into undergraduate pharmacy courses to ensure complete coverage.

9. 6 Recommendations

The following recommendations for community pharmacy computer systems have been made based on the results presented in this thesis and on discussions held with pharmacy computer suppliers and community pharmacists throughout the period of this research. They should be read in conjunction with the "Guidelines on Pharmacy Computer Systems" as reprinted in Medicines, Ethics and Practice a Guide for Pharmacists[159].

General

1. Pharmacy computer system suppliers should provide adequate support for their users including: a help desk facility open at least between the hours of 9am and 6pm, six days a week; a maintenance team; and the provision for replacing faulty equipment.

2. Software used on pharmacy computer systems should be updated monthly by the supplier and the updates sent to users on floppy discs or via telephone connections.

3. Software incorporating clinical information such as drug interaction data, contra-indication data, dose information, and drug information for inclusion on patient leaflets should be compiled from reputable sources and updated every month. Ideally a body, such as the RPSGB in consultation with other health professionals, should edit and monitor the clinical information that should be incorporated into community pharmacists' systems.

Specific hardware

4. Pharmacy computer hardware should be multi-tasking so that activities other than labelling can be undertaken without disrupting the prescription processing routine.

5. Hardware should be multi-user so that more than one member of the pharmacy staff can use the computer at a particular time.

Labelling

6. All cautionary and advisory labels as given in the BNF should be automatically added.

7. There should be a facility to enlarge or reduce print size.

8. A facility for printing labels in foreign languages should be a future consideration.

Patient medication records

9. The following patient details should be recorded: full name; address; sex; date of birth; telephone number; name of GP; drug sensitivities; allergies; chronic conditions; medicines purchased; any other relevant notes. Prescriber details as in the Society's guidelines should be kept.

10. The pharmacist should be alerted visually and audibly to interactions, in addition a label detailing the interaction or contra-indication should be printed as a permanent record.

11. The interaction or contra-indication should be classified according to clinical significance.

12. Interactions and contra-indications involving over the counter medications should be included. The data could be added through an additional terminal in the shop or through bar code wanding using an EPoS system.

13. The pharmacist should be alerted visually and audibly to unusual doses, in addition a label detailing the usual dose should be printed. This feature should be included for preparations with a narrow therapeutic index and where serious problems could arise from over and under dosing.

14. Prescription data should be linked to stored patient data such as sensitivities, allergies and specific conditions which need careful monitoring.

15. It should be possible to change repeat labels prior to printing from a patient record.

16. It should be possible to produce records for a group of patients in a residential home in a format suitable for use with a controlled dosage system.

17. Bag and record card labels should be easily produced with varying amounts of information on them.

18. It should be possible to merge records, edit records, and import or export data when added to the wrong record.

19. It should be possible to quickly and easily download data, for example, using a tape streamer. A removable hard disc could be advantageous for security.

20. It should be possible and simple to archive data when hard discs are full, for consumer protection requirements.

21. Recording batch numbers should be possible thus taking into account liability considerations.

Endorsements

22. There should either be a method of guiding or carrying out endorsement of prescriptions in accordance with the Drug Tariff. Such a facility needs careful monitoring to include changes on a monthly basis. These changes should be sent to pharmacists on disc.

23. As a minimum, screen prompts should be provided to show the pharmacist which items have more than one charge/fee and which require special endorsements such as manufacturer's name.

Leaflet production

24. Standard medicine information leaflets should be automatically generated for patients receiving a new drug. The information should be accurate and acceptable. Again a respected editorial or monitoring body needs to ensure the information's integrity.

Ability to access information

25. A modem to access on-line information should be available.

26. Provision should be made to include other relevant information on the hard disc of the system eg. malaria prophylaxis information. Such information should be regularly updated for example from the NPA's information service. Other information that could be incorporated includes de-lousing agents. Regional Drug Information Centres need to be involved here.

Stock ordering

27. It should be possible to order stock from any wholesaler, and the order be automatically retrieved from the pharmacy computer by the wholesaler computer.

Stock control

28. It should be possible to carry out stock control using the system assuming regular reconcilliation exercises.

9. 6. 1 Recommendations for future research

1. The usefulness of an electronic source of malaria information, provided on pharmacists' monthly update floppy discs, should be investigated.

2. The usefulness of a free-standing computer to provide information on minor ailments and general health care advice to members of the public in community pharmacies should be investigated.

3. The effects of information leaflets on patient loyalty to a particular pharmacy should be investigated.

4. Cost effectiveness studies for EPoS systems in small and large community pharmacies should be carried out.

5. The usefulness of hand held computers to assist community pharmacists in responding to patients' symptoms, and when performing activities outside of the pharmacy, should be investigated.

REFERENCES

1. *Pharmacy - A report to the Nuffield Foundation.* London: The Nuffield Foundation, 1986.

2. Smith MC, Wilkinson WE, The Automation of Vendor Drug Claims. *Journal of the American Pharmaceutical Association* 1970; **NS10** (9): 501-5.

3. Fassett WE, Christiansen DB, *Computer applications in pharmacy.* Philadelphia: Lea and Febiger, 1986.

4. Kushner D, Feierman R, Rate of computerisation increases in retail and hospital pharmacies. *American Druggist* 1985; **191**: 100-106.

5. Anon, Community pharmacy sales grow at 9% in 1985, Neilson survey shows. *American Pharmacy* 1987; **NS27**: 110.

6. Anon, American Pharmaceutical Association: Report of the policy committee on professional affairs. *American Pharmacy* 1988; **NS28**: 55-57.

7. Lockwood WA, The new era of paperless claims. *American Pharmacy* 1990; **NS30**: 20-22.

8. Stevens RG, Crabbe AM, What future for the computer? *Pharmaceutical Journal* 1982; **228**: 209-210.

9. Nilsson L, Kristoferson K. *Computers at Swedish pharmacies and drug statistics.* In: Manell P, Johansson SG (eds). The impact of computer technology on Drug information. Amsterdam: North-Holland Publishing Company, 1982.

10. Sarv H, Organisational concepts of pharmacy automation. *Pharmacy International* 1984: **5**; 97-100.

11. Dagerus B, Johansson SG, Lindgren K, Manell P, Ostling B, *The Swedish Drug Information System, SWEDIS.* In: Manell P, Johansson PA (eds). The impact of computer technology on Drug information. Amsterdam: North-Holland Publishing Company, 1982.

12. Crabbe AM, Stevens RG, Lessons to be learnt from the Dutch. *Chemist and Druggist* 1981; **215**: 644-651.

13. Gunner C, Patient retained records. The smartcard. *Proceedings of the Primary Health Care Specialist Group of the British Computer Society* Sept. 1988, 45-47.

14. Anon, Pharmacists' data system. *Clinica* 1988; **169**: 6.

15. Anon, 10 per cent computerised in two years - forecast. *Australian Journal of Pharmacy* 1981; **62**: 640.

16. Anon, 40 per cent of pharmacists assessing computers. *Australian Journal of Pharmacy* 1981; **62**: 643.

17. Anon, Survey shows 60 per cent penetration by computers; Amfac-Chemdata leader. *Australian Journal of Pharmacy* 1987; **68**: 148.

18. Anon, "More professional" pharmacy management using computers "key to survival". *Australian Journal of Pharmacy* 1989; **70**: 450.

19. Anon, 2½ cents extra for NHS claims via computer. *Australian Journal of Pharmacy* 1987; **68**: 457.

20. Anon, POS systems can increase pharmacy stock turnover many times. *Australian Journal of Pharmacy* 1989; **70**: 456.

21. Personal communication, Lockie H, Research Manager, Lockie Computing, New Zealand 1989.

22. Gardiner NH, Gardiner RH, Powell EJ, Dudley RD, Ferguson DP, Use of an automatic typewriter in general practice pharmacy. *Pharmaceutical Journal* 1978; **220**: 102-104.

23. Anon, Stock control system. *Pharmaceutical Journal* 1978: **221**; 63-64.

24. Anon, Vestric's new "data capture unit". *Pharmaceutical Journal* 1980; **224**: 169.

25. Anon, Computer technology in pharmacy practice. *Pharmaceutical Journal* 1979; **223**: 226-227.

26. Anon, Unichem launches dispensing label printer. *Pharmaceutical Journal* 1981; **226**: 228.

27. Stevens RG and Crabbe AM, Evaluation of a computerised dispensary management system. *Pharmaceutical Journal* 1984; **232**: 783-6.

28. Anon, Vestric link up as level 2 launched at last. *Chemist and Druggist* 1983; **219**: 374.

29. Anon, Link Scripts puts level 3 on-line. *Chemist and Druggist* 1984; **221**: 635.

30. Dawson RG, Denkinson G, Clarkson J, An adaptable prescription labelling program. *Pharmaceutical Journal* 1982; **229**: 618.

31. Anon, Date set for machine printing of labels of dispensed medicines.
Pharmaceutical Journal 1982; **229**: 545-6.

32. Special supplement.
Pharmaceutical Journal 1985; **234**: 306-317.

33. Anon, Additional labelling to be mandatory.
Pharmaceutical Journal 1986; **237**: 306.

34. Anon, Chemex preview for Richardson system.
Pharmaceutical Journal 1985; **235**: 353.

35. Anon, System for direct order launched.
Pharmaceutical Journal 1986; **237**: 173.

36. *Promoting Better Health. The government's programme for improving primary health care.*
London: HMSO; CM249 1987.

37. Dunn WR, Hamilton DD, Determining the continuing education priorities for pharmacists.
Pharmaceutical Journal 1988; **237**: 225-228.

38. *Primary health care: An agenda for discussion.*
London: HMSO; CM 9771 1986.

39. Shulman JI, Shulman S, Haines AP, The prevention of adverse drug reactions - a potential role for pharmacists in the primary care team?
Journal of the Royal College of General Practitioners 1981; **31**: 429-434.

40. Hughes RI, Computers in the pharmacy: a question of priorities.
Pharmaceutical Journal 1980; **224**: 154-155.

41. Anon, Report of the working party on computers in pharmacy.
Pharmaceutical Journal 1983; **231**: 15-16.

42. Anon, Society backs patient records.
Chemist and Druggist 1984; **221**: 107.

43. Anon, Guidelines on pharmacy computer systems.
Pharmaceutical Journal 1989; **242**: 348-349.

44. *Data Protection Act 1984*
Her Majesty's Stationery Office, London

45. Davidson AW, Data Protection Act: (2) The profession.
Pharmaceutical Journal 1987; **239**: 630-631.

46. Anon. Computer held medication records.
Pharmaceutical Journal 1988; **241**: 187.

47. Anon. Boots to link all pharmacies by computer. *Pharmaceutical Journal* 1989; **242**: 729

48. Bright R. *Smart cards: Principles, practice, applications.* Chichester: Ellis Horwood, 1988.

49. Baig SS, Coordinated action in the field of Patient Data Cards. *Smart Card Monthly* 1990; April: 8-10.

50. Markwell D, Patient held medication records in Europe. *Proceedings of the Primary Health Care Specialist Group of the British Computer Society* Sept. 1990, Cambridge 103-109.

51. Bouldin EW, Callen R, The optical memory card: a portable medical record. *Smart Card Monthly* 1990; April: 26-29.

52. Benson T, Health Cards - The move towards standards. *Smart card monthly* 1990; April: 11-13.

53. Stevens RG, Crabbe AM, "Credit card" medication records. *Pharmaceutical Journal* 1987; **239**: 724-729.

54. Anon, Smart cards. *Practice computing* 1989; February: 4.

55. Stevens RG, Crabbe AM, The Rhydefelin computer card medication record trial - impressions after three years. *Pharmaceutical Journal* 1991; **246**: 27-30.

56. Seidman S, West London Maternity LaserCard Update. *Smart Card Monthly* 1990; April: 30-31.

57. *The Care Card. Evaluation of the Exmouth project.* London: HMSO, 1990.

58. Stevens RG, Pharmacy aspects of the Exmouth Care Card trial. *Pharmaceutical Journal* 1991; **246**: 359-361.

59. Borda I, Slone D, Jick H. Assessment of Adverse Reactions within a drug surveillance program. *Journal of the American Medical Association*, 1968, **205**, 645-7

60. Cartwright A, Smith C. *Elderly people, their medicines and their doctors.* Tavistock, England: Routledge, 1988.

61. Stevens RG, Crabbe AM, Computers in community pharmacy. *Pharmaceutical Journal* 1986; **237**: 267-268.

62. Stevens RG, Crabbe AM, Patient medication records - evaluation of a drug interaction routine and potential for time saving. *International Journal of Pharmacy Practice* 1991; **1**: 41-43.

62. Stevens RG, Crabbe AM, Patient medication records - evaluation of a drug interaction routine and potential for time saving.
International Journal of Pharmacy Practice 1991; 1: 41-43.

63. Kirking D, Thomas JW, Ascione F, Boyd E. Detecting and Preventing Adverse Drug Interactions: The Potential Contribution of Computers in Pharmacy.
Social Science and Medicine. 1986, **22** (1), 1-8.

64. World Health Organisation. International drug monitoring: The role of the hospital.
Technical Report Series 1969; **425**: 5.

65. Aurthur Anderson and Company *A study of Family Practitioner Services Administration and the use of computers*.
London: DHSS, 1984.

66. Anon, PPA links successful.
British Journal of Health Care Computing 1987; **4**: 3.

67. Anon, PPA computer link plan shelved.
Pharmaceutical Journal. 1989; **242**: 35.

68. Personal communication, Kennedy E, Computer development manager Prescription Pricing Authority 1990.

69. Anon, Automated script endorsement introduced by Medicopharma.
Pharmaceutical Journal. 1991; **247**: 367.

70. Carr A, Compliance with medical advice.
British Journal of General Practice 1990; **40**: 358-360.

71. Kitching JB, Patient information leaflets - the state of the art.
Journal of the Royal Society of Medicine 1990; **83**: 298-300.

72. McMahon T, Clark CM, Bailie GR, Who provides patients with drug information?
British Medical Journal 1987; **294**: 355-356.

73. Ridout S, Waters WE, George CF, Knowledge of and attitudes to medicines in the Southampton community.
British Journal of Clinical Pharmacology 1986; **21**: 701-712.

74. Busson M, Dunn APM, Patients' knowledge about prescribed medicines.
Pharmaceutical Journal 1986; **236**: 624-626.

75. Sandler DA, Mitchell JRA, Fellows A, Garner ST, Is an information booklet for patients leaving hospital helpful and useful?
British Medical Journal 1989; **298**: 870-874.

76. Regner MJ, Hermann F, Ried LD, Effectiveness of a printed leaflet for enabling patients to use digoxin side-effect information.
Drug Intelligence and Clinical Pharmacy 1987; 21: 200-204.

77. Dodds LJ, Effects of information leaflets on compliance with antibiotic therapy.
Pharmaceutical Journal 1986; **236**: 48-50.

78. Johnson MW, Mitch WE, Sherwood J, Lopes L, Schmidt A, Hartley H, The impact of a drug information sheet on the understanding and attitude of patients about drugs.
Journal of the American Medical Association 1986; **256**: 2722-2724.

79. George CF, Waters WE, Nicholas JA, Prescription information leaflets: a pilot study in general practice.
British Medical Journal 1983; **287**: 1193-1196.

80. Gibbs S, Waters SE, George CF, Prescription information leaflets: a national study.
Journal of the Royal Society of Medicine 1990; **83**: 292-297.

81. Winfield AJ, Owen CW, Information leaflets: a means of improving patient compliance.
British Journal of Pharmaceutical Practice 1990; 12: 206-209.

82. Weinman J, Providing written information for patients: psychological considerations.
Journal of the Royal Society of Medicine 1990; **83**: 303-305.

83. Anon, Leeds pharmacists develop medicine information chart.
Pharmaceutical Journal. 1988; **240**: 252.

84. Kobrin L, ASHP monographs impress retail customers.
ComputerTalk for the Pharmacist 1987; May/June: 12-13.

85. Wells FO (ed). *Medicines good practice guidelines.*
Belfast: The Queen's University, 1990.

86. *The Medicines Act 1968*
Her Majesty's Stationery Office, London

87. *Consumer Protection Act 1987*
Her Majesty's Stationery Office, London

88. Personal communication, Law Department, Royal Pharmaceutical Society of Great Britain, 1991.

89. Morley A, *A study of the role of the community pharmacist in responding to symptoms.*
PhD thesis, Aston University, 1988.

90. Anon, Growing faith in pharmacists?
Chemist and Druggist 1990; **234**: 106.

91. Mobey N, Wood A, Edwards C, Jepson MH, An assessment of the response to symptoms in community pharmacies.
Pharmaceutical Journal 1986; **237**: 807.

92. Goodburn E, Mattosinho S, Mongi P, Waterston T, Management of childhood diarrhoea by pharmacists and parents: Is Britain lagging behind the Third World?
British Medical Journal 1991; **302**: 440-443..

93. Balon ADJ, Response to symptoms.
Pharmaceutical Journal 1985; **234**: 532-536.

94. Duda RO, Shortliffe EH, Expert systems research.
Science 1983; **220**: 261-267.

95. McSherry D, Fullerton K, Preceptor: a shell for medical expert systems and its application in a study of prognostic indices in stroke.
Expert Systems 1985; **2**: 140-147.

96. Buchanan BG, Expert systems: working systems and the research literature.
Expert systems 1986; **3**: 32-51.

97. Sutton GC, How accurate is computer-aided diagnosis?
The Lancet 1989; **2**: 905-908.

98. Uplekar MW, Antia NH, Dhumale PS, Sympmed I: computer program for primary health.
British Medical Journal 1988; **297**: 841-843.

99. Anon, Computer program aids counter prescribing.
Pharmaceutical Journal 1986; **236**: 263.

100. King RM, Now - the use of computers in patient counselling.
IPU Review 1986; October: 293-295.

101. Balon ADJ, Responding to symptoms: A computer program to help structure the patient interview.
Pharmaceutical Journal 1989; **243**: R1-R4.

102. Saul PD, Accessing remote data bases using microcomputers.
Journal of the Royal College of General Practitioners 1985; **35**: 384-386.

103. Hughes RI, Interfacing the patient, prescriber, pharmacy and the drug.
Proceedings of the Primary Health Care Specialist Group of the British Computer Society September 1988, sponsored by Glaxo Laboratories: 43-44.

104. Anon, Pharmacy Information and News Service.
Pharmaceutical Journal 1986; **237**: 291-292.

105. Anon, Pharmacy Information and News Service: An update.
Pharmaceutical Journal 1987; **238**: 315.

106. Anon, Free software for branches and regions.
Pharmaceutical Journal 1987; **238**: 46.

107. Personal communication, Shenton D, PINS manager 1990.

108. Henson RH, (letter)
Pharmaceutical Journal 1990; **244**: 713.

109. Denholm A, (letter)
Pharmaceutical Journal 1990; **245**: 141.

110. Anon, Monthly meeting of council.
Pharmaceutical Journal 1990; **245**: 188.

111. Personal communication, Anderson D. Principal Pharmacist, Lothian drug information service, 1990.

112. Phillips PJ, (letter)
Pharmaceutical Journal 1990; **245**: 231.

113. Anon, Computer system for easy identification.
Pharmaceutical Journal 1987; **238**: 590.

114. Anon, Pharmacist brings microprocessors into the dispensary.
Pharmaceutical Journal 1979; **223**: 209.

115. Paine A. EPoS 84: a group gets it together.
Chemist and Druggist 1984; **222**: 519-522.

116. King R, EPoS 84: The dos and don'ts.
Chemist and Druggist 1984; **222**: 518-519.

117. Bigger C, EPoS 84: Boots go scanning.
Chemist and Druggist 1984; **222**: 522.

118. Anon. Use of EPoS systems in retailing and the dispensary.
Pharmaceutical Journal **244**: 776-7.

119. Anon, New system for over-the-counter sales.
Pharmaceutical Journal 1981; **227**: 64.

120. Anon, Graham Tatford takes computers to the pharmacy counter.
Pharmaceutical Journal 1985; **235**: 662.

121. Anon, POS and stock control system.
Pharmaceutical Journal 1987; **238**: 574.

122. Anon, Liverpool pharmacist's EPoS system.
Chemist and Druggist 1988; **230**: 940.

123. Anon, New EPoS system.
Pharmaceutical Journal 1990 **245**: 368.

126. McKay AB, Jackson RA, Smith MC, Sharpe T, Gardner DD, The provision of management CAI through commercially available pharmacy computer systems.
American Journal of Pharmaceutical Education 1984; **48**: 11-18.

127. Rowe P, Mottram D, Computer-assisted learning for community pharmacists,
Pharmaceutical Journal 1989; **243**: 142-5.

128. Mottram D, Rowe P, Enpharm - a learning package.
Pharmaceutical Journal 1991; **246**: 523.

129. Anon, Law CAL program now available.
Pharmaceutical Journal 1991; **246**: 697.

130. Daly JE, Nicholls DK, Brain KR, Grassby PF, Temple DJ, A novel approach to computer-assisted learning for pharmacists.
Pharmaceutical Journal 1990; **245**: E1-E3.

131. Nicholls D, Temple DJ, Preliminary assessment of the acceptability of a computer assisted learning scheme for community pharmacists.
British Pharmaceutical Conference 1991, Pharmacy Practice Research posters P36. Royal Pharmaceutical Society of Great Britain 1991.

132. Anon, Controlled dosage systems for residential homes.
Pharmaceutical Journal 1990; **244**: 385-386.

133. Anon, Region backs Sharp portables.
British Journal of Healthcare Computing 1988; **5** (7): 9.
British Journal of Healthcare Computing May 87 Sept 88

134. Beck RJ, Ellis LBM, Scott DM, Raines JR, Hakanson N, Microcomputer as patient educator.
American Journal of Hospital Pharmacy 1982; **39**: 2105-2108.

135. Morgan RM, Carswell C, Moore H, Markham A, Computer assisted learning in a community pharmacy.
Pharmaceutical Journal 1986; **236**: 112.

136. Daly MJ, Jones S, Preliminary assessment of a computerised counselling program for asthmatic children.
Pharmaceutical Journal 1991; **247**: 206-208.

137. Diamond G, Using IT in community pharmacy.
Pharmaceutical Journal 1991; **246**: 223.

138. Anon, Administration and control of medicines in residential homes.
Pharmaceutical Journal 1986; **236**: 631-635.

139. Harding G, Nettleton S, Taylor K, *Sociology for pharmacists an introduction.*
London: Macmillan, 1990.

140. Moser CA, Kalton G. *Survey methods in social investigation.*
London: Heinemann Educational Books, 1979.

141. Goode WJ, Hatt PK. *Methods in Social Research.*
Tokyo: McGraw-Hill, 1952.

142. Hoinville G, Jowell R. *Survey Practice Research.*
London: Heinemann Educational Books, 1978.

143. *SPSS. Data entry II.*
Chicago: SPSS Inc., 1988.

144. *SPSS Inc. Statistical Package for social sciences.*
Chicago: SPSS Inc., 1988.

145. Anon, Computer capability.
Chemist and Druggist 1988; **236**: 589.

146. *The Annual Register of Pharmaceutical Chemists.*
London: The Pharmaceutical Society of Great Britain, 1988.

147. Fisher RA, Yates F, *Statistical tables for biological, agricultural and medical research.*
London: Oliver and Boyd, 1957.

148 *United States Pharmacopeia Drug Information.*
Rockville: The United States Pharmacopeial Convention, 1986.

149. Mumford E, Job satisfaction: method of analysis.
Personnel Review 1972; **1** (3): 48-57.

150. Kirking DM, Evaluation of an explanatory model of pharmacists' patient counselling activities.
Journal of Social and Administrative Pharmacy 1984; **2** (2): 50-56.

151. Johnson RE, Ried LD, Robertson N, Pharmacy computerisation and job satisfaction of outpatient pharmacists.
Journal of Social and Administrative Pharmacy 1990; **7** (2): 61-68.

152. Di Ponio SM, *The computerisation of primary health care.*
PhD thesis, Aston University, 1991.

153. Seltzer SM, Electronic point of sale comes of age.
American Druggist 1986; **192** (2): 71, 74.

154. Anon, Payments for domiciliary services and PMRs agreed in England. *Pharm J.* 1989; **243**: 157.

155. Jepson MH, Jesson J, Kendall HK, Pocock R, *Consumer expectations of community pharmacy services - A research report for the Department of Health.*
Aston University, 1991

156. Henry J (ed), *The British Medical Association Guide to Medicines and Drugs.*
London: Dorling Kindersley, 1988.

157. *A general system for clinical decision support.* Information sheet, Wolfson Research Laboratories, Queen Elizabeth Medical Centre, Birmingham, 1991.

158. Smith FJ, Factors important to clients when seeking the advice of a pharmacist.
Pharmaceutical Journal 1990; **244**: 692-693.

159. *Medicines, Ethics and Practice. A guide for pharmacists.*
London: Royal Pharmaceutical Society of Great Britain, October 1991.

APPENDIX 1 Comparison of the advantages and disadvantages of mail surveys and interview surveys

Mail survey	**Interview survey**
Cost generally lower	Cost generally higher
Survey population can be widely dispersed	Impractical if survey population widely dispersed
Questionnaires can be completed when convenient for respondent	Questionnaires must be completed at the time of the interview
Respondents are able to consult documents, other people etc. but the researcher has no control over this	Respondents not usually able to to consult documents people etc.,
Researcher cannot be certain of the respondent's identity	Researcher can be reasonably certain of the respondent's identity
No interviewer bias	Possibility of interviewer bias
Respondent less likely to be embarrassed by sensitive questions	Respondent more likely to be embarrassed by sensitive questions
No control over the date on which survey completed	Date on which survey completed can be controlled
Probing questions not possible	Probing questions possible
Complex questions not possible	Complex questions possible

APPENDIX 2 Statistical tests used in the thesis

Chi-squared tests

The chi-squared test is a non-parametric statistical test used to investigate the null hypothesis, H_0, that there is no significant difference between groups when the data consists of frequencies in discrete groups. For example, it can be used to test whether there is a significant difference between the proportions of two groups of respondents agreeing and disagreeing with a particular statement.

The test compares the observed frequencies in each category with the frequencies that would be expected if there was no difference between the two groups.

Each chi-squared value has an associated probability of occurrence if the null hypothesis is true. If the probability of occurrence is less than or equal to the level of significance, the null hypothesis is rejected. The chi-squared tests described here use the significance level of 99%.

One of the requirements of the chi-squared test is the expected frequencies in each category are not too small (none less than 1 and not more than 20% less than 5). In the analyses performed during the research, it was sometimes necessary to combine categories to comply with this requirement. For example, when levels of agreement with a particular statement were being analysed the "disagree" and "strongly disagree" sometimes had to be combined.

APPENDIX 2. 1 Chi-squared tests used in chapter 4

1. Chi-squared test to investigate the relationship between respondents' satisfaction with their pharmacy computers and the date of installation of those computers.

H_0: There are no significant differences in respondents' satisfaction with their pharmacy computer systems depending on the date of installation of those computers.

Crosstabulation showing observed and expected values (in brackets) 1 = very satisfied, 2 = satisfied, 3 = indifferent, 4 = unsatisfied, 5 = very unsatisfied

	1	2	3	4	5
'89	56 (33)	71 (78)	9 (18)	3 (9)	0 (1)
'88	93 (67)	162 (158)	22 (37)	2 (18)	2 (2)
'87	45 (50)	125 (118)	26 (13)	12 (13)	2 (2)
'86	30 (39)	95 (92)	25 (21)	12 (10)	2 (1)
pre '86	60 (96)	220 (227)	74 (53)	46 (25)	4 (3)

Chi-squared = 106, df = 16, p<0.001, therefore H_0 is rejected

2. Chi-squared tests to investigate the relationship between respondents' attitudes towards PMRs andtheir use of PMRs

H_0: There is no significant difference in attitudes towards PMRs between those respondents that use them and those respondents that do not.

Crosstabulation showing observed and expected values (in brackets). Group 1 have PMRs, group 2 do not

		1	2
a) keeping patient records would allow me to offer a better service to my prescription customers	**strongly agree**	164(86)	187 (265)
	agree	121(162)	538 (497)
	indifferent	12(30)	109 (91)
	disagree	3(22)	85 (66)

Chi-squared = 142, df = 3, p<0.001, therefore H_0 is rejected

		1	2
b) PMRs held in my pharmacy would be a useful source of information for other health professionals such as GPs, hospitals and the emergency services	**strongly agree**	113(61)	132 (185)
	agree	137(152)	480 (465)
	indifferent	39(53)	175 (161)
	disagree	12(35)	131 (108)

Chi-squared = 88, df = 3, p<0.001, therefore H_0 is rejected

c) PMRs are of little interest to me because of the time involved in creating and maintaining them	**strongly agree**	2(9)	35 (28)
	agree	10(28)	101 (84)
	indifferent	10(39)	149 (120)
	disagree	277(223)	624 (678)

Chi-squared = 69, df = 3, $p<0.001$, therefore H_0 is rejected

d) PMRs are only of use in pharmacies with a large number of regular prescription customers	**strongly agree**	9(21)	77 (65)
	agree	86(120)	401 (367)
	indifferent	29(33)	104 (386)
	disagree	177(127)	335 (386)

Chi-squared = 50, df = 3, $p<0.001$, therefore H_0 is rejected

APPENDIX 2. 2 Chi-squared tests used in chapter 5

1. Chi-squared test to investigate the relationship between respondents' agreement with the statement "My use of PINS is limited because it interrupts labelling in the dispensary" and the frequency of PINS use by those respondents.

H_0: There is no significant difference between the frequency of PINS use among respondents who agreed and disagreed that their use of PINS was limited by interruptions to dispensing.

Crosstabulation showing observed and expected values (in brackets)

	Agree	Disagree
Once	26 (26)	9 (9)
< Once	63 (61)	19 (22)
> Once	12 (15)	8 (5)

Chi-squared = 2. 88, df = 2, $0.2 < p < 0.3$, therefore H_0 is accepted

2. Chi-squared test to investigate the relationship between respondents' agreement with the statement "In general, I only use PINS for consulting the Register of Pharmaceutical Chemists" and the frequency of PINS use by those respondents.

H_0: There is no significant difference between the frequency of PINS use among respondents who agreed and disagreed that they generally only used PINS to consult the Register of Pharmaceutical Chemists.

Crosstabulation showing observed and expected values (in brackets)

	Agree	Disagree
Once	5 (10)	29 (25)
< Once	31 (22)	48 (57)
> Once	1 (6)	19 14)

Chi-squared = 16.0, df = 2, $p < 0.001$, therefore H_0 is rejected

3. Chi-squared test to investigate the relationship between respondents' agreement with the statement "I do not think PINS is user friendly" and the frequency of PINS use by those respondents.

H_0: There is no significant difference between the frequency of PINS use among respondents who agreed and disagreed that PINS was not user friendly.

Crosstabulation showing observed and expected values (in brackets)

	Agree	Disagree
Once	20 (23)	14 (11)
< Once	69 (59)	17 (27)
> Once	6 (13)	13 (6)

Chi-squared = 18.5, df = 2, $p < 0.001$, therefore H_0 is rejected

APPENDIX 2. 3 Statistical test used in chapter 7

1. Chi-squared test to investigate the relationship between respondents' job satisfaction and the presence of a PILLS pharmacy computer system.

H_0: There is no significant difference between the job satisfaction of respondents with and without PILLS systems.

Crosstabulation showing observed and expected values (in brackets)

	PILLS	non PILLS
Very unsatisfied	34 (36)	110 (109)
Satisfied	130 (118)	350 (362)
Unsure	135 (133)	409 (411)
Satisfied	334 (350)	1095 (1079)
Very satisfied	90 (90)	278 (278)

Chi-squared = 6.78; df = 5, 0.3>p>0.2, therefore H_0 is accepted

2. Chi-squared tests to investigate the relationship between respondents' attitudes towards patient counselling and the presence of a PILLS pharmacy computer system.

H_0: There is no significant difference in attitudes towards patient counselling between those respondents that use PILLS and those respondents that do not.

Crosstabulation showing observed and expected values (in brackets).

Patient counselling:

	Response	PILLS	Non PILLS
a) requires more time	**Unlikely**	3 (4)	12 (11)
	Uncertain	1 (3)	11 (9)
	Likely	69 (66)	199 (202)

Chi-squared = 1.30, df = 2, 0.7>p>0.5, therefore H_0 is accepted

b) increases the accuracy of patients' drug taking	**Unlikely**	0 (2)	8 (6)
	Uncertain	4 (6)	20 (18)
	Likely	69 (65)	196 (200)

Chi-squared = 3.88, df = 2, 0.2>p>0.1, therefore H_0 is accepted

c) requires training I don't have	**Unlikely**	46 (41)	121 (126)
	Uncertain	15 (17)	56 (54)
	Likely	11 (14)	47 (44)

Chi-squared = 1.90, df = 2, 0.5>p>0.3, therefore H_0 is accepted

d) improves my image as a health professional	**Unlikely**	0 (1)	5 (4)
	Uncertain	1 (4)	16 (13)
	Likely	72 (68)	203 (207)

Chi-squared = 4.51, df = 2, 0.2>p>0.1, therefore H_0 is accepted

e) is considered a waste of time by patients	**Unlikely**	65 (60)	179 (184)
	Uncertain	5 (10)	34 (29)
	Likely	3 (3)	10 (10)

Chi-squared = 3.92, df = 2, $0.2>p>0.1$, therefore H_0 is accepted

f) helps patients understand their therapy	**Unlikely**	0 (2)	6 (5)
	Uncertain	4 (4)	13 (13)
	Likely	69 (67)	205 (207)

Chi-squared = 2.28, df = 2, $0.5>p>0.3$, therefore H_0 is accepted

g) increases my legal liability	**Unlikely**	16 (13)	38 (41)
	Uncertain	22 (30)	101 (93)
	Likely	35 (29)	83 (89)

Chi-squared = 5.38, df = 2, $0.1>p>0.05$, therefore H_0 is accepted

h) results in increased return business	**Unlikely**	4 (6)	22 (20)
	Uncertain	17 (16)	49 (50)
	Likely	50 (50)	153 (154)

Chi-squared = 0.96, df = 2, $0.7>p>0.5$, therefore H_0 is accepted

i) requires an environment of privacy	**Unlikely**	7 (5)	13 (15)
	Uncertain	16 (13)	38 (41)
	Likely	50 (55)	172 (167)

Chi-squared = 2.58, df = 2, $0.3>p>0.2$, therefore H_0 is accepted

j) increases the effectiveness of patients' therapy	**Unlikely**	0 (1)	3 (2)
	Uncertain	11 (12)	39 (38)
	Likely	62 (60)	182 (184)

Chi-squared = 1.70, df = 2, $0.5>p>0.3$, therefore H_0 is accepted

k) requires two way communication between patient and pharmacist	**Unlikely**	3 (2)	3 (5)
	Uncertain	2 (2)	6 (6)
	Likely	68 (70)	215 (213)

Chi-squared = 1.38, df = 2, $0.7>p>0.5$, therefore H_0 is accepted

APPENDIX 2. 4 Chi-squared tests used in chapter 8

1. Chi-squared tests to investigate the relationship between respondents' attitudes towards EPoS and the types of pharmacy in which those respondents worked.

H_0: There is no significant difference in attitudes towards EPoS between respondents working in different types of pharmacies.

Crosstabulation showing observed and expected values (in brackets)

EPoS would:

		Disagree	Unsure	Agree
a) Provide me with useful management information	**Independent**	28 (19)	45 (36)	192 (210)
	Small multiple	7 (12)	25 (23)	134 (132)
	Large multiple	6 (11)	10 (21)	136 (121)

Chi-squared = 20.2, df = 4, p<0.001, therefore H_0 is rejected

		Disagree	Unsure	Agree
b) Improve stock control in my pharmacy	**Independent**	38 (27)	55 (39)	170 (198)
	Small multiple	12 (17)	24 (25)	131 (125)
	Large multiple	9 (15)	7 (23)	136 (114)

Chi-squared = 34.6, df = 4, p<0.001, therefore H_0 is rejected

		Disagree	Unsure	Agree
c) improve the image of my pharmacy	**Independent**	85 (67)	90 (85)	91 (114)
	Small multiple	39 (42)	56 (53)	71 (71)
	Large multiple	24 (39)	40 (48)	88 (65)

Chi-squared = 25.4, df = 4, p<0.001, therefore H_0 is rejected

		Disagree	Unsure	Agree
d) make my business more profitable	**Independent**	60 (39)	113 (106)	91 (106)
	Small multiple	23 (29)	83 (79)	60 (79)
	Large multiple	8 (23)	50 (61)	94 (61)

Chi-squared = 49.5, df = 4, p<0.001, therefore H_0 is rejected

		Disagree	Unsure	Agree
e) only be feasible for large multiple pharmacies	**Independent**	45 (59)	87 (102)	131 (102)
	Small multiple	35 (37)	67 (64)	64 (64)
	Large multiple	51 (34)	71 (59)	30 (59)

Chi-squared = 39.2, df = 4, p<0.001, therefore H_0 is rejected

		Disagree	Unsure	Agree
f) improve stock security	**Independent**	75 (68)	86 (96)	103 (101)
	Small multiple	40 (43)	71 (61)	56 (64)
	Large multiple	34 (39)	55 (55)	63 (58)

Chi-squared = 5.7, df = 4, 0.3>p>0.2, therefore H_0 is accepted

g) decrease the workload in my pharmacy	**Independent**	88 (74)	111 (103)	62 (83)
	Small multiple	50 (47)	75 (66)	41 (53)
	Large multiple	27 (43)	43 (60)	82 (49)

Chi-squared = 56.1, df = 4. p<0.001, therefore H_0 is rejected

h) increase the workload in my pharmacy	**Independent**	81 (108)	93 (88)	88 (66)
	Small multiple	59 (69)	66 (56)	41 (42)
	Large multiple	100 (63)	35 (51)	17 (38)

Chi-squared = 56.0, df = 4, p<0.001, therefore H_0 is rejected

i) slow down counter service	**Independent**	89 (110)	95 (88)	78 (64)
	Small multiple	69 (70)	60 (56)	38 (41)
	Large multiple	86 (64)	41 (51)	25 (37)

Chi-squared = 21.6, df = 4, p<0.001, therefore H_0 is rejected

2. Chi-squared tests to investigate the relationship between respondents' attitudes towards EPoS and the contribution to turnover made by the dispensary in those shops.

H_0: There is no significant difference in respondents' attitudes towards EPoS between those in shops with high and low dispensary turnovers.

Crosstabulation showing observed and expected values (in brackets)

EPoS would:

		Disagree	Unsure	Agree
a) Provide me with useful management information	**Upto 40%**	8 (9)	10(16)	106(99)
	50% and above	23(22)	46(40	233(240)

Chi-squared = 4.36, df = 3, 0.3>p>0.2, therefore H_0 is accepted

b) improve stock control in my pharmacy	**Upto 40%**	8(13)	18(20)	98(91)
	50% and above	38(33)	50(48)	213(220)

Chi-squared = 4.14, df = 3, 0.3>p>0.2, therefore H_0 is accepted

c) improve the image of my pharmacy	**Upto 40%**	25(28)	34(38)	64(56)
	50% and above	73(70)	99(95)	131(139)

Chi-squared = 2.73, df = 3, 0.5>p>0.3, therefore H_0 is accepted

d) make my business more profitable	**Upto 40%**	15(21)	34(46)	74(56)
	50% and above	57(51)	125(113)	119(137)

Chi-squared = 14.97, df = 3, p<0.01, therefore H_0 is rejected

e) is only feasible for large multiple pharmacies	**Upto 40%**	39(29)	49(46)	35(49)
	50% and above	60(70)	108(111)	132(118)

Chi-squared = 10.8, df = 3, $0.02>p>0.01$, therefore H_o is accepted at the 98% level but rejected at the 99% level

f) would improve stock control in my pharmacy	**Upto 40%**	31(32)	34(42)	58(48)
	50% and above	81(80)	112(104)	109(119)

Chi-squared = 5.10, df = 3, $0.2>p>0.1$, therefore H_o is accepted

g) would decrease the workload in my pharmacy	**Upto 40%**	36(34)	39(50)	46(37)
	50% and above	83(85)	135(124)	82(91)

Chi-squared = 6.86, df = 3, $0.1>p>0.05$, therefore H_o is accepted

h) would increase the workload in my pharmacy	**Upto 40%**	60(49)	33(41)	29(32)
	50% and above	108(119)	110(102)	82(79)

Chi-squared = 6.53, df = 3, $0.1>p>0.05$, therefore H_o is accepted

i) would slow down counter service	**Upto 40%**	61(54)	38(39)	23(29)
	50% and above	124(132)	98(97)	78(72)

Chi-squared = 3.39, df = 3, $0.5>p>0.3$, therefore H_o is accepted

3. Chi-squared test to investigate the relationship between respondents' liklihood of buying an EPoS system and the contribution to turnover made by the dispensary in those shops.

H_o: There is no significant difference in the likelihood of respondents buying an EPoS system between those in shops with high and low dispensary turnovers.

Crosstabulation showing observed and expected values (in brackets)

	V. likely	**Likely**	**Unsure**	**Unlikely**	**V. unlikely**
Up to 49%	16 (10)	22 (15)	33 (34)	18 (24)	16 (22)
50% and above	20 (27)	36 (43)	96 (95)	71 (65)	68 (62)

Chi-squared = 14.1, df = 4, $p<0.01$, therefore H_o is rejected

4. Chi-squared test to investigate the relationship between respondents' liklihood of buying an EPoS system and the types of pharmacy in which those respondents worked.

H_o: There is no significant difference in the likelihood of respondents buying an EPoS system depending on the type of shop in which respondents work.

	V. likely	**Likely**	**Unsure**	**Unlikely**	**V. unlikely**
Independent	16 (23)	27 (36)	81 (87)	64 (54)	65 (54)
Small multiple	5 (14)	26 (23)	56 (55)	42 (35)	32 (35)
Large multiple	25 (9)	20 (15)	40 (36)	5 (22)	14 (22)

Chi-squared = 63.3, df = 8, $p<0.001$, therefore H_o is rejected

APPENDIX 3 Respondents' usefulness rating of the options available on the Pharmacy Information and News Service (PINS)

Option	Percentage of respondents rating each option		
	Useful	Little use	Not answered
News section	62	11	27
Malaria prophylaxis	60	13	27
Register enquiries	58	16	26
Product recalls	50	19	31
PINS news	50	15	36
New medicinal products	44	22	34
Legal and ethical	44	19	37
RPSGB press releases	40	28	32
CSM section	40	21	40
Blacklist additions	35	31	35
PSNC area on PINS	32	25	43
Medical journals	30	29	42
Medicines & poisons lists	27	33	40
Pharmaceutical press	25	34	41
Subscribers list	24	39	37
Selected RPSGB services	21	36	43
Postgraduate education	20	41	40
Headquarters staff guide	16	43	41
Other organisations	15	40	45
E mail	10	49	41
Central diary	7	49	44

APPENDIX 4 Comments made by pharmacists about the patient counselling module

"In this shop it is not be practical, the dispensary is quite a way back from the counter .... The patients should be able to see the screen .... I would use the package as a learning aid".

"I was very impressed with the patient counselling module. I have only tried it out on one patient (showing her what I was doing) but she was in a great hurry and the computer was too slow for her. The main disadvantage of using it while the patient is in the shop will be the time factor. It would be very useful as a learning tool".

"I have used the software with the patients standing by the computer in the dispensary so that they can see what is happening on the screen. Patients have seen it as a novelty but it is only the end result ie. the advice that they really take note of. I do not use it very often for the following reasons: the patient has to come into the dispensary ; the shop is small; the shop is busy and can be understaffed. The programme is easy to use and contains about the right amount of information, however in some cases, I am not sure about its accuracy eg. many of the cough branches lead to "bronchial obstruction" which I feel is too serious a diagnosis. It too time consuming to use regularly".

"It is impractical - my patients expect me to respond to queries on the spot, also the computer is positioned round a corner from the counter, a hand-held version would be good"

"The patient counselling module would be practical if it was separate from the labelling system.... I would like to get patients involved at the screen.

"It is more useful as a learning tool than in the shop situation although it could be of more practical use to less experienced pharmacists. I have used it once with a patient and showed them exactly what was going on, although I don't think that is how the software should be used. I would like to see more areas covered".

"Not practical - takes too long and could decrease customer faith in the pharmacist. Would be helpful to have the information from the programme in a booklet. The programme is easy to use but the language is a bit technical, there is too much information for the system to be practical for use with customers".

"Members of staff have used it as a learning aid and liked it. It is a gimmick that would attract customers. It would be most practical in a counselling area and if customers could use it themselves. It would be helpful for reinforcing what the pharmacist says eg.'you don't need any medicine' or 'you must see a doctor'. With supervision from the pharmacist, customers shouldn't be alarmed by the information. I would like to see more subjects covered eg: travel sickness, sunburn and hayfever".

APPENDIX 5 Respondents' ratings of importance for the following features in an EPoS system

Feature	Percentage of respondents rating each option		
	Important	Importance not known	Not important
The system is simple to use	84	8	1
The system incorporates bar code readers	74	13	3
Price inquiry look up is available	82	8	2
The system runs several tills	56	17	19
There is a parallel printer for management reports	58	23	9
The system incorporates a battery back up	84	6	2
Software updates are provided regularly	85	6	1
A telephone helpline is provided by the supplier	86	6	1
Training on the use of the system is given by the supplier	87	4	1
The system incorporates magnetic card readers	56	21	14
Detailed customer receipts are produced	75	10	8
A printed copy of the receipt is retained in the machine	72	14	7
A link to the dispensary PMR system allows detection of OTC drug interactions	62	20	10
Sales of P medicines are automatically brought to the pharmacist's attention	72	12	13
Professional messages can be included on receipts	45	24	23

APPENDIX 5 continued

A bar code reader in the dispensary allows a second check on dispensed items	40	32	16
Overstocks can be identified	84	6	3
Staff time is saved not counting stock	73	11	9
The number of out of stock items is minimised	83	6	2
Total stock evaluation can be provided	78	10	4
Stock ordering is automatic	64	16	11
The system is usable from day 1	74	12	3
Money is saved by better stock control	85	5	2
Profit and loss reports are produced	62	20	8
Balance sheets are produced	55	25	11
Sales analyses are produced	74	16	5
Cash reconciliation is given	66	16	5
Product performance is monitored	73	13	4
Invoices are produced	49	24	17
Information from branches can be automatically received at head office	46	18	20
Full audit trails are available	63	16	6
Correct prices are charged	87	3	1
Pilferage can be identified	37	7	2
The system has a lockable cover	57	24	8

APPENDIX 6 Questionnaire and covering letter: Survey of computer use among community pharmacists

ASTON UNIVERSITY

PHARMACEUTICAL SCIENCES

Professor of Pharmaceutical Microbiology
* M R W Brown MSc PhD DSc FRPharmS
Professor of Pharmacology
C B Ferry BPharm BSc PhD FRPharmS
Professor of Biochemical Toxicology
A Gescher BSc PhD DSc
Professor of Experimental Chemotherapy
M F G Stevens BPharm PhD DSc MRPharmS CChem FRSC
Professor of Cancer Biochemistry
M J Tisdale BSc PhD DSc
* Head of Department this session

May 1989

Dear Pharmacist,

SURVEY OF THE USE OF COMPUTERS IN COMMUNITY PHARMACY

I am a postgraduate student working in the Pharmacy Practice Research Group at Aston University, investigating the use of computers and information technology in community pharmacy.

I believe that these two areas will greatly influence the future development of community pharmacy and am conducting a nationwide survey of pharmacists, to find out what the present situation is as regards pharmacy computers and what pharmacist's attitudes are towards other aspects of information technology.

I should be very grateful if you would complete the enclosed questionnaire, which is part of the survey, and return it to me in the pre-paid envelope provided. All results will be treated in strict confidence and used fot statistical analysis only. It is hoped that the collated results will contribute to future advances in pharmacy practice.

Thank you very much for your co-operation, please do not hesitate to contact me if you need any further information.

Yours faithfully,

Rebecca Boakes

Rebecca Boakes BPharm MRPharmS.

Aston Triangle, Birmingham B4 7ET. Telephone 021-359 3611. Telex 336997 UNIAST G
Electronic Mail PHARMSCI@UK.AC.ASTON

SURVEY OF THE USE OF COMPUTERS IN COMMUNITY PHARMACY

All questions apply to the pharmacy to which the questionnaire was posted, they should be answered by the pharmacy owner, pharmacy manager or superintendent pharmacist.

For office use only

Where applicable, please tick the box corresponding to the appropriate response.

SECTION A

---

1. Is your pharmacy:

An independent	1	5
A small multiple (2-10 stores)	2	
A large multiple (over 10 stores)	3	

2. What is your status as a pharmacist?

Proprietor	1	6
Manager	2	
Superintendent	3	

3. Which age category do you fall into?

20-30	30-40	40-50	Over 50	
1	2	3	4	7

4. Do you have a computer in your pharmacy?

Yes	1	8
No	2	

5. Which, if any, of the following do you have in your pharmacy?
(Tick as many boxes as appropriate)

Manual (ie not computerised) Patient Medication Records	1	9-10
A second computer terminal	2	
A video recorder	3	
A fax (facsimile) machine	4	
An EPOS (electronic point of sale) terminal	5	
A modem	6	

- 1 -

If your answer to <u>question 4</u> was <u>'No'</u>, please go to <u>question 14</u>.

If your answer to <u>question 4</u> was <u>'Yes'</u> please <u>carry on</u>.

YOUR PRESENT COMPUTER

---

6. Which computer system is used in your pharmacy?

a) Please indicate the computer hardware used eg Amstrad 6128, Sharp, Panasonic, Electron.

.... 10-11

b) Please indicate the supplier of your computer hardware eg. Richardson, Park, Vestric (AAH), Image, other computer retailer. If it is a 'home-built' system, please indicate that here.

.... 11-12

c) What was the source of the software you are using with your computer?

It came with the hardware	1	13
It was bought separately	2	
It was written as part of a 'home built' system	3	

d) Please indicate the form in which your software is stored:

Cassette	1	14
Floppy disk	2	
Hard disk	3	
Other (please specify)........		

.... 4

7. For which of the following is your computer used:
(Tick as many boxes as appropriate)

Labelling	1	15-16
Patient Medication Records	2	
Drug interaction monitoring	3	
Stock ordering	4	
Stock control	5	
Accessing information sources eg.PINS	6	
Word processing	7	
Market research	8	
Other (please specify)	9	

....

- 2 -

8. When was your present computer installed?

1989	1	17
1988	2	
1987	3	
1986	4	
pre 1986	5	

9. Is this the first computer that your pharmacy has had?

Yes	1	18
No	2	

10. If you answered 'No' to question 9, how many computers has your pharmacy had altogether?

Two	1	19
Three	2	
Four	3	
More than four	4	

11.How satisfied are you with your present computer?

Very satisfied	Satisfied	Indifferent	Unsatisfied	Very unsatisfied	
1	2	3	4	5	20

12. Which maintenance service do you use for your present computer?

Supplier	1	21
NPA	2	
None	3	
Other (please specify)........		
....	4	

13. How satisfied are you with your maintenance?

Very satisfied	Satisfied	Indifferent	Unsatisfied	Very unsatisfied	
1	2	3	4	5	22

-3-

FUTURE COMPUTER USAGE

14. Is it likely that, within the next 12 months, you will:
a) purchase a new computer?

Yes	1	23
No	2	

b) obtain more software for your existing computer

Yes	1	24
No	2	

15. If you answered 'Yes' to either question 14a or 14b, which of the following do you want to be available on your new computer/software?
(Tick as many boxes as appropriate)

Patient Medication Records	1	25-26
Drug interaction monitoring	2	
Stock ordering	3	
Stock control	4	
Access to information sources eg.PINS	5	
Word processing	6	
Other (please specify)		

....

16. If you answered 'Yes' to question 14a which computer/computer system are you most likely to buy?

A John Richardson system	1	27
A Park system	2	
A Vestric (AAH) system	3	
Unsure	4	
Other (please specify)...........		

....

SECTION B

The remainder of the questions ask for your opinion on a number of topics. Please indicate your views on these topics by ticking the box corresponding to the appropriate response after each of the following statements.

17. Patient Medication Records, (PMRs).

a) Keeping PMRs would enable me to offer a better service to my prescription customers than I could do otherwise. 28

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1	2	3	4	5

b) PMRs held in my pharmacy would be a useful source of information for other health professionals such as GPs, hospitals and the emergency services. 29

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1	2	3	4	5

c) PMRs are of little interest to me because of the time involved in creating and maintaining them. 30

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1	2	3	4	5

d) PMRs are of use only in pharmacies with a large number of regular prescription customers. 31

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1	2	3	4	5

18. 'Smart cards'

A smart card is a credit-card sized device capable of storing information electronically. Such patient-held cards have been used to carry medical information between doctors and pharmacists.

Please tick the box corresponding to the appropriate response after each of the following statements:

a) I would like to see the introduction of 'smart cards' as a method of transferring patient data between health-care professionals

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	32
1	2	3	4	5	

b) As a pharmacist, I should be able to add information on OTC medicines to a smart card.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	33
1	2	3	4	5	

c) Smart cards would be well accepted by most of the customers at my pharmacy.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1	2	3	4	5

d) Smart cards would do nothing to improve my business.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	34
1	2	3	4	5	

e) Doctors will not want pharmacists to add data to smart cards.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	35
1	2	3	4	5	

19. Electronic information services in the pharmacy.

Examples of these services include PINS and Prestel, information is obtained on a terminal in the pharmacy from a central computer via a modem.

Please tick the box corresponding to the appropriate response after each of the following statements :

a) Information provided electronically in the pharmacy would be a useful source for improving my pharmaceutical knowledge

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	36

b) Access to electronically provided information sources would put me in a better position to advise patients.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	37

c) Access to electronically provided information sources would put me in a better position to advise other health care professionals

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	38

d) Printed information currently available is sufficient to satisfy my pharmaceutical knowledge requirements.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	39

e) Electronic sources of information have no place in community pharmacy at present.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	40

20. Computerised information available to the public.

At present, information on general health care matters is available to the public in the form of leaflets displayed in pharmacies. The same sort of information could be stored on a computer, placed in the pharmacy area, which could be used by members of the public as an additional source of health care advice.

Please tick the box corresponding to the appropriate response after each of the following statements, which relate to computerised information as outlined above:

a) Customers will appreciate being able to access a computer, to obtain health care information, in my pharmacy.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	41

b) Providing customer access to a computer would be an effective means of offering simple health advice to the general public.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	42

c) Public access to computerised information in the pharmacy would lead to a reduction in the number of people consulting me for advice on health care matters.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	
1	2	3	4	5	43

21. Computerised aids to counter-prescribing.

Please tick the box corresponding to the appropriate response after the following statements.

a) A computer programme to help me when counter-prescribing (responding to symptoms) would be a useful addition to my pharmacy

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	44
1	2	3	4	5	

b) Most of my customers would object to my use of a computer programme, when responding to their symptoms.

Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	45
1	2	3	4	5	

I am hoping to interview a sample of the respondents of this survey at a later date, please tick the box if you would be prepared to take part in this follow up study. ☐ 46

Once again, thank you very much for your co-operation in this survey. If you have any further comments I should be very grateful if you could write them here.

....

....

....

....

....

....

....

....

Yours faithfully

Rebecca Boakes

Dept. of Pharmaceutical Sciences,
Aston University,
Aston Triangle,
Birmingham B4 7ET.

APPENDIX 7 Questionnaire and covering letter: Survey of pharmacists with positive attitudes towards electronic sources of information

ASTON UNIVERSITY

PHARMACEUTICAL
SCIENCES

Professor of Pharmaceutical Microbiology
M R W Brown, MSc PhD DSc FPS
Professor of Pharmacology
C B Ferry, BPharm BSc PhD FPS
Professor of Experimental Chemotherapy
M F G Stevens, BPharm PhD DSc MPS CChem FRSC
Head of Department this Session

May 1990

Dear Pharmacist,

SURVEY OF USE OF COMPUTERS IN COMMUNITY PHARMACY
ELECTRONIC SOURCES OF INFORMATION

During May and June of 1989 I sent a questionnaire to community pharmacists throughout the country which asked questions about their use of computers. Thank you very much for completing one of these questionnaires and for indicating that you would be prepared to take part in a follow-up study.

The survey results (due to published shortly in the Pharmaceutical Journal) showed that the majority of respondents felt information provided electronically in their pharmacies would be a useful source of pharmaceutical knowledge and would put them in a better position to advise patients and other health care professionals. However, only 7% of respondents used their pharmacy computers to access PINS, the electronic information service provided by the Royal Pharmaceutical Society.

I am sending the enclosed questionnaire to all those who gave positive responses to statements about electronic sources of information, who did not subscribe to PINS at the time of the survey and who indicated that they would be willing to take part in a follow-up study.

I should be most grateful if you would complete this short questionnaire, which should not take very long, and return it to me in the enclosed pre-paid envelope. As previously, all results will be treated in strict confidence and used for statistical analysis only.

Thank you very much for your co-operation, please do not hesitate to contact me or my supervisor Michael Jepson if you need any further information (021 359 3611 ext4192)

Yours sincerely,

Rebecca Boakes

Rebecca Boakes BPharm MRPharmS

Research Student, Pharmacy Practice Research Group, Pharmaceutical Sciences Institute, Aston University.

Aston Triangle, Birmingham B4 7ET Telephone 021-359 3611 Telex 336997 UNIAST G
Electronic Mail COMPSCI@UK.AC.ASTON.MAIL

FOLLOW UP SURVEY - ELECTRONIC SOURCES OF INFORMATION

All questions apply to the pharmacy to which this questionnaire has been posted, they should be answered by the pharmacy owner, pharmacy manager or superintendent pharmacist.

Where applicable, please tick the box corresponding to the appropriate response.

---

1. Below is a list of "hard copy" information sources used by community pharmacists, please indicate which of these sources you have in your pharmacy by ticking the appropriate boxes:

Chemist and Druggist Price List (latest ed.)..........	
MIMS (latest ed.)......................................	
Martindale (29th ed.)..................................	
Martindale (28th ed.)..................................	
Pharmaceutical Handbook	
Pharmaceutical Codex 1979...............................	
Drug and Therapeutics bulletin (latest ed.)...........	
First aid handbook	
Pocket Medical Dictionary...............................	
Drug interactions textbook..............................	
Clinical pharmacology textbook..........................	
Responding to symptoms textbook.........................	

2. Roughly how many times, if any, during the last year did you contact the following external information sources via the telephone:

SOURCE	NUMBER OF CALLS			
	0	1-3	4-5	>5
Local hospital drug information centre				
National Pharmaceutical Association (NPA)				
Royal Pharmaceutical Society (RPSGB)				
Pharmaceutical Services Negotiating Committee (PSNC)				
Prescription Pricing Authority (PPA)				
A pharmaceutical company's product information dept.				
Other(s) - please specify				

3. The Royal Pharmaceutical Society's Pharmacy Information and News Service (PINS) is an electronic information source specifically aimed at pharmacists. Had you ever heard of PINS before receiving this questionnaire (or any other from Aston)?

Yes	1
No	2

4. If you answered "No" to question 3, please go to question 6, if you answered "Yes" to question 3, have any of the following reasons deterred you from becoming a PINS subscriber? (please tick the appropriate box(es) as appropriate)

Lack of suitable hardware.................................. ☐

Lack of information about PINS hardware requirements........ ☐

Lack of information about the service provided by PINS...... ☐

Not being confident about accessing PINS.................... ☐

The cost of becoming a PINS subscriber...................... ☐

The costs of accessing PINS................................. ☐

Other(s), please specify ....

....

....

5. What would you say has been the main reason for your not becoming a PINS subscriber?

....

....

....

6. Do you ever use any of the following ELECTRONIC sources of information at work or at other times (please tick as appropriate):

	AT WORK	AT ANY OTHER TIME
Martindale On-line		
Ceefax		
Oracle		
Prestel		
British Telecom Gold		
*Interlex		
*Philex		

*Databases of information stored on floppy discs covering prescrition medicines and drug interactions, produced by Exeter Database Systems.

7. What information would you find useful on an electronic information source such as PIMS?

....

....

....

....

....

Once again, thank you very much for your co-operation.

Yours sincerely,

Rebecca Boakes.

APPENDIX 8 Questionnaire and covering letter: Survey of PINS subscribers

ASTON UNIVERSITY

PHARMACEUTICAL SCIENCES

Professor of Pharmaceutical Microbiology
M R W Brown MSc PhD DSc FPS
Professor of Pharmacology
C B Ferry BPharm BSc PhD FPS
Professor of Experimental Chemotherapy
M F G Stevens BPharm PhD DSc MPS CChem FRSC
Head of Department this Session

May 1990

Dear PINS subscriber,

SURVEY OF 'PINS' SUBSCRIBERS

I am a postgraduate student working in the Pharmacy Practice Research Group of the Pharmaceutical Sciences Institute at Aston University, investigating the use of computers and information technology in community pharmacy.

I am sending this questionnaire to everyone on the current list of PINS subscribers, the PINS office having provided the addresses. The questionnaire asks about level of use of PINS, uses to which PINS is put and views about PINS. It is hoped that the results will help to improve on-line information sources for community pharmacists.

As it was not possible to separate the community pharmacist subscribers from other subscribers, this questionnaire will have been sent to hospital and industrial subscribers as well. If you are not a community pharmacist, could you please indicate so in the space provided at the start of the questionnaire then return it to me in the enclosed pre-paid envelope. If you are a community pharmacist, I should be very grateful if you could complete the whole questionnaire and then return it to me in the pre-paid envelope provided.

All results will be treated in strict confidence and used for statistical analysis only.

Thank you very much for your co-operation, please do not hesitate to contact me or my superviser Michael Jepson if you need any further information (021 359 3611 ext.4192)

Yours sincerely,

Rebecca Boakes

Rebecca Boakes BPharm MRPharmS.

Aston Triangle, Birmingham B4 7ET Telephone 021-359 3611. Telex 336997 UNIAST G
Electronic Mail PHARMSCI@ UK.AC.ASTON

SURVEY OF THE USE OF 'PINS' BY COMMUNITY PHARMACISTS

Where applicable, please tick the box(es) corresponding to the appropriate response.

Are you currently a PINS subscriber Yes [ ] No [ ]

Are you a community pharmacist Yes [ ] No [ ]

If you answered 'No' to either of the above questions ie if you are not now a PINS subscriber, or if you are not a community pharmacist, you need not answer any more questions, please send back the questionnaire in the envelope provided, thank you for your co-operation.
If you answered 'Yes' to the above questions please continue:

---

1. In which year did you become a PINS subscriber? 19____

2. On average, how many times per week do you access PINS? ____________

3. On average, how long do you spend accessing PINS during one session?

Less than 5 minutes	1	5-10 minutes	2
More than 10 minutes	3		

4. At what time of day are you most likely to access PINS? (Please tick one or more boxes as appropriate).

Before shop opens	1	In the morning (shop hours)	2
At lunch time	3	In the afternoon	4
In the evening (shop hours)	5	After shop closes	6

Other (please specify)
....

5. Do you access any other electronic information sources eg Prestel?

No [1]

Yes (please give details).. [2]

6. Please indicate briefly what lead you to become a PINS subscriber eg. friend's recommendation, article in pharmaceutical press, need for certain information.

....

....

7a. Is the type of information provided by PINS what you expected?

Yes [1]
No [2]

If "No", please expand ....

7b. Is the quality of information provided by PINS similar to what you expected?

Yes	1
No	2

If "No", please expand ....

8. Do you use PINS more, less or about the same as you thought you would?

More	1
Less	2
About the same	3

9. Below is a list of the options available on PINS. For each option that you use, please indicate how useful you find it by ticking the appropriate column.
For the options that you find most useful please indicate how often you access them under the heading "frequency of use".

OPTIONS ON PINS	USEFULNESS				FREQUENCY OF USE
	Very useful	Useful	Of little use	Of very little use	Number of times /week /month /year
News section					
Drug recalls (alerts)					
New medicinal products					
Register enquiries					
PINS news					
E-mail					
RPSGB press releases					
Selected RPSGB services					
Pharmaceutical Press					
Headquarters staff guide					
CSM Current Problems					
From other organisations					
Central pharmacy diary					
Malaria prophylaxis					
Legal and ethical advice					
Medical journals					
PSNC area on PINS					
Medicines/Poisons lists					
Blacklist additions					
Postgraduate education					
PINS subscriber list					

10. What other information would you like to see made available on PINS?

....

....

11. Would you say that you use PINS:

	YES	NO	DON'T KNOW
"mainly as a general interest source of information ie for browsing through"	☐	☐	☐
"mainly as a source of information when specific problems arise in the pharmacy ie for acute problems"	☐	☐	☐

12. Here are some comments people have made about PINS, please indicate whether you agree or disagree with each one:

	AGREE	DISAGREE	DON'T KNOW
a) "My use of PINS is limited because it interrupts labelling in the dispensary"	☐	☐	☐
b) "I am surprised more pharmacists do not subscribe to PINS"	☐	☐	☐
c) "In general, I only use PINS for consulting the Register of Pharmaceutical Chemists"	☐	☐	☐
d) "I <u>do not</u> think PINS is user-friendly"	☐	☐	☐
e) "I am put off using PINS because of the telephone charges"	☐	☐	☐
f) "PINS information is always up to date"	☐	☐	☐

If you have any other comments about PINS, please write them here:

....

....

....

....

....

Once again, thank you very much for your co-operation.

Yours sincerely,

Rebecca Boakes.

APPENDIX 9 Questionnaire and covering letter: Survey of PILLS users

ASTON UNIVERSITY

PHARMACEUTICAL SCIENCES

Professor of Pharmaceutical Microbiology
* *M R W Brown MSc PhD DSc FRPharmS*
Professor of Pharmacology
C B Ferry BPharm BSc PhD FRPharmS
Professor of Biochemical Toxicology
A Gescher BSc PhD DSc
Professor of Experimental Chemotherapy
M F G Stevens BPharm PhD DSc MRPharmS CChem FRSC
Professor of Cancer Biochemistry
M J Tisdale BSc PhD DSc

* *Head of Department this session*

December 1990

Dear Pharmacist,

SURVEY OF "PILLS" COMPUTER USERS

Last month I sent a questionnaire to all users of the P.I.L.L.S pharmacy computer system as part of some research investigating the effects a P.I.L.L.S system may have on a pharmacy. There has been an encouraging response so far but I am keen to get as many more replies as possible to maximise the validity of the results. Therefore, I am writing to all those pharmacists from whom I have not yet heard, enclosing a second copy of the questionnaire.

I realise that this may be a very busy time of year for you but I should be most grateful if you would complete this short questionnaire, if you have not already done so. I beleive that the collated results will contribute to future advances in pharmacy practice and it is hoped that a summary of the findings will be published in the pharmaceutical press.

Please return your completed questionnaire to me in the pre-paid envelope provided. All replies will be treated in strict confidence and used for statistical analysis only.

Thank you very much for your co-operation, please do not hesitate to contact me, if you need any further information, on 021 359 3611 ext.4192.

Yours sincerely,

Rebecca Boakes

Rebecca Boakes BPharm MRPharmS

Pharmacy Practice Research Group, Aston University.

Aston Triangle, Birmingham B4 7ET. Telephone 021-359 3611. Telex 336997 UNIAST G
Electronic Mail PHARMSCI@UK AC ASTON

SURVEY OF "PILLS" PHARMACY COMPUTER USERS

Where applicable, please circle the number(s) corresponding to the appropriate response.

---

1. Is your pharmacy:

An independent	1
A small multiple (2-10 branches)	2
A large multiple (>10 branches)	3

2. Is your pharmacy located:

In a city (non-residential area)	1
In a city (residential area)	2
In a town (non-residential area)	3
In a town (residential area)	4
In a village	5

3. Are you:

Owner of your pharmacy	1
Manager of your pharmacy	2
Pharmacy superintendent	3
Other	4

4. Which age category do you fall into?

21-30	1	51-60	4
31-40	2	Over 61	5
41-50	3		

5. Did you have a pharmacy computer system incorporating patient medication records before you acquired your PILLS system?

Yes	1
No	2

6. When did you install your PILLS pharmacy computer system

1990	1	1988	3
1989	2	1987	4

7. Does your PILLS pharmacy computer system incorporate a leaflet printer?

Yes	1
No	2

If you answered NO to question 7 above, please go to question 12, if you answered YES to question 7 please carry on, questions 8 to 11 refer to the leaflets printed by your PILLS pharmacy computer system:

8. Who do you give PILLS leaflets to?

All prescription patients 1 Certain groups of patients only 2

If you give PILLS leaflets to <u>certain groups of patients only</u>, could you please specify which groups of patients these are and why you give leaflets to them.

....

....

9. Have the number of enquiries you receive from customers/patients about their prescription drugs increased, decreased or stayed the same since you started giving out PILLS leaflets?

The number of enquiries has increased 1
The number of enquiries has decreased 2
The number of enquiries has stayed the same 3
I am unsure 4

10. Have your prescription numbers increased, decreased or stayed the same since you started giving out PILLS leaflets?

Prescription numbers have increased 1
Prescription numbers have decreased 2
Prescription numbers have stayed the same 3
I am unsure 4

11. Has the speed of your dispensing process increased, decreased or stayed the same since you started giving out PILLS leaflets?

Speed of dispensing has increased 1
Speed of dispensing has decreased 2
Speed of dispensing has stayed the same 3
I am unsure 4

12. Before you acquired your PILLS system, had you ever given <u>pre-printed leaflets about specific drugs</u> to customers?

No 1
Yes 2 - please specify the source of these leaflets

and their subject matter ....

....

Job satisfaction

13. This question is about your present job as a community pharmacist. Please indicate how satisfied you are with each of the following aspects of your job by circling the appropriate number opposite:

1 = Very unsatisfied; 2 = Unsatisfied; 3 = Unsure; 4 = Satisfied; 5 = Very satisfied

a) Use of pharmaceutical skills and knowledge	1	2	3	4	5
b) Development of pharmaceutical skills and knowledge	1	2	3	4	5
c) Level of responsibility	1	2	3	4	5
d) The tasks you perform	1	2	3	4	5
e) Your status in the community	1	2	3	4	5
f) Your status amongst other health professionals	1	2	3	4	5
g) Financial reward/effort ratio	1	2	3	4	5
h) Sense of achievement gained	1	2	3	4	5
i) Ability to maintain personal standards	1	2	3	4	5
j) Ability to achieve ambitions	1	2	3	4	5

Patient counselling

14. The following statements are beliefs held by certain pharmacists about patient counselling. Please indicate how likely or unlikely you think each statement is to be true by circling the appropriate number opposite:

1 = Very unlikely; 2 = Unlikely; 3 = Likelihood uncertain ; 4 = Likely; 5 = Very likely

Patient counselling:

a) Requires more pharmacist time	1	2	3	4	5
b) Increases the accuracy of patients' drug taking	1	2	3	4	5
c) Requires training I don't have	1	2	3	4	5
d) Improves my image as a health professional	1	2	3	4	5
e) Is considered a waste of time by patients	1	2	3	4	5

f) Helps patients understand their therapy	1	2	3	4	5
g) Increases my legal liability	1	2	3	4	5
h) Results in increased return business	1	2	3	4	5
i) Requires an environment of privacy	1	2	3	4	5
j) Increases the effectiveness of patients' therapy	1	2	3	4	5
k) Requires two-way communication between patient and pharmacist	1	2	3	4	5

15. Briefly, what were your main reasons for purchasing a PILLS pharmacy computer system?

....

....

....

....

16. If you have any other comments about your PILLS computer systems, please write them here.

....

....

....

....

....

17. Would you be happy for me to contact you about possible further studies

Yes 1
No 2

Once again, thank-you very much for your co-operation.

Yours sincerely, Rebecca Boakes

APPENDIX 10 Questionnaire and covering letter: Survey of control pharmacists

ASTON UNIVERSITY

PHARMACEUTICAL SCIENCES

Professor of Pharmaceutical Microbiology
** M R W Brown MSc PhD DSc FRPharmS*
Professor of Pharmacology
C B Ferry BPharm BSc PhD FRPharmS
Professor of Biochemical Toxicology
A Gescher BSc PhD DSc
Professor of Experimental Chemotherapy
M F G Stevens BPharm PhD DSc MRPharmS CChem FRSC
Professor of Cancer Biochemistry
M J Tisdale BSc PhD DSc
** Head of Department this session*

December 1990

Dear Pharmacist,

STUDY OF COMPUTERS AND COMMUNITY PHARMACISTS

Last month I sent a questionnaire to a random sample of community pharmacists throughout the country as part of some research investigating what may influence the uptake of pharmacy computers by pharmacists. There has been an encouraging response so far but I am keen to get as many more replies as possible to maximise the validity of the results. Therefore, I am writing to all those pharmacists from whom I have not yet heard, enclosing a second copy of the questionnaire.

I realise that this may be a very busy time of year for you but I should be most grateful if you would complete this short questionnaire, if you have not already done so. I beleive that the collated results will contribute to future advances in pharmacy practice and it is hoped that a summary of the findings will be published in the pharmaceutical press.

Please return your completed questionnaire to me in the pre-paid envelope provided. All replies will be treated in strict confidence and used for statistical analysis only.

Thank you very much for your co-operation, please do not hesitate to contact me, if you need any further information, on 021 359 3611 ext.4192.

Yours sincerely,

Rebecca Boakes

Rebecca Boakes BPharm MRPharmS

Pharmacy Practice Research Group, Aston University.

Aston Triangle, Birmingham B4 7ET. Telephone 021-359 3611. Telex 336997 UNIAST G
Electronic Mail PHARMSCI@UK.AC.ASTON

STUDY OF COMPUTERS AND COMMUNITY PHARMACISTS

Where applicable, please circle the number(s) corresponding to the appropriate response.

---

1. Is your pharmacy:

An independent	1
A small multiple (2-10 branches)	2
A large multiple (>10 branches)	3

2. Is your pharmacy located:

In a city (non-residential area)	1
In a city (residential area)	2
In a town (non-residential area)	3
In a town (residential area)	4
In a village	5

3. Are you:

Owner of your pharmacy	1
Manager of your pharmacy	2
Pharmacy superintendent	3
Other	4

4. Which age category do you fall into?

21-30	1	51-60	4
31-40	2	Over 61	5
41-50	3		

5. Do you have one or more computers in your pharmacy?

Yes, one computer 1
Yes, more than one computer 2
No, I do not have a computer 3

If you do not have a computer, please jump to question 8, if you do have a computer please carry on.

6. For which of the following is/are your computer(s) used:
(Circle as many numbers as appropriate)

Labelling	1
Patient Medication Records	2
Drug interaction monitoring	3
Stock ordering	4
Stock control	5
Accessing information sources eg.PINS	6
Word processing	7
Market research	8
Accounts/other financial uses	9
Other (please specify)	

....

7. If you answered "Yes" to question 5 above, who supplied your pharmacy computer(s)? (Circle as many numbers as appropriate)

AAH (Link)	1	Macarthys	11
Calvert Computer Systems	2	Mawdsley Brooks	12
Channel Business Systems	3	Microscript	13
Chemtec Systems	4	Park Systems	14
Fairscan	5	P.C.S. (Pace Beta)	15
Hadley Hutt Computing (PILLS)	6	Rombus Computers	16
IDC Computer Systems	7	Simple Software Solutions	17
Image Microsystems	8	Talk Data Computer Sysytems	18
John Richardson Computers	9	Unichem	19
Logaline Computer Systems	10		

Other, please specify

....

Job satisfaction

8. This question is about your present job as a community pharmacist. Please indicate <u>how satisfied you are with each of the following aspects of your job</u> by circling the appropriate number opposite:

1 = Very unsatisfied; 2 = Unsatisfied; 3 = Unsure; 4 = Satisfied; 5 = Very satisfied

a) Use of pharmaceutical skills and knowledge	1	2	3	4	5
b) Development of pharmaceutical skills and knowledge	1	2	3	4	5
c) Level of responsibility	1	2	3	4	5
d) The tasks you perform	1	2	3	4	5
e) Your status in the community	1	2	3	4	5
f) Your status amongst other health professionals	1	2	3	4	5
g) Financial reward/effort ratio	1	2	3	4	5
h) Sense of achievement gained	1	2	3	4	5
i) Ability to maintain personal standards	1	2	3	4	5
j) Ability to achieve ambitions	1	2	3	4	5

Patient counselling

9. The following statements are beliefs held by certain pharmacists about patient counselling. Please indicate how likely or unlikely you think each statement is to be true by circling the appropriate number opposite:

1 = Very unlikely; 2 = Unlikely; 3 = Likelihood uncertain ; 4 = Likely; 5 = Very likely

Patient counselling:

a) Requires more pharmacist time	1	2	3	4	5
b) Increases the accuracy of patients' drug taking	1	2	3	4	5
c) Requires training I don't have	1	2	3	4	5
d) Improves my image as a health professional	1	2	3	4	5
e) Is considered a waste of time by patients	1	2	3	4	5
f) Helps patients understand their therapy	1	2	3	4	5
g) Increases my legal liability	1	2	3	4	5
h) Results in increased return business	1	2	3	4	5
i) Requires an environment of privacy	1	2	3	4	5
j) Increases the effectiveness of patients' therapy	1	2	3	4	5
k) Requires two-way communication between patient and pharmacist	1	2	3	4	5

10. Would you be happy for me to contact you about possible further studies?

Yes 1
No 2

Once again, thank-you very much for your co-operation.

Yours sincerely,

Rebecca Boakes BPharm MRPharmS

APPENDIX 11 Questionnaire and covering letter: Survey of the use of electronic point of sale among community pharmacists

ASTON UNIVERSITY

PHARMACEUTICAL
SCIENCES

Professor of Pharmaceutical Microbiology
M R W Brown MSc PhD DSc FPS
Professor of Pharmacology
C B Ferry BPharm BSc PhD FPS
Professor of Experimental Chemotherapy
M F G Stevens BPharm PhD DSc MPS
CChem FRSC
Head of Department this Session

August 1990

Dear Pharmacist,

SURVEY OF ELECTRONIC POINT OF SALE (EPoS) IN COMMUNITY PHARMACY

I am a postgraduate student working in the Pharmacy Practice Research Group at Aston University, investigating the use of computers and information technology in community pharmacy. A report of some of our work was published recently in the Pharmaceutical Journal#.

One technological development that seems likely to have a significant impact on community pharmacy in the near future is electronic point of sale, or EPoS. I have therefore sent you the enclosed questionnaire as part of a nationwide survey of community pharmacists' opinions on EPoS. It asks for **your** views on some aspects of this topical subject.

I should be very grateful if you would complete this questionnaire, **whether or not you have an EPoS system** and return it to me in the pre-paid envelope provided. All replies will be treated in strict confidence and used for statistical analysis only. It is hoped that the results will be of value in the future development of pharmacy computer systems.

Thank you very much for your co-operation, please do not hesitate to contact me if you need any further information.

Yours sincerely,

Rebecca Boakes

Rebecca Boakes BPharm MRPharmS.

#Pharmaceutical Journal 244 (26.5.90) p620-623

Aston Triangle, Birmingham B4 7ET. Telephone 021-359 3611. Telex 336997 UNIAST G
Electronic Mail PHARMSCI@UK.AC.ASTON

ELECTRONIC POINT OF SALE (EPoS) IN COMMUNITY PHARMACY

All questions apply to the pharmacy to which the questionnaire was posted, they should be answered by the pharmacy owner, pharmacy manager or superintendent pharmacist.
Where applicable, please CIRCLE the number corresponding to the appropriate response.

---

1. Is your pharmacy:

An independent	1
A small multiple (2-10 branches)	2
A large multiple (more than 10 branches)	3

2. Are you the:

Pharmacy owner	1
Pharmacy manager	2
Pharmacy superintendent	3

3. What age group are you?

21-30	1	41-50	3
31-40	2	Over 51	4

4. How many computers do you have in your pharmacy?

One computer (one screen)	1
One computer (more than one screen)	2
More than one computer	3
I do <u>not</u> have a computer	4

If NOT please turn to question 6

5. If you have a computer in the pharmacy, what do you use it for? (circle as many numbers as appropriate)

Labelling	1
Patient medication records	2
Automatic stock control	3
Stock ordering from wholesalers	4
PINS	5
Counter interaction searches	6
Prescription interaction searches	7
Counselling	8
Word processing	9
Accounts	10
Other please specify	

6. Do you have any of the following in your pharmacy?

A modem	1
A video recorder	2
A fax machine	3
Manual PMRs (ie records kept on file cards)	4
An EPoS (electronic point of sale) system	5

The remaining questions are on the subject of electronic point of sale (EPoS) in community pharmacy. EPoS systems allow details of all transactions to be recorded at the point of sale for example using a bar-code reader. The transaction data is stored on computer and can be used in a variety of ways to help in the management of the pharmacy. **WHETHER OR NOT YOU HAVE EPOS OR HAVE HEARD OF IT, PLEASE ATTEMPT THE REMAINDER OF THE QUESTIONNAIRE- THANK YOU**

---

7. If you have EPoS, which system do you currently use?

Fairscan	1
LCS	2
Other please specify	

8. If you are not an EPoS user, which companies are you aware of?

None	1
Fairscan	2
LCS	3
Others please specify	

9. Please read the following statements about EPoS and indicate your level of agreement with each statement by circling the appropriate number opposite :
1 = Strongly disagree; 2 = Disagree; 3 = Unsure; 4 = Agree; 5 = Strongly agree

a) An EPoS system would improve the image of my pharmacy	1	2	3	4	5
b) An EPoS system would increase the workload in my pharmacy	1	2	3	4	5
c) An EPoS system would improve stock control in my pharmacy	1	2	3	4	5
d) An EPoS system would provide me with useful shop management information	1	2	3	4	5
e) EpoS systems are only economically feasible for large multiple pharmacies	1	2	3	4	5
f) An EPoS system would improve stock security in my pharmacy	1	2	3	4	5
g) An EPoS system would slow down counter service in my pharmacy	1	2	3	4	5
h) An EPoS system would decrease the workload in the shop	1	2	3	4	5
i) An EPoS system would make my business more profitable	1	2	3	4	5

10. Please indicate how important you feel it would be for an EPoS system to have each of the following features by circling the appropriate number opposite that feature:
1 = Not important; 2 = Of little importance; 3 = Importance not known; 4 = Important; 5 = Very important; 6 = Don't understand

a) General features						
The system is simple to use	1	2	3	4	5	6
The system incorporates bar code readers	1	2	3	4	5	6
Price inquiry look up is available	1	2	3	4	5	6
The system runs several tills	1	2	3	4	5	6
There is a parallel printer for producing management reports	1	2	3	4	5	6
The system incorporates a battery back-up in case of power failure	1	2	3	4	5	6
Software updates are provided by the supplier regularly	1	2	3	4	5	6
A telephone helpline is provided by the supplier	1	2	3	4	5	6
Training on use of the system is given by the supplier	1	2	3	4	5	6
The system incorporates magnetic card readers	1	2	3	4	5	6
The till roll printer has two part paper	1	2	3	4	5	6
b) Professional features						
A link to the dispensary PMR system allows OTC drug interactions to be detected	1	2	3	4	5	6
Sales of P medicines are automatically brought to the pharmacist's attention	1	2	3	4	5	6
Detailed customer receipts are produced	1	2	3	4	5	6
Professional messages can be included on receipts	1	2	3	4	5	6
A bar code reader in the dispensary allows a second check to be made on dispensed items	1	2	3	4	5	6
c) Stock control features						
Overstocks can be identified	1	2	3	4	5	6
The number of out of stock items is minimised	1	2	3	4	5	6

1 = Not important; 2 = Of little importance; 3 = Importance not known; 4 = Important; 5 = Very important; 6 = Don't understand

Total stock evaluation can be provided	1	2	3	4	5	6
Stock ordering is automatic	1	2	3	4	5	6
Money is saved by better stock control	1	2	3	4	5	6
d) Shop management features						
Profit and loss reports are produced	1	2	3	4	5	6
Balance sheets are produced	1	2	3	4	5	6
Sales analyses are produced	1	2	3	4	5	6
Cash reconciliation is given	1	2	3	4	5	6
Product performance is monitored	1	2	3	4	5	6
Invoices are produced	1	2	3	4	5	6
Information from branches can be automatically received at head office if required	1	2	3	4	5	6
e) Security features						
Full audit trails are available	1	2	3	4	5	6
Correct prices are charged	1	2	3	4	5	6
Pilferage can be identified	1	2	3	4	5	6
The system has a lockable cover	1	2	3	4	5	6

11. If you do not have an EPoS system in your pharmacy, what have been the main reasons for this.

....

....

For the final section of the questionnaire, questions are asked about the type of pharmacy and acceptance of EPoS. **Only trend data are being sought and complete confidentiality is guaranteed.** However, if you do not wish to answer any question, please ignore it and move on to the next.

12. What proportion of your turnover is shop and what proportion is dispensary?

Dispensary %

Shop %

13. If you do NOT have an EPoS system in the pharmacy, are you likely to buy one?

I will definitely buy a system	1
I am likely to buy a system	2
I don't know enough about EPoS to make a decision	3
I am unlikely to buy a system	4
I will definitely NOT buy a system	5

14. What price would you consider reasonable for an EPoS system?

£............

15. The following 10 features could form an ideal EPoS system for a pharmacy. Would you please rank each feature in order of importance with 1 as the most important down to 10 as the least important.

Increased profitability ....
Increased cost savings ....
Reduction of stock holding ....
Totally automatic ordering ....
Identification of slow and fast moving lines ......
Reduction of out of stocks ......
Valuable management information ....
Increased security ......
Faster more accurate service ......
Reduced "shrinkage" ....

16. If a system was available with these features, would you be likely to buy in the next 12 months?

NO	1
YES	2
UNSURE	3

17. What price would you consider reasonable for such a system?

Less than £3000	1
£3000 - £3999	2
£4000 - £4999	3
£5000 - £5999	4
£6000 - £6999	5
£7000 - £7999	6
£8000 - £8999	7
More than £9000	8

Once again thank you very much for your co-operation.
Yours sincerely,

Rebecca Boakes