A REPORT ON

Patient Non-Adherence

IN IRELAND

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IRISH PHARMACY UNION

The voice of community pharmacy

Pfizer

Irish Patients' Association

Contents

Foreword

Pfizer Healthcare Ireland

The statistics in relation to medication non-adherence make for stark reading. Non-adherence is costing EU governments an estimated €125 billion annually and contributing to the premature deaths of nearly 200,000 Europeans a year.[31]

Non-adherence can have a profound impact for patients as many will not achieve optimal management of their disease and may continue to experience complications or progression of their disease. It also has major cost implications as much expenditure is in effect being "wasted" on medicines that are not being taken at all or taken incorrectly.

This report aims to provide an insight into the main drivers of, and barriers to, patient adherence in Ireland.

The main reason for not taking medication was simple forgetfulness which was cited by 71% of those surveyed; followed by lack of belief that the medication was needed (20%) and the belief that the condition has improved and hence medication is not needed (16%).

The reasons for non-adherence can be broadly divided into non-intentional (e.g. patient forgot or didn't understand the dosing regimen) to intentional (e.g. didn't feel medication was necessary; was worried about side effects; deliberate dose-stretching to reduce cost). Non-intentional non-adherence is likely to be easier to address through patient reminders and prompts whereas intentional non-adherence requires different strategies.

In times of increased scrutiny of expenditure on medicines, it is important that all stakeholders involved, including healthcare professionals, pharmaceutical companies, patients and their families/carers and policy-makers look at strategies to improve adherence which will result in better health outcomes for patients and potentially reduced cost as disease and illness are better managed.

Mr Paul Reid
Managing Director, Pfizer Healthcare Ireland

Irish Pharmacy Union

Non-adherence to medications undermines healthcare outcomes and also has a significant economic cost. With the growing emphasis in healthcare systems on securing maximum value from spending on medicines, it is imperative that patients take their medicines as directed.

While finance and health budgets are major concerns, the key beneficiaries of better medication adherence are the patients themselves. Adherence to medication results in better health outcomes for patients and in turn an improved quality of life.

Pharmacists are among the most accessible and most consulted healthcare professionals and are therefore ideally placed to tackle non-adherence to medication, by educating patients, helping them make informed decisions about their medicines and supporting them in adhering to their prescribed therapy, thus ensuring that, by taking the right medicines in the right way at the right time, patients achieve optimum benefit.

Services to improve medication adherence have the potential to improve patients' health and quality of life and reduce healthcare costs. The development of pharmacy-based services including Medicine Use Reviews and New Medicine Services can improve healthcare outcomes and assist pharmacists in addressing patient non-adherence to medications. Medication reviews and adherence programmes are part of a wider trend internationally towards expanding the role of pharmacists, in order to improve patients' treatment outcomes, improve their quality of life and save downstream healthcare costs.

This report takes a comprehensive look at the extent and problem of non-adherence to medication in Ireland. The barriers, including social, economic and psychological concerns, are outlined and key solutions are identified.

While the issues addressed in this report are challenging, there is no doubt that a concerted effort by all stakeholders, including patients, healthcare professionals, the pharmaceutical sector and all those involved in healthcare outcomes, can lead to an improvement in adherence levels.

Addressing patient non-adherence to medication is of crucial importance to everyone and this report will assist in raising the required awareness necessary to stimulate the development of a coherent strategy to address the barriers to adherence, and identify and implement tailored policies to ensure long-term compliance.

Rory O' Donnell MPSI
President, Irish Pharmacy Union

Irish Patients' Association

It is very likely that one of our generations' strengths is that we spend a huge amount of our resources collectively and individually on our health, to solve health problems and protect or expand the spaciousness of our health versus all the previous generations known to us.

This report illustrates that patient non-adherence to medicine consumption remains a serious challenge. 18% of respondents in this survey who have a medical condition report to be non-compliant which means that, medicinally at least, their illness will not be managed adequately. In addition, they may become more physically and mentally dependant on family and other carers due to their deteriorating conditions, quality of life can be adversely affected, they may die prematurely and yes, because prescribed medicines were not taken appropriately, they may become a greater cost burden to the healthcare system, consuming resources that could be better spent on the needs of others.

According to a recent study* the consequences of non-adherence not only includes suboptimal clinical outcomes but also avoidable healthcare expenditure. The study demonstrated that each dollar spent on adherence support towards prescribed medicines would reduce overall medical costs by $7 for diabetic patients, $5 for hypercholesterolaemic patients, and $4 for hypertensive patients. As a result, it has been argued that "increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments".

This report marks another step forward in patient safety through creating awareness of the extent and level of non-adherence in the Ireland.

The report and analysis importantly recommend various strategies to assist patients move from being "not always/never" compliant to always taking their medicines as prescribed for their benefit. It suggests a holistic system wide approach to empower patients to accept responsibility and take their medicines appropriately. All relevant stakeholders in patient well-being i.e. the family doctor, the pharmacist, the payer, the policy maker and manufacturer should play a role in promoting the importance of adhering to prescribed medication at every opportunity with the patient. As the message of "Have you washed your hands?" is so important to combat spread of infection, "Are you taking you medicine?" is equally important to support adherence.

Recent research from Dublin City University, "Informing Irish Patients", commissioned by the IPA and funded by the then HIQA interim board, reiterated that "patients should take seriously their responsibility to inform themselves about their health their medications and any other treatments they might be receiving".

As a patient advocate with a passion for embedding a culture of patient safety everywhere, my call to action for patients is: Take your medicines as prescribed! And to health professionals; Always ask your patients "Have you taken your medicine as instructed?"

Stephen McMahon,
CEO Irish Patients' Association

* Nihar R. Desai, Niteesh K. Choudhry. Impediments to Adherence to Post Myocardial Infarction Medications. Curr Cardiol Rep (2013) 15:322.

Executive Summary

This report reviews the existing literature on medication adherence and outlines results from a survey examining adherence in Ireland and the factors which hinder/promote it.

- Ensuring that patients take their medications as prescribed is an increasingly important aspect to effective management
- The World Health Organisation (WHO) reports that when long-term medication is prescribed, approximately 50% of patients fail to adhere to the prescribed regimen[1]
- It is estimated that 20% to 30% of patients do not adhere to medication regimens that are curative or relieve symptoms, and 30% to 40% fail to follow regimens designed to prevent health problems[2]
- Existing literature further confirms that patients find it difficult to adhere to their medication regimens when suffering from multiple conditions
- Non-adherence to medications can have a negative impact on the efficacy of treatments, patient well-being and the use of healthcare resources[1,16-19]
- Patient non-adherence leads to significant costs for healthcare systems[16,24-25]
- Medication non-adherence is costing EU governments an estimated €125 billion and contributing to the premature deaths of nearly 200,000 Europeans annually[31]
- The Irish Platform for Patients' Organisations, Science and Industry (IPPOSI) has identified patient non-compliance and non-adherence as an important issue to highlight, discuss and tackle[2]
- IPPOSI has identified poor medication and treatment compliance as a significant issue within the Irish health system, which affects patient outcomes and costs for the health service[2]
- IPPOSI stated that specific and detailed Irish research was needed to examine the issues behind compliance failure across preventative, chronic and acute treatment[2]
- There are a wide variety of factors which determine patients' adherence. They can be generally categorised as follows:[1,3]
  - Patient-related factors
  - Healthcare system and provider-related factors
  - Treatment-related factors
  - Condition-related factors
  - Cost-related factors
  - Socio-economic & demographic factors

Survey findings

- The study included a nationally representative sample of 1,003 adults aged 16 and over, of whom 283 were suffering from one of a number of significant conditions
- The Irish survey examined adherence using a number of different questions. When asked whether they always take their medication without fail, 18% reported they were not fully adherent all of the time (Figure 3)
- In the demographic sub-analysis, 23% of men and 23% of individuals aged ≤35 yrs tended to miss their medication doses at least once a month (Figure 3)
- Of the conditions requiring regular medication, patients with asthma, diabetes and high cholesterol reported lowest levels of adherence (30% in people with high cholesterol and 31% in people with asthma and diabetes) (Figure 4)
- Of those who sometimes miss their medication, 64% missed it one or more times a week (Figure 6)
- When asked about adherence in general, 29% of subjects surveyed stated that they didn't remember to take their medication (Figure 11). When carers were asked about the management of individuals under their care, 52% said that the person they care for regularly forgets to take their medication (Figure 10)
- The most common reason for missing medications was simple forgetfulness (71% of all respondents). Other reasons included patient perception that they don't need the medication anymore (20%); they feel better (16%); they were anxious about the side effects (5%) or they didn't believe that the medication was effective (4%) (Figure 12)
- Amongst the non-adherent patients, the most common barriers to adherence were the perception that the medication/treatment does not make a difference (44%) or the perception that their treatment will not prevent further deterioration of their condition (39%) (Figure 11). Both these barriers can be addressed by appropriate patient education
- The three factors ranked most important in ensuring people take their medication as prescribed was talking regularly to the doctor (74%); having a good understanding of the illness (42%); and having a good understanding of the medication (40%) (Figure 13)
- 27% of the adult population surveyed had a listed medical condition (Figure 1)
- Of those with a listed condition, 40% had more than one condition; amongst those who were ≥65 yrs of age, 53% suffered from multiple conditions (Table 1)
- Likelihood of non-adherence increased with increasing number of conditions the patient suffered from
- Approximately 43% of patients had a review with a healthcare professional in the past month. The likelihood of recent reviews (within the last month) was associated with patients on medical cards vs. those who were self-funded or on other healthcare schemes (59% vs. 38% and 43%, respectively) (Figure 7a)
- Patients who were reviewed by a healthcare professional regularly tended to be more adherent to their treatment than patients who had longer time intervals between reviews (Figure 8)

- Patient counselling and education have previously been shown to improve adherence[3,4,5,6,7] and indeed, in this survey, patients who had a better understanding of their illness and associated treatment as well as more recent visits to a healthcare professional, demonstrated higher adherence rates than their counterparts (Figure 14)
- Chronic pain was reported as the most frequently reviewed condition by a doctor in the past month (Figure 7b)
- Almost 80% of all patients perceived their medication as effective (Figure 15)
- A majority of all patients (76%) claimed to have no formal method or system to help monitor the usage of their medications (Figure 18)
- Of the 24% of patients who did use an intervention/assistance method to help remember their medication; most used a pillbox (20%) (Figure 18)
- Those who self-funded their medication, patients ≤50 yrs of age and non-adherent patients were least likely to use any prompt to help them remember to take their medication (Figure 18)

Literature analysis

- The literature search identified 47 articles and reports after applying the selection criteria
- Generally there was a high degree of concordance between factors affecting adherence identified in this survey and the literature analysis
- The adherence rate reported in Ireland was higher than that reported in other studies. In other studies, the average rate of adherence was up to 50%, whereas overall, across all demographics and conditions, 82% was reported in this survey. However, amongst specific sub-populations, the rate of non-adherence varied significantly between 23-52%
- Intervention tools most commonly employed, which improved adherence, included improving patient education about the disease/treatment through digital channels (e-channels) or patient literature or simple discussions with the patient; monitoring patient adherence; using reminders; simplifying medication regimens or employing more convenient care methods

Key conclusions

- Adherent patients tend to have regular contact with their healthcare professional
- Regular review of patients and follow-up is essential and is the responsibility of the healthcare provider/management team, including pharmacists. However, it is possible that regular review might be required for some patient populations more than others and in some disease areas more than others
- Older patients tend to have more regular contact with their doctor. There would appear to be a need to similarly motivate younger patients, possibly through digital channels, in order to prevent worsening of their conditions as they age
- "Forgetfulness" was the main self-reported reason for patients missing their medication. This is in line with the World Health Organization's (WHO) finding in its adherence report[1]

- Significant unmet needs identified by the survey and supplemented by the literature analysis include:
  - Patient education regarding their condition and medication
  - Regular follow-up
  - Use of reminders/prompts to improve adherence
  - Simplification of regimens
- The use of memory aids, watch alarms, calendar packs, pillboxes or specialised dose dispensers may be helpful tools to increase adherence to treatment in patients who regularly forget to take their medications[1]
- Healthcare professionals play an important role in emphasising the importance of adherence at each visit
- Patient-related requirements, which can be achieved through regular contact with doctors, pharmacists or nurses include:
  - Need to understand the illness
  - Need to discuss concerns about medication with a healthcare professional
  - Need to understand how medication works
  - Need support from family/carer to help remember medication
  - Need support from pharmacists
  - Need other support to remember medication
  - Need practical advice on how to use devices correctly
  - Need support from patient groups
- Doctors and pharmacists can take a very active and important role in promoting and maintaining patient adherence
- Improving adherence can help save costs for the healthcare system overall. Payers can benefit greatly from improved adherence in terms of improved productivity of individuals over the longer term and reduced long-term care costs as disease progression is slowed and patients experience fewer complications and recurrent episodes

1 Introduction

Medication is often the first choice for medical intervention of chronic and most acute diseases. Ensuring that patients take their medications as prescribed is an increasingly important aspect to effective management. Adherence has been defined as the "active, voluntary, and collaborative involvement of the patient in a mutually acceptable course of behaviour to produce a therapeutic result".[8] The lack of adherence to prescribed therapies is termed "medication non-adherence."

Approximately 91% of adults aged between 57-85 yrs and older take at least one prescription drug a day, and 29% take five or more medications on a regular basis.[9] The issuing of a prescription is the first step towards safe and high-quality pharmacotherapy; however, in one study, 20% of breast cancer patients had stopped filling their prescription at one year; this rose to 50% at five years which would have had a significant impact on survival rates.[2] The WHO reports that when long-term medication is prescribed, 50% of patients fail to adhere to the prescribed regimen.[1] Capgemini Consulting carried out a survey in order to examine adherence across the United States and Europe, which revealed an average adherence rate of 69% for first filling of prescription, falling off to 43% from first filling of prescription to continuous refill after six months.[3] Given the increasing prevalence of chronic diseases (e.g. diabetes, allergies and cardiovascular or degenerative diseases), which require long-term treatments, the problem of non-adherence to therapy has been identified as a major problem facing medical practice.

Another recent adherence survey, carried out by Booz & Company, demonstrated that non-adherence to therapy is a common and significant problem in healthcare.[10] Existing literature further confirms that patients find it difficult to adhere to their medication regimens when suffering from a number of different conditions. For example, research indicates patients with hypertension take only 50% to 70% of the prescribed doses of their antihypertensive medications and up to 50% of patients discontinue their treatment within the first year. In addition, up to 75% of patients do not achieve target blood pressure (BP).[11] A literature review of patients on antidepressants demonstrated that almost half prematurely discontinued therapy within six months of initiation.[12] A meta-analysis demonstrated that medication non-adherence rates in heart failure patients range typically from 40% to 60%, with some studies reporting values as extreme as 10% to 92%.[13,14] Although it is well known that antidiabetic, antihypertensive, and lipid-lowering therapies significantly reduce the risk of ischaemic events, long-term adherence to these medications is poor even among patients who have already experienced a cardiovascular event.[15]

The Irish Platform for Patients' Organisations, Science and Industry (IPPOSI) has identified patient non-compliance and non-adherence as an important issue to highlight, discuss and tackle.[2] On June 27th, 2013, IPPOSI held a roundtable meeting entitled "*A Focus on Patient Compliance & Adherence*".[2] This roundtable identified poor medication and treatment compliance as a significant issue within the Irish health system, which affects patient outcomes and costs for the health service. Arising from the roundtable discussion, IPPOSI identified a number of key recommendations and consensus points. Principal amongst these recommendations was the need for a specific body or working group to be formed to address the issue of medication and treatment compliance in Ireland.[2] Furthermore, there was also agreement that specific and detailed Irish research was needed to examine the issues behind compliance failure across preventative, chronic and acute treatment.[2]

Non-adherence to medication can have a negative impact on the efficacy of treatments, patient well-being and the use of healthcare resources.[1,16-19] Non-adherent diabetes and heart disease patients have been estimated to have significantly higher mortality rates than adherent patients.[16] This may be because medication non-adherence contributes to many patients failing to achieve targets e.g. those who are prescribed statins.[17] One study suggests that an estimated 86,000 premature deaths per year could potentially be avoided among hypertensive patients in the United States, with appropriate and optimally used medication.[18] Another study found that the risk of hospitalisation, rehospitalisation, and premature death among non-adherent patients is 5.4 times higher in hypertension, 2.8 times higher in dyslipidaemia, and 1.5 times higher in heart disease compared with adherent patients.[19] Furthermore, the WHO report stated that poor adherence to recognised standards of care is the principal cause of development of complications of diabetes and their associated individual, societal and economic costs.[1]

The negative effects on outcomes are not restricted to cardiovascular or metabolic disease. An Irish study found that poor adherence with osteoporosis medications resulted in around a 50% reduction in the potential benefits observed in clinical trials and a doubling of the cost per quality-adjusted life year (QALY) gained from these medications.[20] In addition, health-related outcomes (poor control, exacerbations, hospitalisations, lung function decline), associated with severe asthma, are often worsened by non-adherence.[21] A study of HIV patients revealed adherence levels less than 95% independently predicted viral failure, hospital admissions and opportunistic infections.[22]

Costs to the healthcare system

Poor adherence is also linked to adverse patient outcomes leading to increased consumption of healthcare resources.[1,15,24,25] Medication non-adherence is costing EU governments an estimated €125 billion and contributing to the premature deaths of nearly 200,000 Europeans annually.[31] In the United States, non-adherence has been estimated to cost the healthcare system between $100 billion and $289 billion annually.[23] In a United States study of patients with heart failure, it is acknowledged that medication adherence rates within this population vary widely. The suboptimal drug use in these patients is associated with an increase in unplanned hospital admissions, increased mortality and morbidity rates, accompanied by additional healthcare-related costs.[24] In addition, of all medication-related hospitalisations that occur in the United States, between one-third and two-thirds are the result of poor medication adherence[15] and as much as a 40% increase in nursing home admissions.[25]

The direct costs of complications attributable to poor control of diabetes are 3–4 times higher than those of good control.[1] Another study in diabetic patients found that hospitalisation rates were significantly lower for patients with high medication adherence.[26] The UK's National Institute for Clinical Excellence (NICE) produced guidelines for patient adherence in which it estimated that the cost of hospital admissions resulting from patients not taking medications as prescribed was between £36million - £196million in 2006-2007.[27]

According to the WHO, improving adherence to medical therapy for conditions of hypertension, hyperlipidaemia, and diabetes would yield very substantial health and economic benefits.[1,15] However, in order to achieve this, the causes of non-adherence must be understood.

Factors affecting adherence

There are a wide variety of factors which determine patients' adherence. They can be broadly categorised as follows:[1]

- Patient-related factors
- Healthcare system and provider-related factors
- Treatment-related factors
- Condition-related factors
- Socio-economic & demographic factors

The WHO has used this classification to sub-divide the factors they identified in their report. In order to simplify the findings in the current Irish survey, we have also sub-divided the factors we found in this study in a similar fashion. However, it is very important to note that these factors represent overlapping issues affecting adherence.

2 Survey Findings

2.1 Literature search

The literature search identified 47 articles after applying certain selection criteria (Appendix 1). Both randomised and non-randomised studies were included as well as systematic reviews and surveys (Appendix 1).

2.2 Overview of survey findings

2.2.1 Illness incidence

The survey demonstrated that 27% (281) of all participants (30% women and 25% of men) suffer from a listed condition in the questionnaire (Figure 1). 212 of 281 patients with a listed condition (75%) were prescribed medication by their doctor. The incidence of illness varied among the age groups with the highest frequency being reported in Irish adults ≥50 yrs of age. Furthermore, patients in this age group were more likely to be suffering from multiple conditions than those outside this age group (Table 1).

Figure 1: Incidence of illness

Q Do you suffer from any of the following?

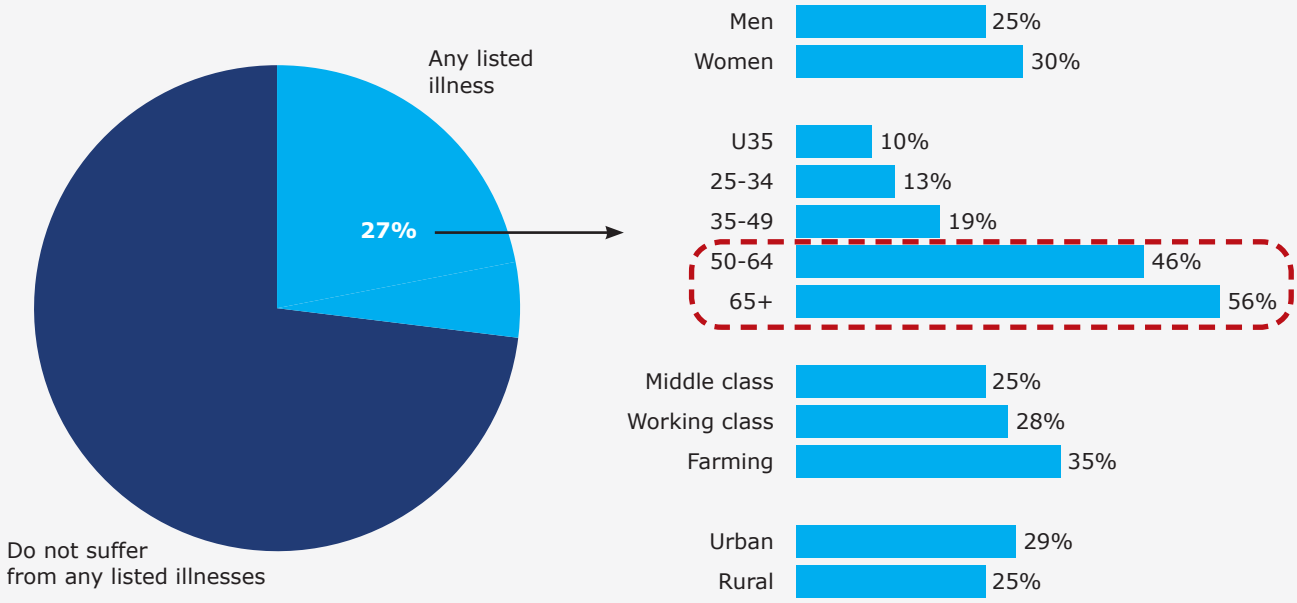


Table 1: Number of Conditions Experienced by Age

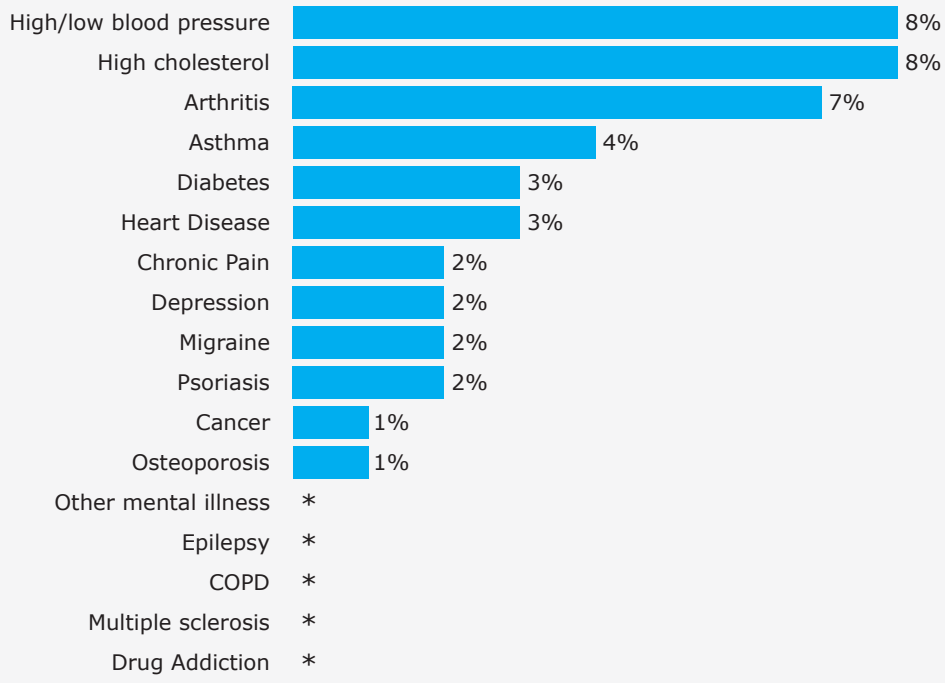
	All Adults	Under 35	35-49	50-64	65+
Base	1003	357	273	218	155
	%	%	%	%	%
Any Condition	27	11	19	46	56
One Condition	17	8	14	27	27
Two Conditions	6	2	4	10	13
Three Conditions	3	1	1	6	11
4+ Conditions	2	–	1	3	5
Single/All	60%	73%	71%	59%	47%
Multiple/All	40%	27%	29%	41%	53%

Elevated blood pressure and hypercholesterolemia were the most common conditions reported by the participants. Many people suffered from multiple conditions; 27% of 1,003 subjects suffered from at least one condition. Of those 27% (n=281): 17% suffered from just one condition (60% of 281 subjects) and 11% suffered from two or more conditions (40% of 281 subjects) (Table 1).

Generally, a significant overlap was found between heart disease, hypercholesterolemia and blood pressure. Those with arthritis, asthma, infections, depression and cancer were less likely to have a second condition (data not shown).

Figure 2: Frequency of conditions identified (many suffered from multiple conditions)

Q Do you suffer from any of the following?



* Indicates less than 0.5%

27% suffer with any of these conditions

2.3 Adherence overview

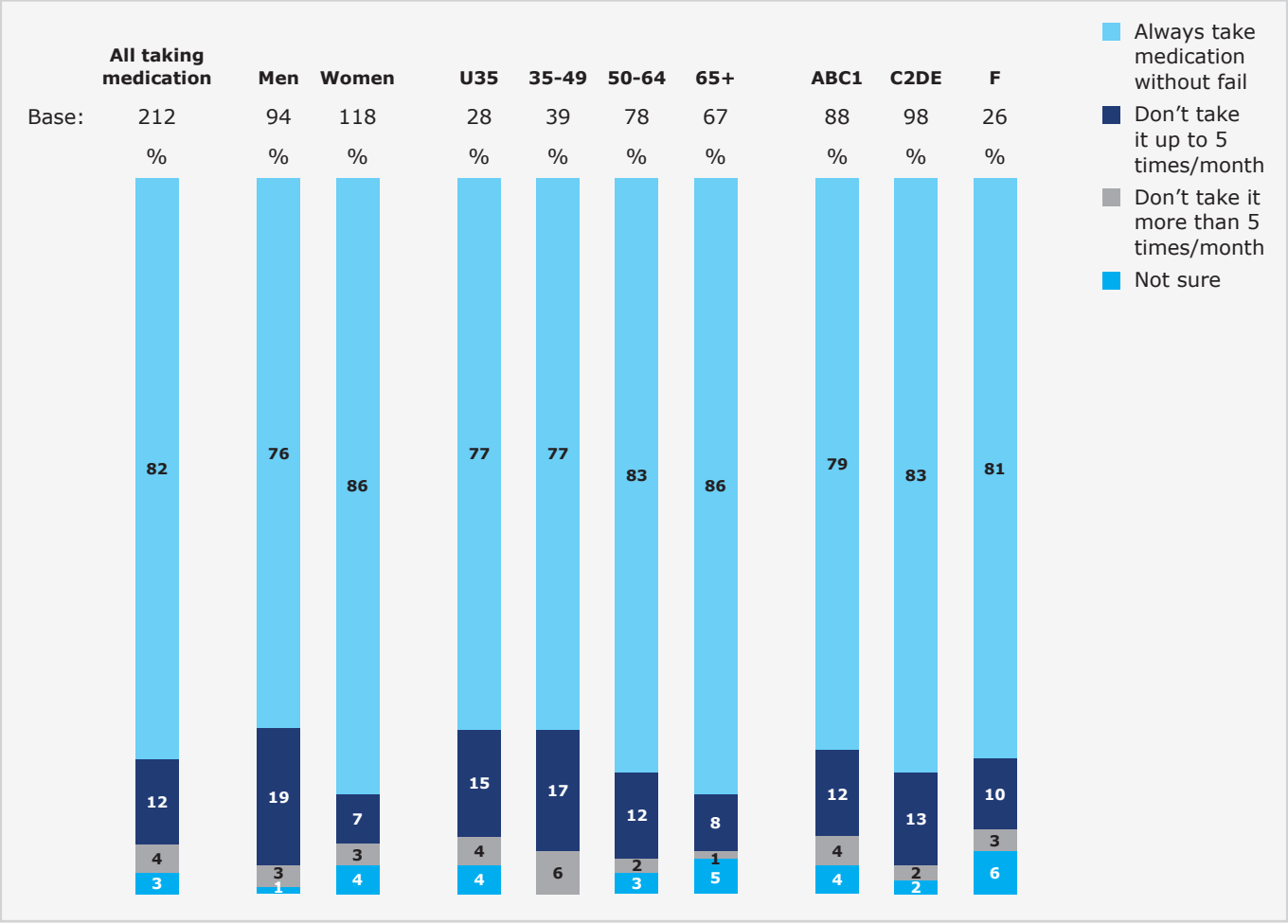
2.3.1 Overall adherence rates

The survey demonstrated that the adherence rate in all patients regardless of their condition was 82%; 18% of the study population were non-adherent. Men were slightly less likely to be adherent than women. There was a tendency towards increasing adherence rate with age, with patients aged ≤35 yrs reporting the highest rate of non-adherence at 23% (Figure 3) even though this patient demographic was less likely to suffer from a chronic medical condition.

Figure 3: Adherence overview for any condition (n=281)

Q1 Are you prescribed regular medication (defined prescribed any medication by your doctor to be taken regularly)?;

Q2 Thinking about a typical month, on how many occasions if any, might you not fully follow your prescribed course of treatment?

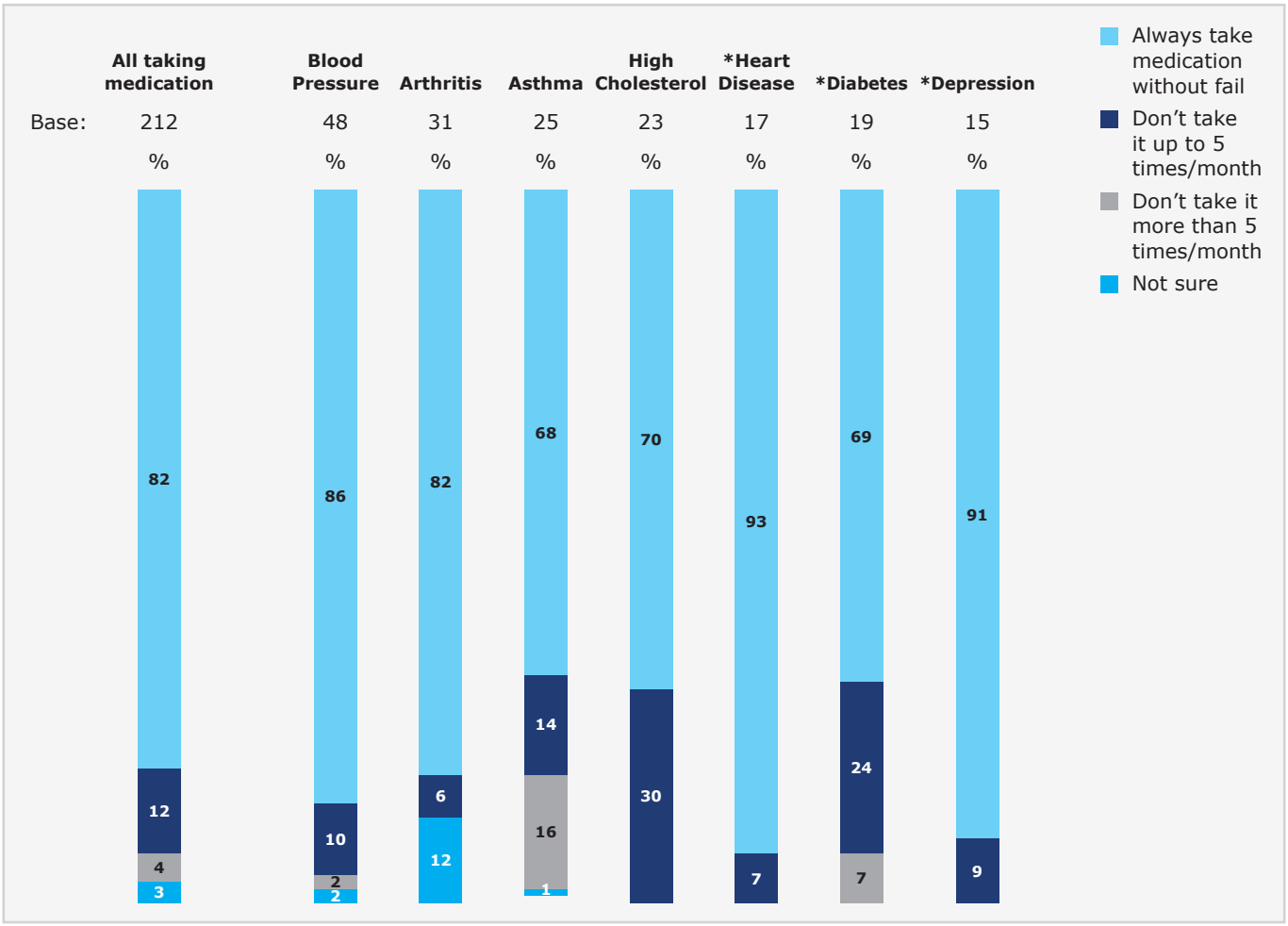


When adherence was examined for a specific condition, patients with heart disease and depression appeared to have the highest rate of adherence (93% and 91% respectively). However, the reported rate of non-adherence was 31% in patients with asthma, 31% in patients with diabetes and 30% in those with high cholesterol (Figure 4). Notably, the survey did not distinguish between type 1 and type 2 diabetes.

Figure 4: Adherence overview for specific conditions (n=281)

Q1 And for which, if any of these conditions, are you on medication?;

Q2 Thinking about a typical month, on how many occasions if any, might you not fully follow your prescribed course of treatment?

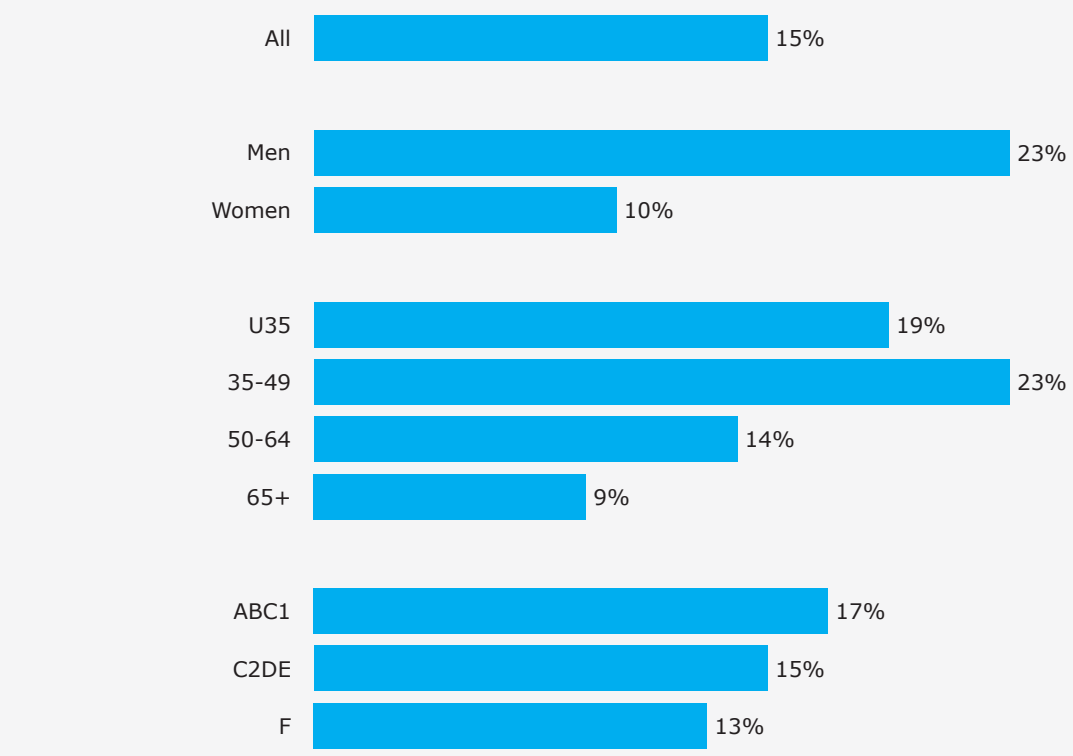


* Small base

When asked whether they take their medications as prescribed, 15% of those prescribed medication admitted to not being completely adherent to their prescription instructions at least once a month (Figure 5). Significantly more men generally failed to follow treatment instructions properly than women.

Figure 5: Proportion of patients not fully adherent at least once a month

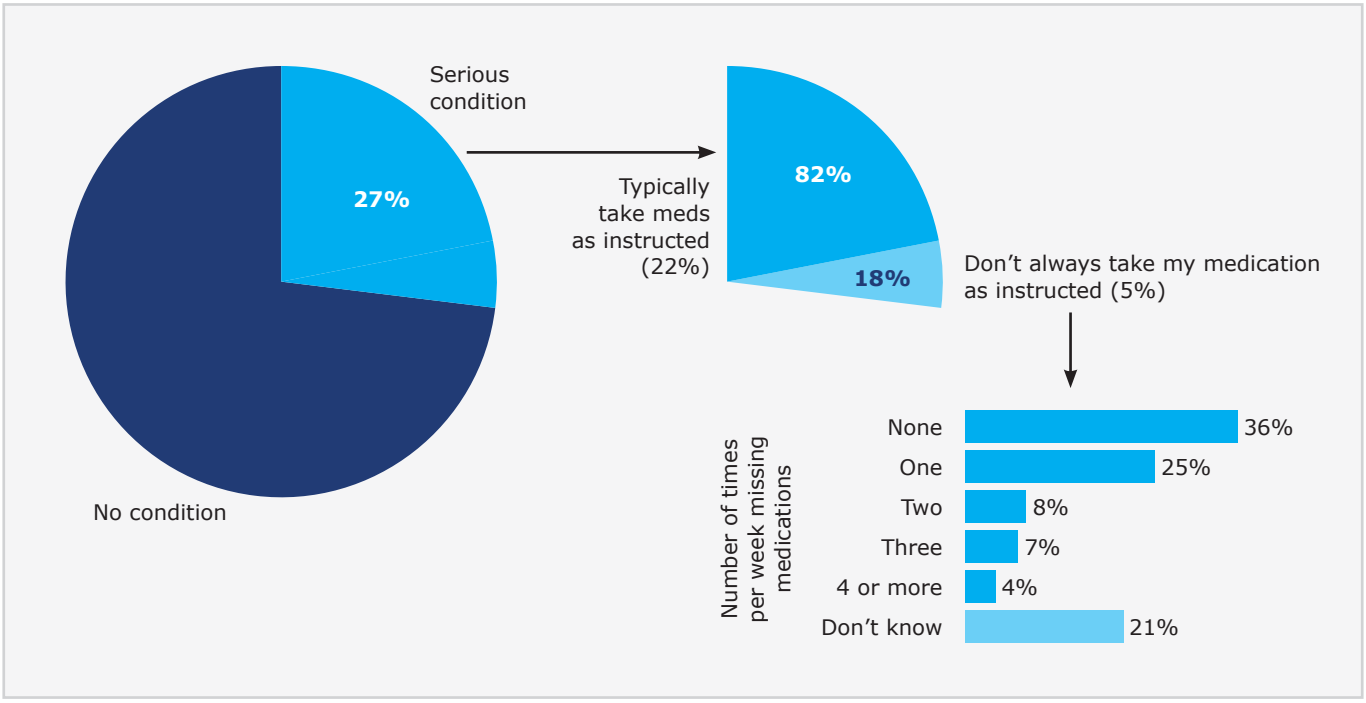
Q Thinking about a typical month, on how many occasions, if any, might you not fully follow your prescribed course of treatment?



Of those patients with a medical condition on prescribed medication, 18% admitted to not taking their medicines as instructed. Of those who don't always take their medication as instructed, 64% were missing doses at least once a week (Figure 6).

Figure 6: Proportion of patients not fully adherent at least once a week

Q On how many days in a typical week might you miss taking your prescribed medication as instructed on average?



2.4 Factors affecting adherence

2.4.1 Overview of adherence factors from the literature analysis

Factors affecting adherence identified by the literature analysis are summarised in Table 2. An overview of the factors identified in this survey are summarised in Table 3. Generally there was a high degree of concordance between factors identified in this survey and the literature analysis.

Table 2: Adherent vs. Non-adherent Patient Characteristics from the Literature Analysis

Adherent	Non-adherent
Disease related factors	
• Type of illness • Enlarged prostate; cancer; cardiac problems; and Parkinson's disease (adherence rate ≥60%)[3] • Severe illness[3,44,28] • Higher level of disability (physical, psychological, social and vocational) and higher rate of disease progression[3] • Multiple disorders/comorbidities[14,24,53]	• Type of illness • Depression; pain; bronchitis; GERD; HIV; incontinence; arthritis (adherence rate 50-59%)[3] • Lung condition[48] • Multiple disorders/comorbidities[53]
Healthcare system- and providers- (management team) related factors	
• Patient/caregiver support[48] • Good personal connection with a doctor and/or pharmacist[1,3,15,48,67] • Quality, duration and frequency of doctor/patient contact[67] • Patient satisfaction with their healthcare	• Doctor/patient poor communication & relationship[1,3,15,67] • Lack of quality, duration and frequency of doctor/patient contact[67] • Lack of understanding of patient needs[3] • Ineffective communication about adverse events[15] • Lack of continuity with the same provider[15] • Limited access to care (e.g. short visit times)[15] • Non-availability of medical or social support to cope with side effects[1] • Lack of patient satisfaction with their healthcare[67]
Patient related factors	
• Better information and understanding of illness[29,48,61] • Patient involvement in decision making[67] • Better communication with healthcare provider[46,48,67] • Patient satisfaction with treatment[62]	• Low understanding of illness[3,15] • Lack of involvement in treatment decision[15,67] • Forgetting medication[3,48]
Treatment related factors	
• Good drug effectiveness and tolerability[3] • Positive perception of treatment[46,62]	• Complexity of the medical regimen and frequent changes to treatment[1,3,51,53] • Duration of treatment and previous treatment failure[1,3,63] • Poor drug effectiveness and/or tolerability[3,44,51,65] • Perceptions of diagnosis and health risks associated with disease and treatment[1,3,46,48] • Cannot remember why medication is needed[1,11,68,62] • Route of administration[3]
Cost-related factors	
• Afford medication[3,48]	• Cannot afford medication[3,48,51]
Socio-economic factors	
• Older age[48,53] • Female patients[61,63]	• Younger age[48] • Male patients[61,63]

2.4.2 Characteristics of adherent/non-adherent groups from the survey

Table 3 outlines the characteristics of adherent vs. non-adherent patients as identified in this survey.

Table 3: Adherent vs. Non-adherent Patient Characteristics from the Survey

Adherent	Non-adherent
Disease related factors	
• Single condition • Those with heart disease, depression or blood pressure, psoriasis, and migraine	• Multiple conditions • Those with arthritis, hypercholesterolaemia, asthma, and diabetes; long-term blood pressure
Healthcare system- and providers- (management team) related factors	
• Recent medicine review with the doctor • Talk regularly to the doctor	• Long lead times between reviews with doctor • Talk regularly to pharmacist
Patient related factors	
• Better understanding of illness • Using a reminder/prompt	• Poor understanding of illness • Not using a reminder/prompt • Worry about illness getting worse
Treatment related factors	
• Confident about their medication	• Don't feel better with medication • Concerns regarding side effects • Medicine doesn't address symptoms adequately • Cannot remember why medication is needed
Cost-related factors	
• Medical card	• Private patients • Healthcare schemes
Socio-economic factors	
• Female, less affluent, more likely to have a family support structure • Older age	• Male, affluent, lack of conventional family support structure • Younger age

2.4.3 Condition-related factors

Approximately 60% of 281 patients with a condition in the survey suffered from at least one condition and over 40% suffered from two conditions or more (Table 1). The likelihood of suffering from more than one condition increased with age; in fact 53% of subjects ≥65 yrs reported suffering from multiple conditions (Table 1). The survey data demonstrated that adherence correlates negatively with increasing number of conditions, 59% of those with one condition claim to take their medication without fail dropping to only 15% in those with three conditions (data not shown).

2.4.4 Healthcare system and provider-related factors

2.4.4.1 Frequency of involvement with healthcare professionals and adherence

Figure 7a illustrates recent review dates of patients with their respective healthcare professionals. Approximately 43% of patients had a review with a healthcare professional in the past month. More recent reviews were more likely for patients on medical cards vs. those who were self-funded or on other healthcare schemes (59% vs. 38% and 43% respectively) (Figure 7a).

Chronic pain was the most frequently reviewed condition by doctors (Figure 7b). Patients with conditions such as high cholesterol, asthma or migraine were notably less likely to have had a recent review with their doctor (Figure 7b).

Figure 7a: Latest review/discussion of any condition with doctor

Q When did you last discuss/review your condition with your doctor?

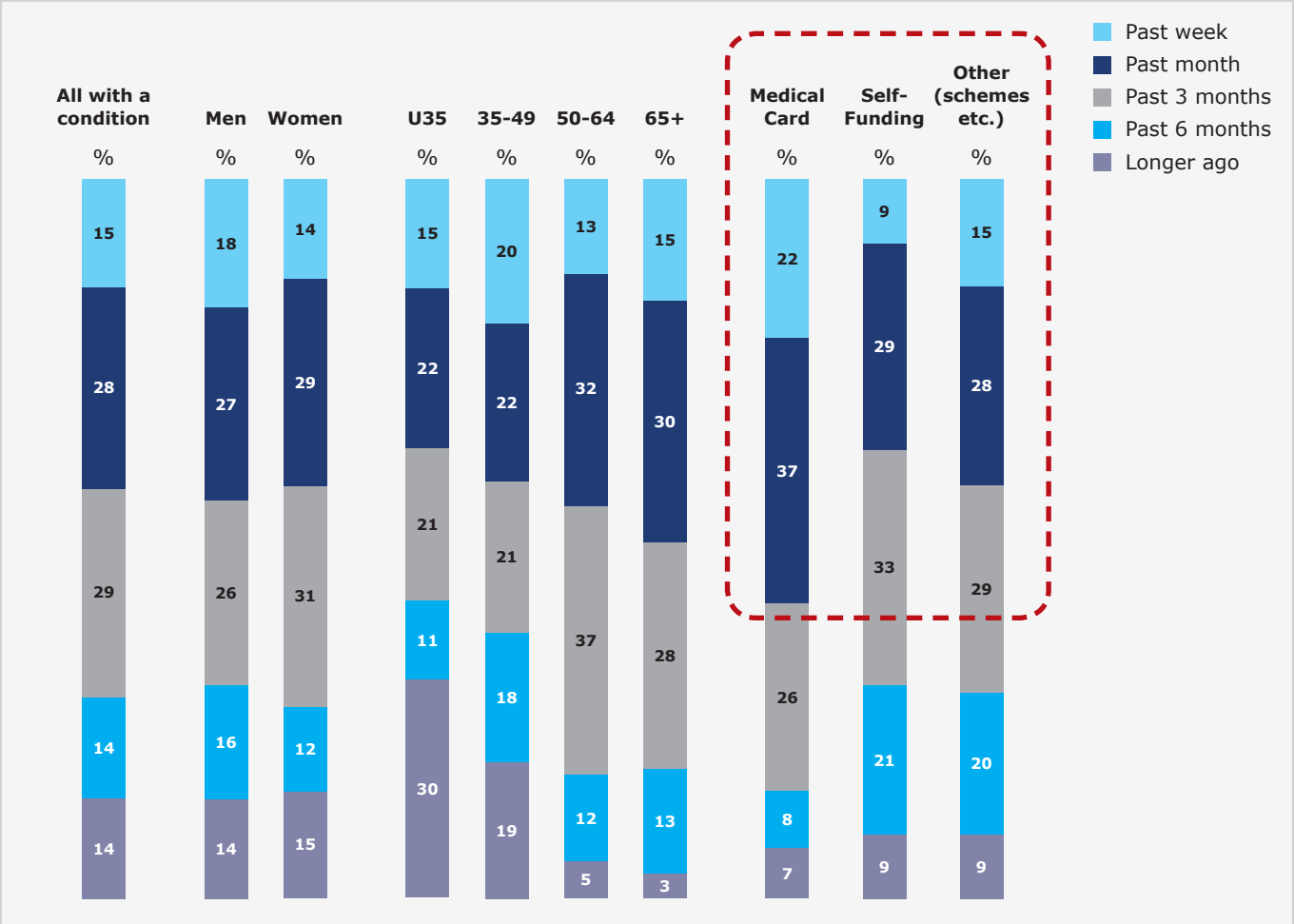
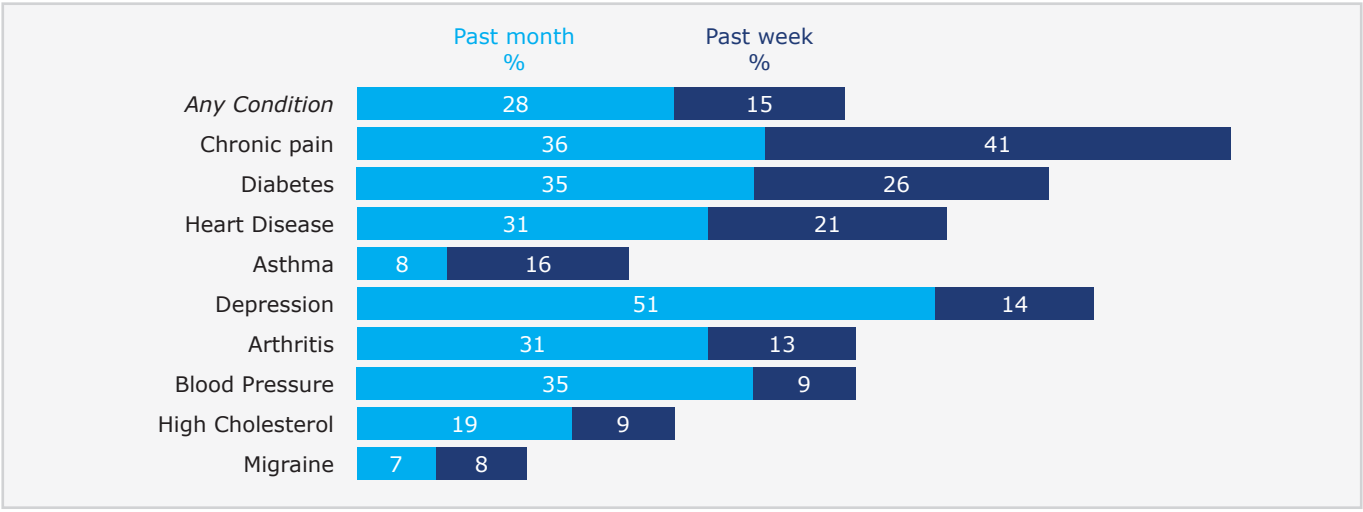


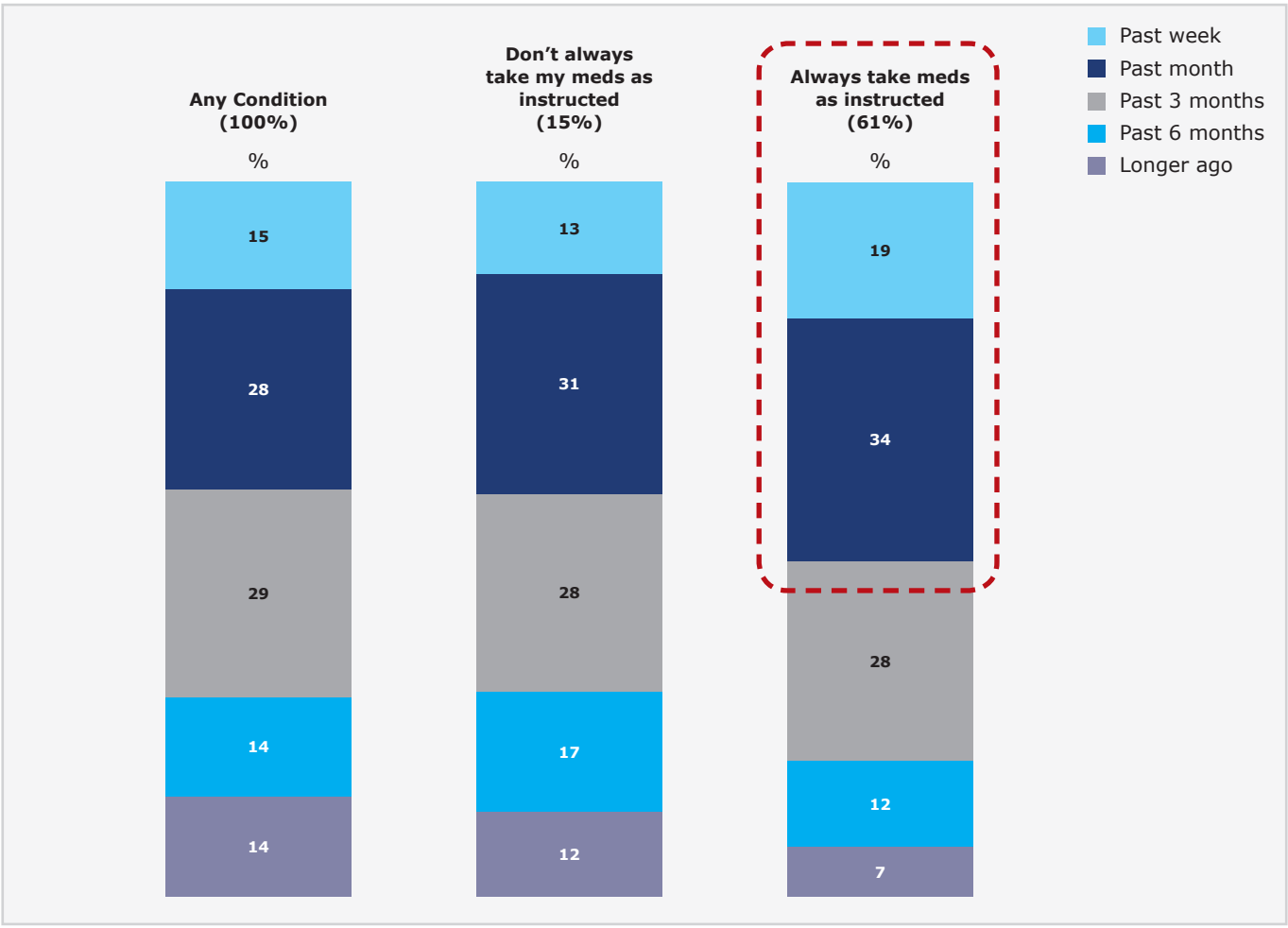
Figure 7b: Latest review/discussion of specific conditions with doctor



Patients who were reviewed by healthcare professionals within the last month tended to be more adherent to their treatment than patients who had longer time intervals between reviews (Figure 8).

Figure 8: Recent review/discussion of condition with doctor and adherence (for any condition)

Q When did you last discuss/review your condition with your doctor?

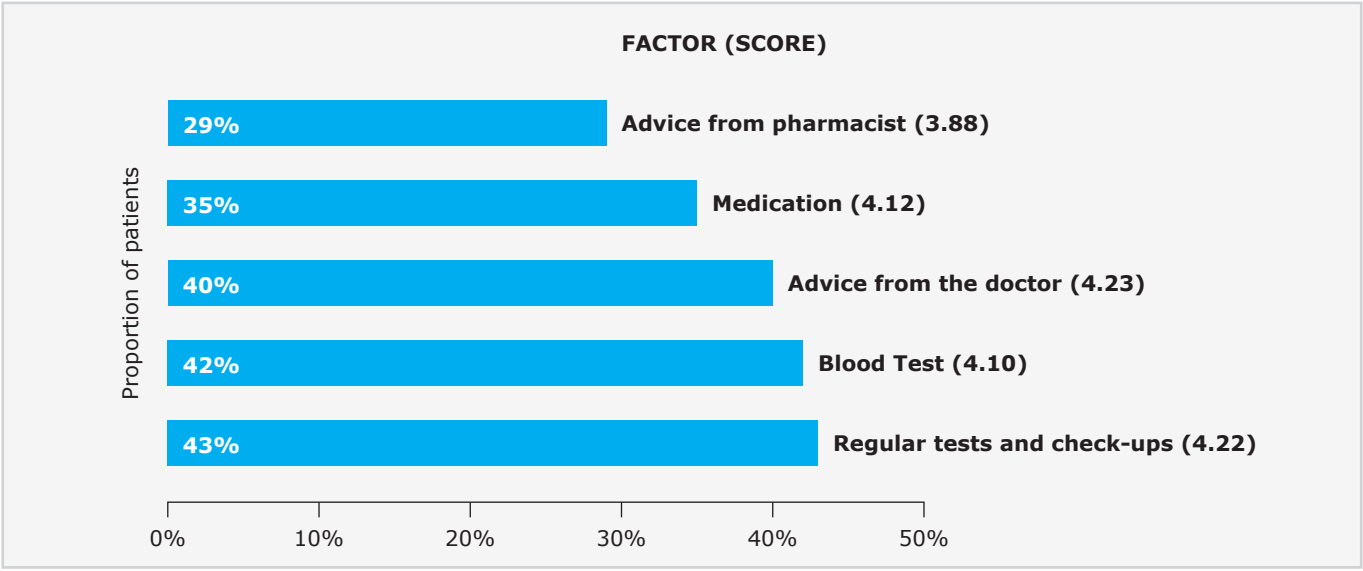


2.4.4.2 Management strategies/patient review/follow-ups/check ups

The patients surveyed on regular medication provided their view of the extent of contribution of various factors to the perceived effectiveness of the treatment of their condition. The results are demonstrated in Figure 9. Regular check-ups and advice from the doctor scored highest whereas advice from pharmacists scored lower in terms of factors affecting perceived effectiveness of treatment.

Figure 9: Factors affecting patients' perceived effectiveness of treatment of their condition

Q How well or badly do you feel the following aspects help you to treat your condition?



Percentage represents percentage of patients scoring these factors a score of 1-5.

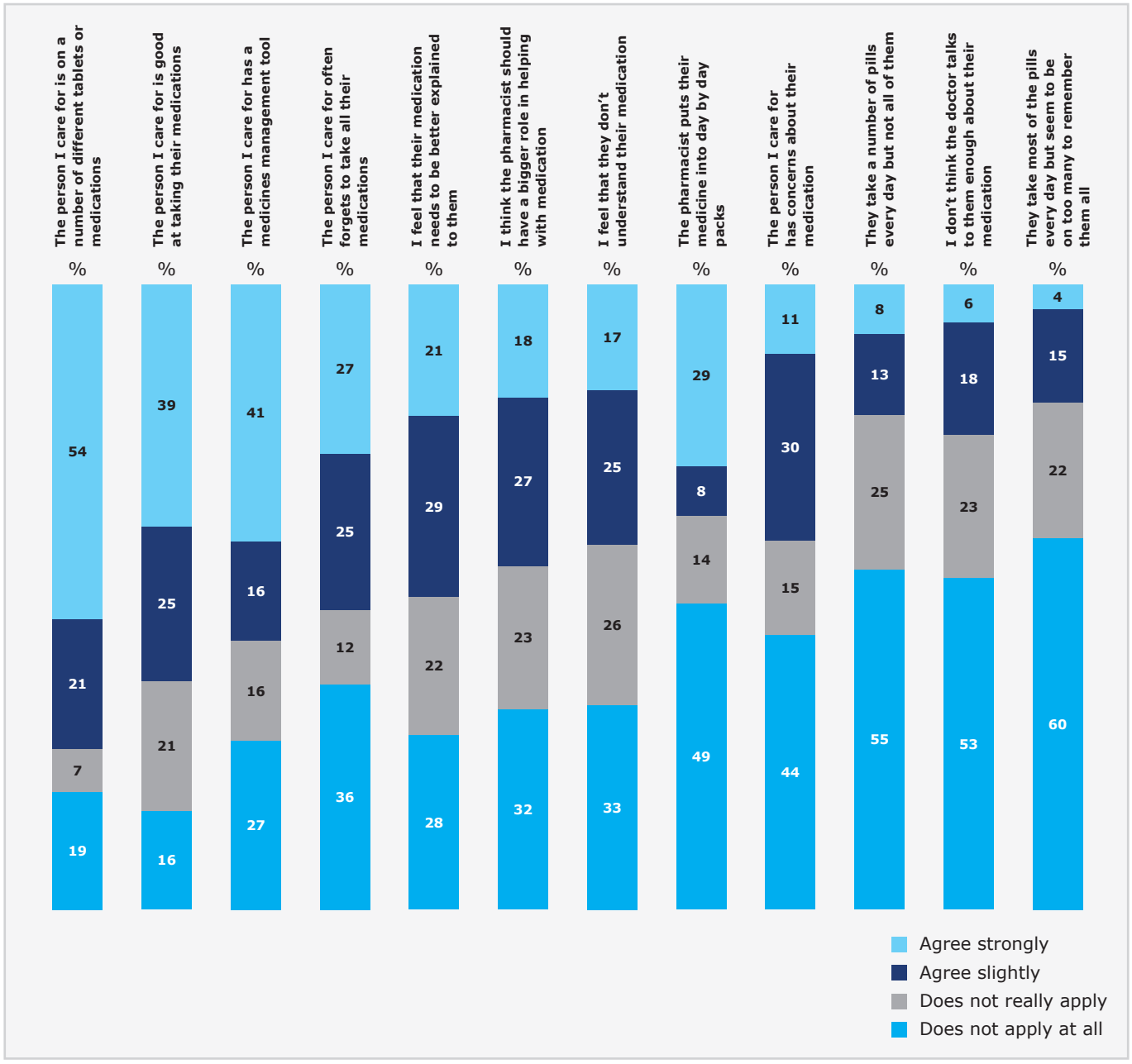
2.4.4.3 A view of patient adherence by carers

A total of 7% of the subjects surveyed were also carers, mainly for elderly relatives. Additional questions were asked of the carers regarding their attitudes towards the individuals in their care.

The majority of carers (75%) reported that the person they care for was on a complex treatment regimen.

52% of carers claimed that the person they care for regularly forgets to take all their medication. 39% admitted that their patients are good at taking their medication regularly and 57% stated that the patients they care for have a tool to help them remember their medicines. 42% of the carers felt the person they care for does not fully understand their medication regimen (Figure 10).

Figure 10: Attitude of carers



2.4.5 Patient-related factors

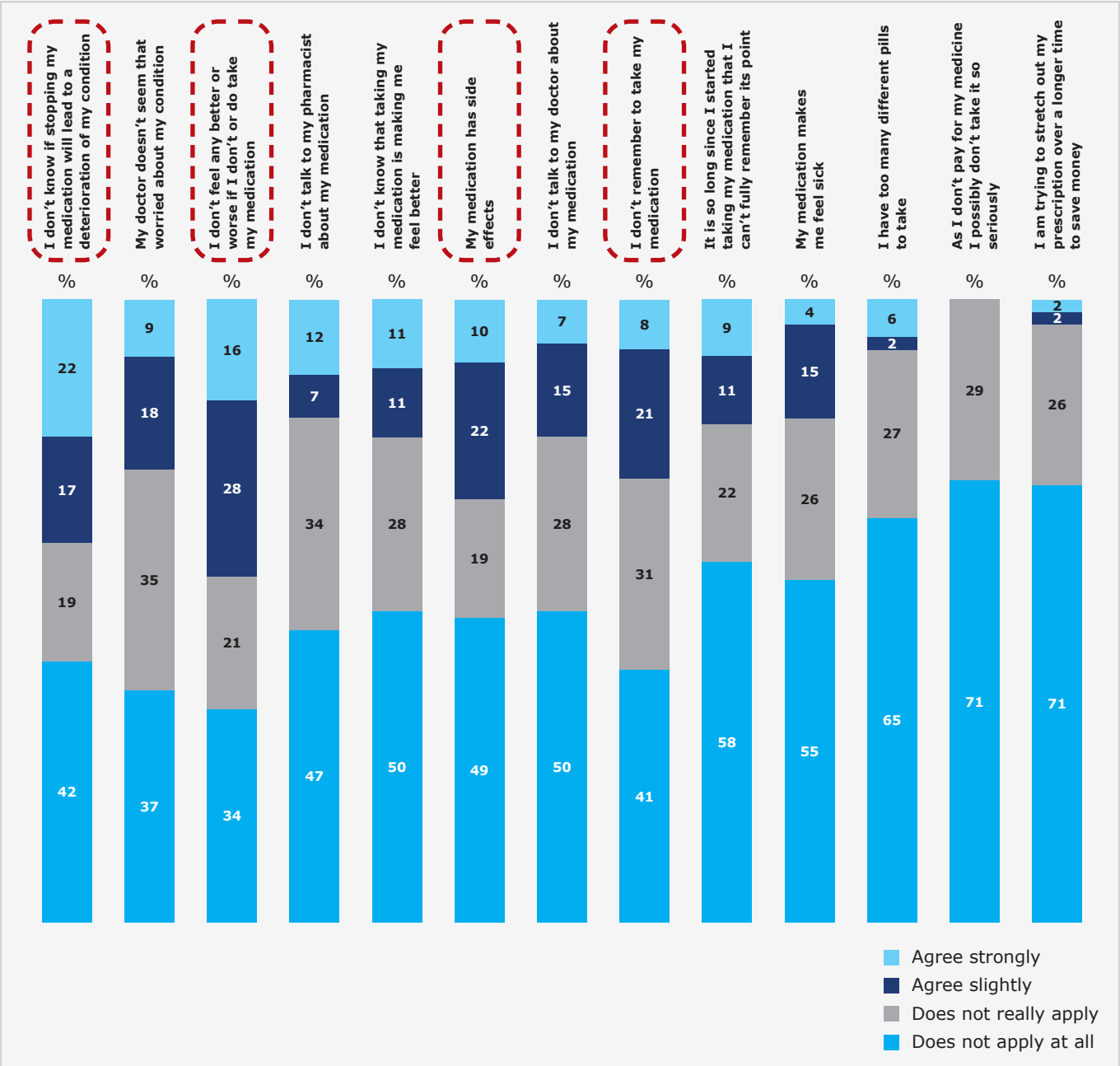
2.4.5.1 Patient-reported factors affecting adherence

Patient-reported barriers to adherence are shown in Figure 11.

Amongst non-adherent patients, 29% reported that not remembering to take medication is a barrier to adherence. The most commonly reported barrier to adherence was the perception that taking their medication didn't make them feel any better or worse (44%) and the perception that their treatment will not prevent further deterioration of their condition (39%) (Figure 11).

Figure 11: Patient-reported barriers to adherence among non-adherent patients

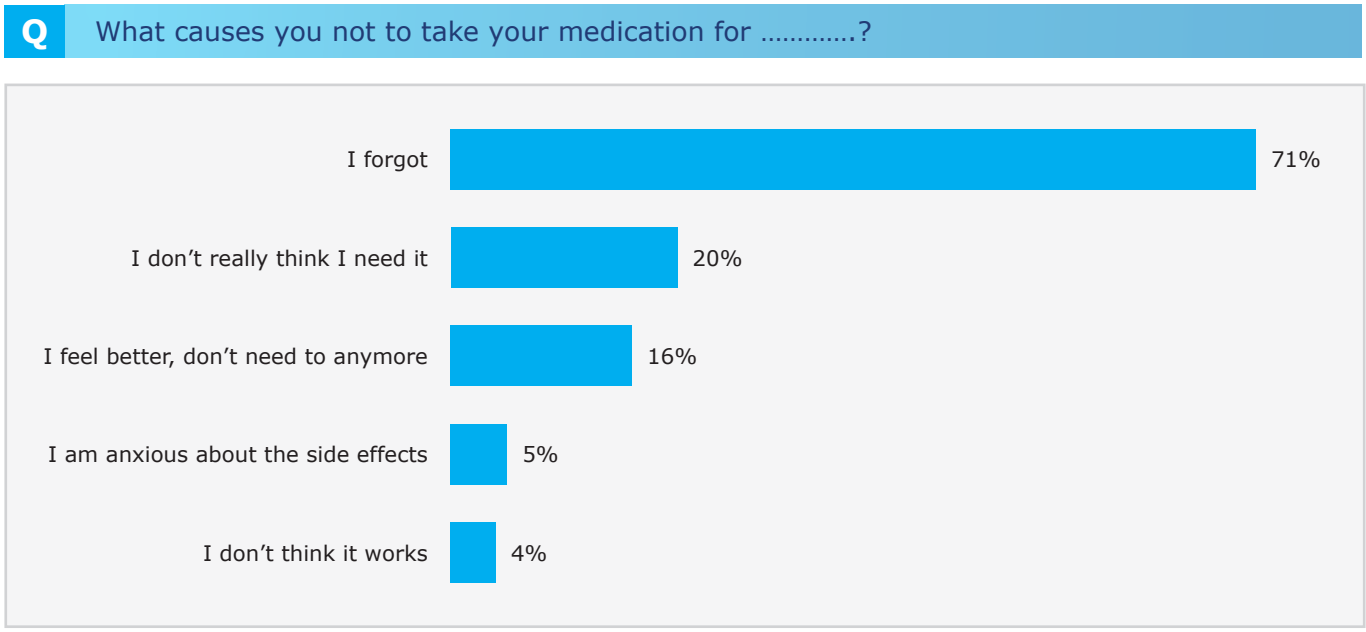
Q Thinking about occasions where you may not fully comply with your prescription, to what extent do the following factors apply to you personally?



2.4.5.2 Patient reasons for missing medication

The most commonly reported reason for missing medications was simple forgetfulness (71% of all respondents). Other reasons included patient perception that they don't need the medication anymore (20%); they felt better (16%); they were anxious about the side effects (5%) or they didn't believe that the medication was effective (4%) (Figure 12).

Figure 12: Patient reasons for missing their medication

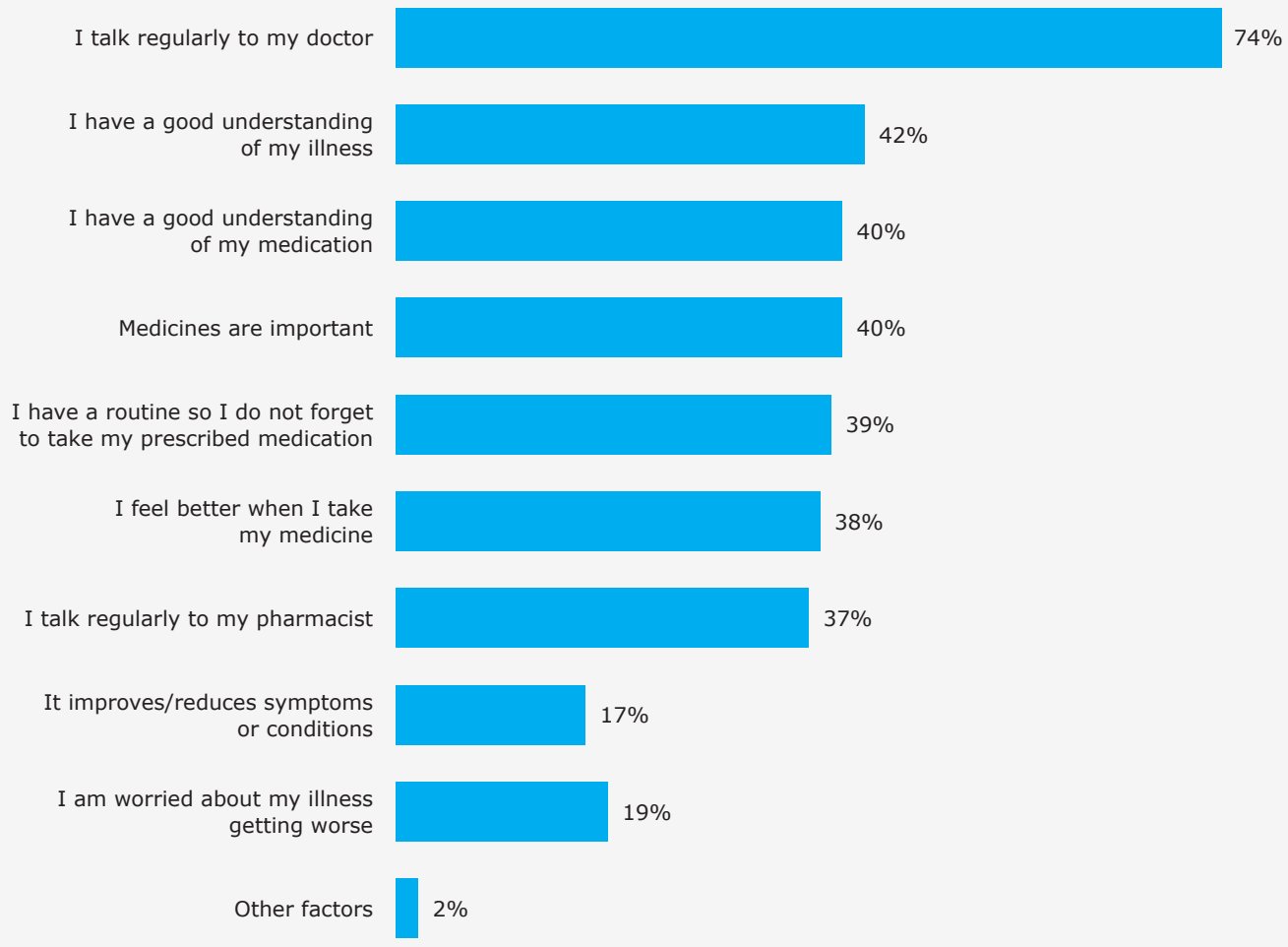


2.4.5.3 Patient factors promoting adherence

Factors promoting adherence are summarised in Figure 13. The three factors ranked most important in ensuring people take their medication were talking regularly to the doctor (74%); having a good understanding of the illness (42%); having a good understanding of the medication (40%). In addition, talking regularly to their pharmacists and having a routine to help them remember to take their medication were also considered important. Worrying about deterioration of the illness was among the lowest rated factors (Figure 13).

Figure 13: Patient-rated factors affecting adherence

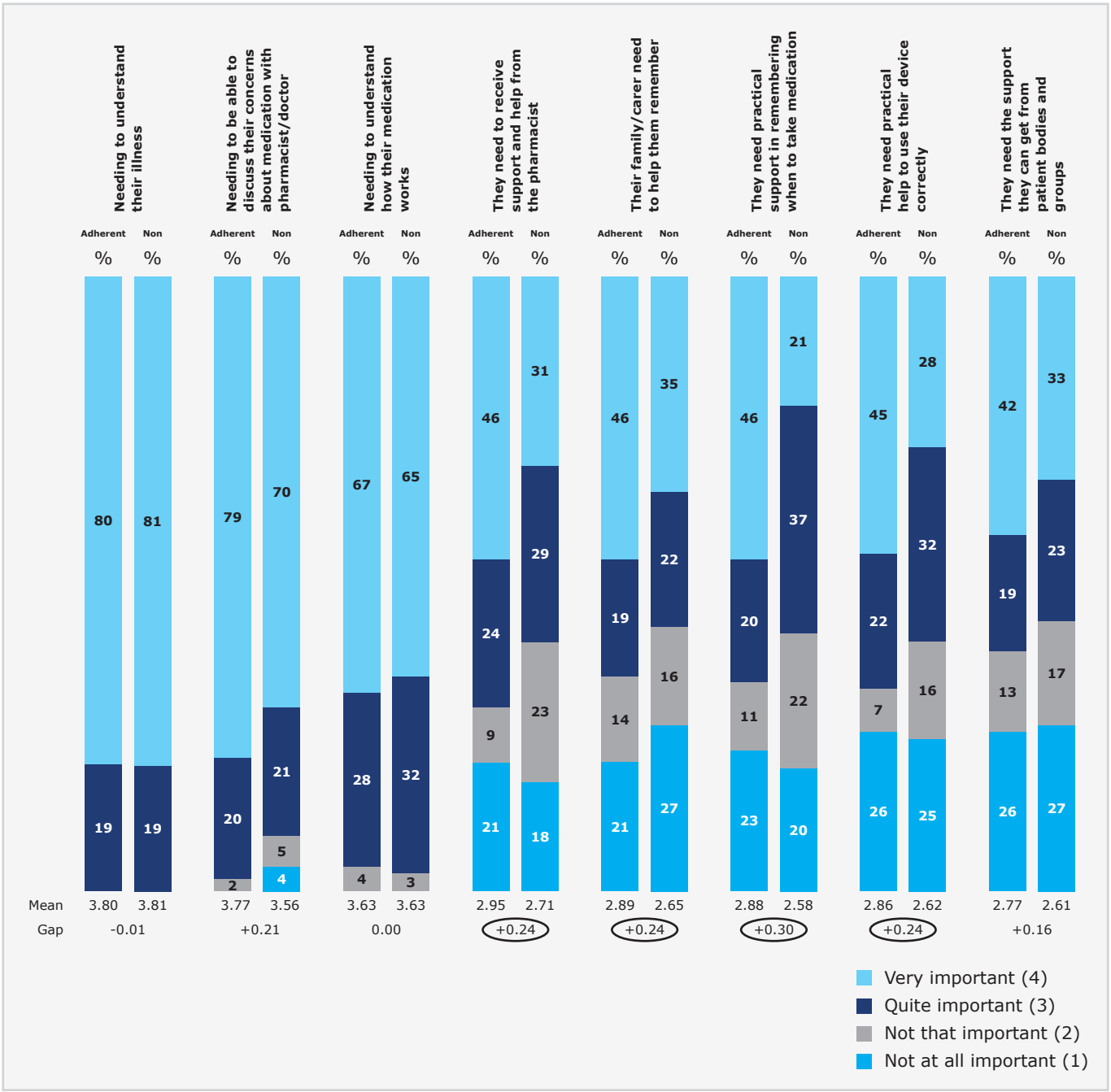
Q Which of the following factors are important in ensuring your own continuation with your medication as prescribed?



Patient-related factors which were considered important in improving adherence are shown below in Figure 14. Both adherent and non-adherent patients agreed that the importance of understanding their illness, understanding how their medication works and being able to discuss concerns about medication with their doctor/pharmacist were important in helping support adherence.

Figure 14: Importance of patient factors for promoting adherence

Q How important are the following factors for improving their disease getting better?

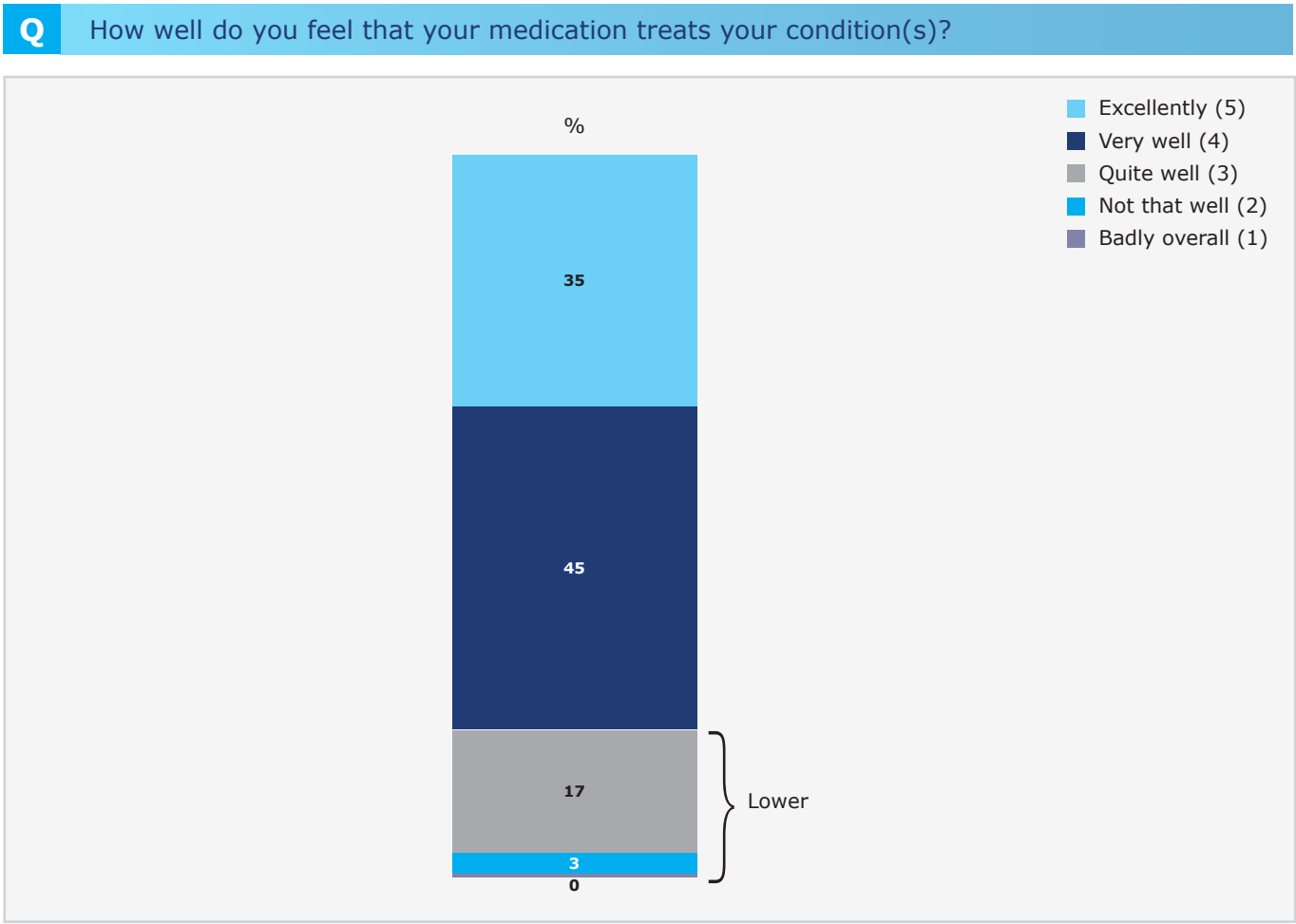


2.4.6 Treatment-related factors

2.4.6.1. Effectiveness of medication

Almost 35% of all patients perceived their medication as very effective or that it treats their condition excellently and overall, 80% claimed that that their medication treats their condition excellently or very well (Figure 15).

Figure 15: Perceived effectiveness of medication by the patients



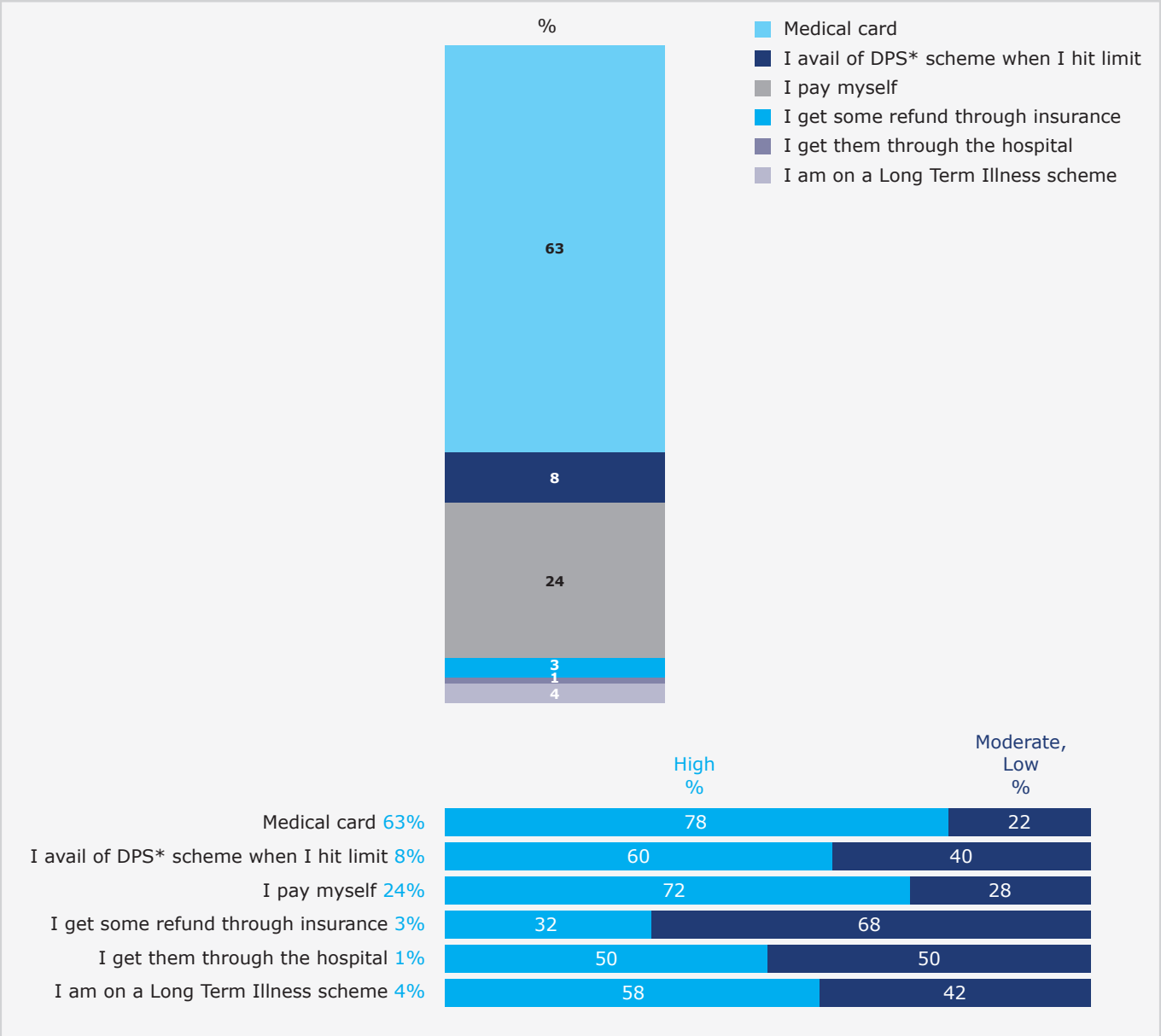
2.4.7 Cost-related factors

2.4.7.1 Treatment funding

Patients with medical cards reported higher adherence rates than those self-funding or co-paying through various healthcare schemes (Figure 16).

Figure 16: Effect of treatment funding on adherence

Q How are your medicines paid for?



* DPS-Drugs Payment Scheme

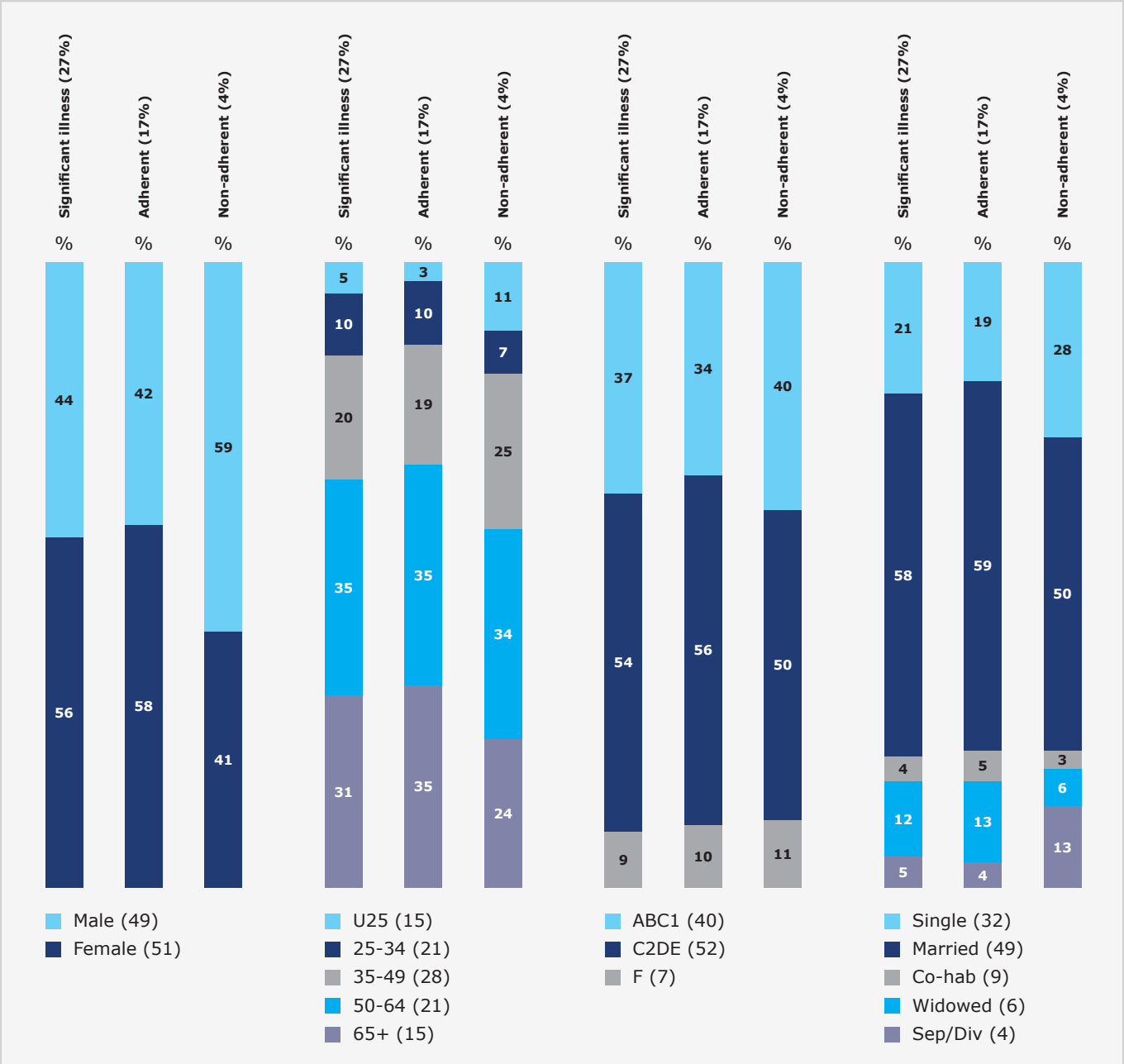
2.4.8 Socio-demographic factors

2.4.8.1 Effect of patient demographics

A greater proportion of those surveyed who reported having a significant illness were women (Figure 17). Of those in the sub-group with significant illnesses, more men than women were non-adherent (59% men vs. 41% women). Adherence generally seemed to increase with age (with a slight dip in the above 65 yrs age group).

Married patients were almost twice as likely to be adherent to their treatment compared with single patients.

Figure 17: Effect of patient demographics on adherence



2.4.9 Interventions to improve adherence

2.4.9.1 Results from the literature search

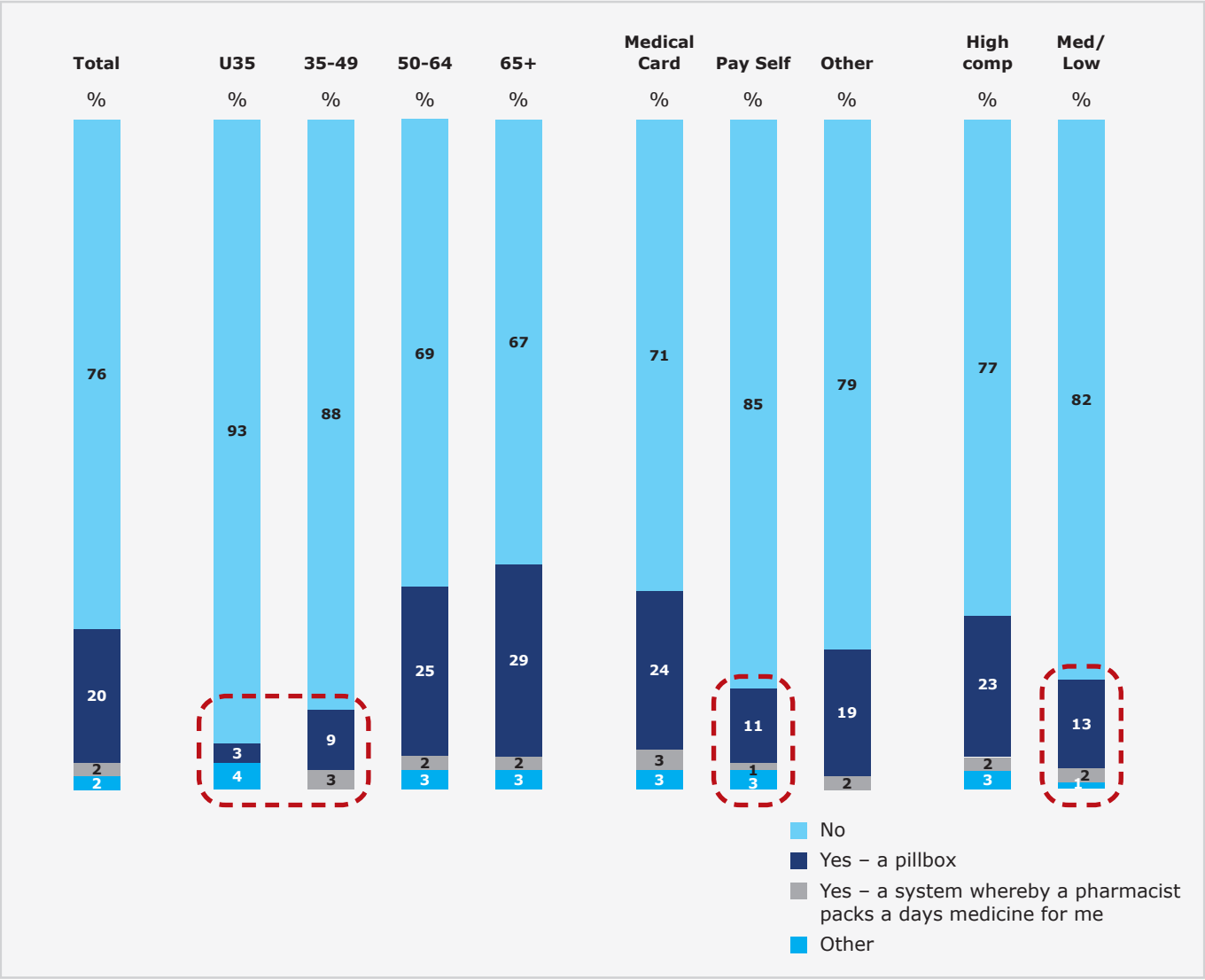
Appendix 2 summarises intervention tools identified from the literature analysis. Intervention tools most commonly employed, which improved adherence included improving patient education about the disease/treatment through digital means (e-channels), patient literature or simple discussions with the patient; monitoring patient adherence; using reminders; simplifying medication regimens or employing more convenient care methods.

2.4.9.2 Survey-reported interventions to improve adherence

76% of participants claimed to have no method to help monitor the usage of their medications. Of the 24% of patients who did use an intervention/assistance method to help remember their medication; most used a pillbox (20%). Another specific intervention described was pharmacist-assisted packaging of medications. Self-payers, patients ≤50 yrs and those with low compliance were less likely to use any self-help method (Figure 18).

Figure 18: Characteristics of patients who use interventions to assist in adherence

Q Do you have any method to help you monitor usage of your medications?



3 Discussion

Adherence is a multidimensional phenomenon determined by the relationship of five factors or dimensions.[1] These five dimensions have been identified within the WHO's multidimensional adherence model, which incorporate socio-economic-, healthcare system-, condition-, treatment-, and patient-related factors.[1]

In this survey we have analysed:

- Overall adherence in a sample of 1,003 adults, of which 27% (281) reported having a medical condition
- Factors which affect non-adherence and adherence, sub-divided in the five sub-categories defined by the WHO
- Patient behaviour
- Interventions aiding adherence

Overall 18% of participants reported that they are not fully adherent all of the time with the number rising to 23% in men only; 23% in ≤35 yrs individuals; 30% in people with high cholesterol; and 31% in people with asthma and diabetes. Various reported studies, as well as the rate reported by the WHO, ranges between 20-66%.

A review of the adherence findings from literature analysis is summarised in Appendix 3.

3.1 Factors affecting adherence

Factors affecting adherence were identified through this survey and additional factors were also identified via the literature analysis. These are briefly discussed below.

3.1.1 Condition-related factors

In the survey, those who were non-adherent were much more likely to have overlapping conditions. Of those who were generally adherent, most had a single condition; therefore multiple conditions may lead to increased likelihood of non-adherence. Comorbid conditions have been linked to non-adherence in the literature also. For example, Corotto *et al* demonstrated comorbidities as a factor contributing to non-adherence in patients with heart failure.[14] Similar findings have been recently reported for patients with liver cancer and atrial fibrillation.[24]

Generally multiple conditions are associated with older age, which is another key predictor of non-adherence. A study investigating improvement of adherence on patients ≥70 yrs of age with multiple conditions concluded that management of polypharmacy and reducing healthcare costs are important considerations when trying to improve compliance in this patient population.[30] However, in this survey, younger age groups were slightly less adherent than older age groups. This is discussed further below under the "demographics" section.

Condition-related factors most likely to result in non-adherence included conditions such as high cholesterol and arthritis. Patients' condition did have an effect on the level of adherence. Conditions with decreasing adherence, in order of highest to lowest, were; heart disease, depression, blood pressure, arthritis, high cholesterol, diabetes and asthma.

3.1.2 Patient-related factors

In this survey, the most common patient-related factor leading to missing medications was simple forgetfulness. This is in line with the WHO finding in their adherence report.[1] This finding probably demonstrates the role for medication reminder prompts for all patients.

The survey also demonstrated that frequent engagements with the doctor together with a good understanding of the illness and the medication prescribed were amongst the highest-rated patient factors promoting adherence; even more so than any concerns over deterioration of the illness. This was further demonstrated in the literature analysis with a significant number of publications advocating the value of patient education (Appendix 2). The Capgemini survey emphasised that the patients who lack understanding of their condition, of why they need this medicine or intervention and why they would benefit from the medicine tend to have poor adherence.[3] Furthermore, the doctors' lack of ability/time to convey the importance of the above was one of the biggest drivers for non-adherence.[3] Lack of emphasis on treatment education and adherence by doctors is viewed as one of the most critical of these patient factors influencing adherence.

In a European Policymakers debate convened in 2010 to discuss medication non-adherence, it was emphasised that patients' understanding and belief in the information provided about their medication is a critical factor in improving adherence, as this improved patients' confidence in using the treatment.[31] A National Community Pharmacists Association (NCPA) survey in the United States concluded that better information, communication and patient/caregiver support increase patients' engagement and involvement in their healthcare, their satisfaction with their care and their loyalty to their healthcare providers.[32]

Interestingly, in a rheumatoid arthritis study of 108 patients, the data demonstrated that medication adherence and illness perception were not improved by use of multimedia or patient literature within one month.[33] This may be specific to arthritis patients as this survey also confirms the low adherence rates amongst these patients (53%); or it may be that longer lasting education programmes are needed for this particular patient group. The latter may be true due to the rapid developments in understanding of the mechanism of this disease amongst healthcare professionals and launch of multiple new medications (e.g. biologics) targeting various elements of the condition, necessitating continuous patient education.

3.1.3 Healthcare system- and providers-related factors

This study demonstrated that patients (even the adherent ones) benefit from regular engagement with their healthcare professionals, where the need and benefits of their prescribed medication can be explained fully (and repeatedly). This may potentially be an avenue where nurses and pharmacists can play a more active role.

Reviewing the condition with the doctors and frequency of reviews significantly impacts adherence. Patients who were reviewed by doctors regularly tended to be more adherent to their treatment than patients who had longer time gaps between reviews. The same applied for patients who were being continually monitored through check-ups, blood tests, medication monitoring, etc. Scheduling regular check-ups was also identified as an important factor in the IPPOSI report, which suggested that undertaking regular monitoring (e.g. simple blood tests) to monitor their condition may improve treatment compliance.[2]

The data suggests another avenue to explore for improving adherence, namely reviewing and monitoring adherence. Literature analysis provided further collaboration that regular patient review and monitoring does indeed tend to influence adherence positively (Appendix 2) and monitoring tools may be useful to explore as interventions for improving adherence. For example, Corotto *et al* have recently demonstrated improvements in adherence levels with telemonitoring in heart failure patients.[14]

A total of 7% of the subjects surveyed were also carers, mainly for elderly relatives. The majority of these carers (75%) felt that the person they care for is on a complex treatment regimen. Not only are complex regimens difficult to remember, they can often translate into high medication costs for patients, another factor which may affect adherence. Once again, this finding was supported by the literature analysis (Appendix 2). Complex medication regimens are discussed further under "treatment-related factors" section below.

3.1.4 Socio-demographic factors

Patient demographics affecting adherence negatively include male sex and younger age (under 50 yrs). Married subjects tended to have a better adherence profile than single subjects. This may be due to the family support structure affecting adherence. In general, more men than women were found to be non-adherent.

The WHO states older age as a factor affecting adherence.[1] In this survey, adherence generally seemed to increase with age (with a slight dip in the above 65 yrs age group). In the literature analysis, race and sex have not been consistently associated with levels of adherence; however, race was not evaluated in this survey.

The NCPA survey, in the United States, also found that older Americans indicate greater adherence than younger respondents, similar to this survey but again different from WHO findings.[32] So, the reason for the discrepancy may also be that the WHO findings were reported in 2003 and the NCPA findings in 2010 (this survey was undertaken in 2013) and the pattern of adherence has probably changed across the various age groups, but larger studies are needed to verify this.

The lack of adherence reported amongst younger age groups (<49 yrs) is a concern. Treatment adherence (including prescribed medication) matters for the working-age population, given the onset of many chronic diseases early in life and the fact that people are retiring later in life. Treatment can help prolong productivity in this population and adherence to medicines will improve long-term outcomes. It may be that younger individuals, who are generally more likely to consult the internet to understand their condition and medications, need more time with the healthcare professional to fully discuss their condition and be convinced of the benefits of adhering to their regimen. This can be achieved by gaining their confidence during longer consultations and regular follow-up.

3.1.5 Treatment-related factors

Complex medication regimen was identified as a key factor influencing adherence. This was also reported by almost all the publications analysed (Appendix 2). Complex medical regimens tend to confuse patients and simpler formulations were generally preferred by participants in this survey. Novel and simpler drug formulations (e.g. fixed dose combinations) can help tackle this issue. Indeed, many studies have emphasised that interventions which reduce the dosing demands of individual therapies can improve adherence.[1,3,5,6,7,15]

This survey also found that patients tend to doubt value of their medication over a long period of time, which can be a concern in chronic illness. These findings are also consistent with the literature analysis. Generally, patients cannot see visible recovery signs and hence lose faith in their treatment. Development of a regular communication plan, including motivational interviewing, is imperative in patients with chronic disease to keep them motivated.

Addressing medication-related factors will require better communication between the patient and his/her prescriber about what to expect from treatment and dosing regimens.[34] Through high-quality, two-way discussions, doctors will be able to identify and discontinue unnecessary medications, simplify dosing regimens, and address other medication-related issues that make adherence difficult.[34] Pharmacists have also an important role to play here.

In the Capgemini survey, respondents rated patient- and therapy-related factors among the top factors driving adherence.[3]

3.2 Improving adherence

This survey indicates that healthcare professionals, especially the patients' doctors, are key influencers towards improving patient adherence. This is in agreement with previous findings. However, other stakeholders, such as pharmacists, also have an important role to play in improving patient adherence (e.g. through smart dispensing, counselling, education, etc). Indeed, in type 2 diabetes, pharmacist interventions may improve medication adherence by 15 to 20%.[10]

Improving adherence can be difficult, but the literature analysis has identified some approaches, which helped improve adherence (Appendix 2). Moreover, these strategies can help save costs for the healthcare system overall and hence present a good investment for policymakers.

Haynes *et al* conducted a Cochrane review, where they concluded that outcomes of interventions to improve therapy adherence are mixed.[35] However, they also stated that the results vary depending upon the conditions, the patient populations and the type of interventions.[35] The review demonstrated that for short-term treatments, several quite simple interventions increased adherence and improved patient outcomes, but the effects were inconsistent from study to study with less than half of studies showing benefits. The review further concluded that current methods of improving adherence for chronic health problems are mostly complex and not very effective, so that the full benefits of treatment cannot be realised. Although this review discussed innovations to assist patients to follow medication prescriptions for long-term disorders, one must also consider the fact that interventions may have to be personalised to demonstrate a significant effect in improving adherence.[35]

This is precisely what this survey is showing here. Interventions to improve adherence have to be specified according to the type of disease, patient population, healthcare provider, etc. For example, regular healthcare provider counselling may be a beneficial intervention in certain chronic diseases such as arthritis but other diseases may require a different type of intervention. Therefore, the intervention has to be individualised to the patient's needs.

Appendix 2 summarises some intervention methods identified through the literature analysis that have shown benefits in various therapy areas. Through promoting such approaches and creating incentives and rewards for providers for undertaking these interventions, treatment adherence can be improved and providers can further develop innovative interventions specific to their patients to further improve outcomes and reduce long-term care costs. Some examples of such interventions are highlighted below.

Patient education plays a central role in improving adherence as seen in this survey and the literature analysis (Appendix 2). The WHO report specifically called on health professionals, researchers, health planners and policymakers to implement a multidisciplinary approach to adherence education and management, emphasising the value of patient education.[1]

Patient Education

The WHO states that good adherence education may be based on:[1]

- Stressing the importance of adherence at the time the therapy is initiated
- Emphasising the consequences of non-adherence
- Spending adequate time with the patient
- Enquiring about adherence at each visit
- Motivating patients to incorporate medication adherence into their lifestyles and
- Designing and implementing intervention strategies to improve adherence to self-medication

Patients who have difficulty maintaining adequate adherence need more intensive strategies than patients who have less difficulty with adherence, a more simple medication regimen, or both.[36] New technologies such as reminders through text messages and personal digital assistants and pillboxes with paging systems may be needed to help patients who have the most difficulty meeting the goals of a regimen.[3,36] These tools may prove very useful moving forward as forgetfulness was cited as the single most frequent cause of non-adherence in this survey and in the literature analysed. Innovative approaches can include reducing complex medical regimens and smart dispensing of medications. O'Carroll *et al* demonstrated that using an electronic pill dispenser improved adherence rates by 10% in stroke survivors.[37] Other approaches to improve medication regimens include development of longer-lasting formulations. Indeed, there is extensive evidence of the benefits of longer-lasting formulations on patient adherence (Appendix 2).

Successful behavioural interventions based on monitoring, regular visits and feedback have also demonstrated better outcomes for patient adherence.[3,7,14] In a study of tuberculosis patients in the United States, Chang *et al* demonstrated that monthly home-based follow-up was an effective method of increasing adherence.[38] Home-based follow-up included language translation, medication delivery, assessment of compliance with pill counts, monitoring for adverse effects, and active tracking of non-compliant patients.[38] Similarly, a review recently emphasised the importance of home blood pressure measurements for improving assessment and adherence to medications.[39] Customer call centres in clinics, in addition to helping patients with queries, can serve to monitor adherence.[3] In a heart failure patients' study, compliance with a daily telemonitoring protocol was shown to be 98.5% over six months, and there was a 56% reduction in mortality in patients randomised to the telemonitoring group ($p<.003$). Thus, this study illustrated the potential of telemonitoring systems to vastly improve adherence.[14,40]

Although 20% of patients surveyed in this study used pillboxes to assist them in remembering their medications, this was not a very common finding in the literature analysis. In a trial of hypertensive patients in France, compliance was measured using electronic pillboxes equipped with a microprocessor that recorded date and time of each opening (Medication Event Monitoring System [MEMS]). The compliance rate was 98.9% in these patients, though the study did not have an arm without the pillbox.[41] A study comparing electronic or normal pillboxes vs. no intervention may be warranted based on these data.

In some patients, counselling or cognitive behavioural therapy may be needed, especially for patients with chronic conditions such as arthritis or diabetes. For example, a recent study of 87 patients demonstrated significant benefits of cognitive behavioural therapy on adherence as well as patient outcomes in type 2 diabetes patients with depression.[23,42]

Al-Eidan *et al* (2002) demonstrated that offering counselling from a hospital pharmacist and a follow-up phone call after three days of antibiotic therapy (including mentioning possible side-effects) resulted in significant improvements in adherence (measured using pill count) and patient outcome.[43] The control population in this study received a standard letter explaining the nature of the infection and the need for treatment. They were asked to contact their general practitioner (GP) to obtain the necessary prescription. The study demonstrated the value of patient counselling since the intervention group were significantly more compliant than those in the control group.[43]

There is some evidence to suggest that self-management programmes offered to patients with chronic diseases improve health status and reduce healthcare resource utilisation and costs.[1] A self-management programme based on feedback of adherence performance and principles of social cognitive theory has shown improvements in adherence to antiretroviral dosing schedules in HIV patients.[44] The National Kidney Foundation's "*Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease*" states that there is some evidence that self-management approaches based in behavioural medicine may be effective in enhancing adherence to the management regimen for diabetes and chronic kidney disease.[45] In asthmatic patients treated with inhaled corticosteroids, education and training in self-management improved adherence with inhaled therapy.[46]

To improve patient adherence, increased collaboration between healthcare stakeholders is vital.[3] A collaborative approach to care augments adherence. Typical stakeholders who would share an interest in improving adherence include employers, payers, healthcare delivery systems, and public sector programme managers. Organisational strategies to improve adherence include: improving patient access, provider training and support, incentives, patient education and healthcare technologies.

Technological advances also allow smart interaction with patients, and include pill calendars, use of text messages, e-monitoring service, etc. Mobile applications provide a useful medium for educating patients about diseases and treatments.[47] Furthermore, these applications can help doctors stay connected to patients to monitor their progress and adherence. Indeed, a study in HIV patients, which reviewed the literature on the use of mobile technology for HIV/AIDS, revealed evidence that mobile health tools support adherence to antiretroviral treatment.[48]

This new survey and the literature analysis conducted demonstrated a clear need for developing and implementing evidence-based interventions for improving medication adherence, providing better training and guidance for all healthcare providers so they can deliver effective adherence interventions.[49] Payers can lead these projects with support from other associated stakeholders. In the UK, NHS reforms promise better health outcomes and improved adherence levels through building a patient-centric healthcare system using collaborations from various disciplines.[3]

Electronic health records (EHR) will be a key component in building an integrated healthcare IT framework.[3,50] Digitisation of patient records will also help improve adherence.[3] Digitisation will help identify causes and consequences of adherence and through sharing this information amongst relevant stakeholders, non-adherence could be better managed and programmes developed to promote adherence. EHRs can further help providers in supporting clinical decisions, payers in constructing accurate pay for performance models, and patients themselves in monitoring their treatment and progress.[3] EHRs are already being used in the United States in the management of chronic conditions such as coronary heart disease to monitor adherence though their usefulness still remains to be determined.[51]

4 Conclusions and Future Outlook

Adherence can lead to a decrease in prescription medication costs as well as a decrease in complications resulting from not taking the medications as instructed. Non-adherence can be viewed as behavioural in origin – best treated by identifying individual risk factors and designing targeted interventions.[28] Non-adherence is common, contributing to substantial morbidity, mortality, and increased healthcare costs. Interventions that target adherence must be tailored to particular illness-related demands experienced by the patient[3] e.g. additional psychological counselling for patients with pain-related conditions. To accomplish this, healthcare providers must assess factors that influence adherence as well as adherence itself.

We report here results of a recent Irish survey examining medication adherence in multiple chronic conditions. The survey data demonstrated that adherence to prescribed medication remains an issue in Ireland with non-adherence rates varying between 23% and 31%, depending on various demographic factors and/or the medical condition in question. The survey data suggest that there may be a need for personalised interventions to overcome non-adherence.

Healthcare providers can have a significant impact by assessing the risks of non-adherence and delivering interventions to optimise adherence.[1] To make this practice a reality, healthcare professionals must have access to specific training in adherence management, and the systems in which they work must be designed to support this objective. Their training should ideally address three topics: knowledge (information on adherence), thinking (the clinical decision-making process) and action (behavioural tools for health professionals to monitor and encourage adherence).[1] Policymakers can further provide incentives for providers to better manage adherence.

Collaboration needs to be built into patient adherence strategies. Future research should consider interventions that have been successful in various therapy areas and those involving partnerships between patients, clinicians, pharmacists and other relevant stakeholders.

There is a lack of national or international policies or guidelines addressing the problem of non-adherence. There is a need to produce evidence-based recommendations for policymakers in order to help healthcare services improve patient adherence.

APPENDICES

APPENDIX 1: Survey methodology and literature analysis

Survey rationale

Poor adherence results in adverse health outcomes, requiring utilisation of more expensive healthcare resources. There is a paucity of data on non-adherence and its impact in Ireland. This survey was undertaken in order to analyse patient adherence in Ireland and examine adherence factors which hinder/promote it.

Survey consultation and assimilation

The research was conducted by Behaviour & Attitudes Ltd. The study involved a quantitative phase of research, incorporating interviews with a nationally representative sample of 1,003 adults aged 16 yrs and over, of whom 283 reported suffering from one of a number of significant conditions. The objective was to gain an insight into adherence with prescribed medication in general. The survey focused on habits and behaviours as opposed to specific issues with specific treatments.

The contact sample of 1,003 was quota-controlled with targets per interviewer set so that the ultimate sample design mirrored the adult population structure in respect of gender, age, social class, region and area of residence. Interviewing was undertaken face-to-face and in-home with respondents screened for eligibility based upon their satisfaction of each interviewer's quota targets. Only one respondent per household was interviewed. The interview was administered by a trained and supervised member of Behaviour & Attitudes interviewer panel. Fieldwork was undertaken in May/June 2013.

Literature analysis

A review of published literature (papers published within the last ten years) was carried out to examine patient adherence to supplement the survey data. The literature search terms included various combinations of the following words: adherence and/or compliance +/- long-term treatment use and/or chronic conditions and/or patient and/or healthcare costs or factors or strategies/ improving. The literature review was further supplemented with adherence reports from various sources such as Booz & Company, Capgemini report, WHO 2003 report, National Community Pharmacists Association (USA) Report 2013, the ABC Report and the Irish Platform for Patients' Organisations, Science and Industry Adherence (IPPOSI) Roundtable Report 2013.

Results of the literature analysis

Study	Number of subjects/studies	Country	Conditions investigated
Al-Eidan FA 2002[43]	76 patients	UK	Dyspepsia
AlGhurair, 2012[11]	1,712 articles	Multiple	Hypertension
Aloia MS 2013[52]	227 patients	USA	Sleep apnoea
Andrejak M 2000[41]	162 patients	France	Hypertension
Bartlett D, 2013[53]	206 patients	Australia	Sleep apnoea
Bermingham M, 2011[17]	119 patients	Ireland	Hypercholestaerolemia
Bitton A 2013[54]	25 articles	Multiple	Coronary artery disease
Bourdin 2012[21]		Multiple	Asthma
Bryant 2013[55]	7 studies	Multiple	Chronic obstructive pulmonary disease (COPD)
Canas 2012[5]	n/a	Europe	Schizophrenia
Catalani C 2013[48]	62 studies	USA	HIV/AIDS
Chang 2013[38]	3,918 patients	USA	Tuberculosis
Christensen 2009[56]	62 studies	Multiple	Hypertension
Clyne 2012[49]	50 stakeholders	14 countries	Multiple
Danford CP 2013[51]	3,779 patients	USA	Coronary artery disease
Duff AJ 2013[57]	60 physicians	UK	Cystic fibrosis
Fuangchan A 2013[58]	16 studies	Multiple	Malaria
Goldberg LR 2003[40]	280 patients	USA	Heart failure
Hauber AB 2009[59]	407 patients	USA & UK	Type 2 diabetes
Haynes 2008 (Cochrane)[35]	65 articles	Multiple	Multiple
Higashi K 2013[60]	37 studies	Multiple	Schizophrenia
Janson SL 2003[46]	65 patients	USA	Asthma
NCPA Report[32]	1,020 subjects	USA	Multiple
Kang MG 2013[61]	475 patients	Korea	Asthma
Kripalani S, 2007[7]	37 studies	Multiple	Chronic medical conditions
Kucukarslan SN. 2012[62]	11 studies	Multiple	Multiple
Laba TL 2013[63]	18 patients	Australia	Osteoarthritis
Li J, 2013[64]	183 patients	China	Epilepsy
Mallick R 2013[29]	1,127 patients	USA	Hepatocellular carcinoma
McDonald HP 2002[42]	34 studies	Multiple	Multiple
Nglazi MD 2013[65]	Study in progress	Multiple	Tuberculosis
O'Carroll RE 2013[37]	62 subjects	UK	Stroke
Paterson *et al* 2000[22]	99 subjects	USA	HIV
REACH* registry[66]	25,737 subjects	Multiple	Atherothrombotic disease
Safren 2013[67]	87 patients	USA	Diabetes
Smith SR 2003[44]	43 patients	USA	HIV/AIDS
Szymczyk I 2013[68]	134 patients	Poland	Cardiovascular risk
Thorneloe RJ 2012[69]	29 studies	Multiple	Psoriasis
Thunander SA 2012[70]	4,875 patients	Sweden	Multiple
Unk JA 2013[33]	108 patients	USA	Rheumatoid arthritis (RA) patients
Verbrugghe M 2013[71]	25 studies	Multiple	Cancer
Viswanathan M 2012[23]	4,124 studies	Multiple	Multiple
Vittorino GA, *et al* 2013[72]	169,375 patients	Italy	Type 2 diabetes

Reviews and other reports identified included the ABC Report[73]; Booz Survey[10]; Boulet 2012[4]; Capgemini survey[3]
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APPENDIX 2: Interventions to improve adherence as identified by the literature analysis

Interventions to improve adherence as identified by the literature analysis

Intervention
Intervention Tools
Monitoring patient adherence[2,4,6,7,42,48,56,51] • Electronic medication delivery devices[55] • Telemonitoring/self-monitoring[3,14,35,40]
Use of patient reminders and monitoring devices[6,17,35,42,64] • Reminder emails or text messages[3,65] • Tracking cards[64]
Pharmacist programmes[3,43,55]
Collaboration with patient organisations[3]
Treatment-related initiatives
Simplifying dosing regimen (e.g. fixed dose formulations use), re-formulation and route of delivery of the medication if possible[1,3,5,6,7,15,35,37,42,57,72]
Improved packaging of medication or pillboxes[3,41,58]
Long acting medication[3]
Patient-related initiatives
Assessing health literacy[15]
Patient-specific education (e.g. counselling sessions; patient materials; websites; etc)[3,4,5,6,7,15,17,23,35,42,52,53,55,58,64,67]
Self-management programmes[1,7,55,44,46]
Addressing patient fears, misconceptions and concerns over side effects[2,4]
Developing a shared decision process[3,4,27]
Improved communication with psychologists or physicians[6,7,15]
Motivational interviewing of patients[52,57]
Cost-related initiatives
Providing discounts/vouchers[3]
Copayments and improved prescription drug coverage[23]
Management team-related initiatives
Supportive care e.g. nurse educators[3,35]
Ensuring continuity of care and regular follow-ups/reinforcement of adherence benefits[5,35]
Educating and involving family members/carers in decision-making process[5,42]
Enhance e-channels so providers can share patient information, promoting collaboration to improve adherence e.g. health websites[3]
Employ "payment by results" initiatives[3]
Training healthcare professionals to educate patients/motivational interviewing/etc[51]
Counselling/family therapy[35]

APPENDIX 3: Adherence findings from literature analysis

Adherence findings from literature analysis

Report	Country	Condition	Findings
Bermingham M, *et al* 2011[17]	Ireland	Hypercholesterolaemia	• 48.7% were not fully adherent to medication • Patients' beliefs about medicines were a significant predictor of self-reported adherence
Booz Survey[10]	U.K., Germany, the Netherlands	All	• 20-30% patients don't follow medical recommendations
Bourdin A 2012[21]	Multiple	Asthma	• 50% of asthma patients are considered poorly adherent to therapeutic advices
Change AH 2013[38]	USA	Tuberculosis	• More patients followed with house calls completed treatment (90% home vs. 73.2% clinic) • Patients followed at home were 21% more likely to complete therapy ($p<0.001$)
Desai & Choudhry 2013[74]	Multiple	Coronary artery disease	• ≤50% of patients with coronary artery disease adhere to their prescribed therapies
Kang MG 2013[49]	Korea	Asthma	• 62.6% discontinue medication
Mallick R 2013[29]	USA	Hepatocellular Carcinoma	• 21.1-28% of patients were non-adherent
NCPIE 2007[34]	USA	All	• In developed countries, adherence among patients with chronic conditions averages only 50% • 49% of respondents forgot a prescribed medicine • 31% of respondents had not filled their prescription • 29% of respondents had stopped taking a medicine before the supply finished • 24% of respondents had taken less than the recommended dose
NCPA 2013[32]	USA	All	• 24% completely adherent (≥60 yrs)
REACH* registry[66]	Multiple	Atherothrombotic disease	• 48.6% of patients were adherent • Adherent patients were younger, white, and had less severe disease
Safren SA 2013[67]	USA	Diabetes	• Cognitive behavioural therapy was an effective intervention for adherence in adults with type 2 diabetes and depression
Thorneloe RJ 2013[69]	Multiple	Psoriasis	• 21.6-66.6% of patients were adherent (33.4-78.4% non-adherent)
Thunander SA 2012[70]	Sweden	Multiple	• 66.4% were non-adherent
WHO 2003[1]	Multiple	HIV and AIDS	• Adherence varies between 37% and 83% depending on the drug and demographic characteristics of patient populations
	Australia	Asthma	• 43% of asthma patients take their medication as prescribed • 28% use prescribed preventive medication
	China, the Gambia and Seychelles	Hypertension	• 43%, 27% and 26%, in China, the Gambia and Seychelles respectively, of patients with hypertension adhere to their antihypertensive medication regimen
	Multiple	All	• 50% adherence reported in developed countries

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