

MedAlert

Mobile Medication Reminder Mechanism



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Introduction

MindAscent is a research driven technology solutions provider, with close financial and academic affiliations with the University of Huddersfield. At MindAscent, our focus and drive is to create innovative yet practical solutions for the health industry. MedAlert is the culmination of two years of research and development.

MedAlert our unique response to patient non-compliance. Its central aim is to remind patients to follow their prescribed therapeutic regimen and encourage healthy lifestyles by sending highly focused and targeted text messages to mobile phones. However, MedAlert is more than a simple messaging system. It incorporates an array of advanced features that have been developed in conjunction with careful analysis of clinical studies and MindAscent's own research on human computer interaction and persuasion strategies. MedAlert seeks to create dynamic communication relationships between patients and medical practitioners. MedAlert has access to a large electronic repository of patient education material. The material is appended to the end of each text message reminder. The system can automatically profile and tailor high impact motivation and lifestyle content for all patients.

MindAscent – Our Expertise

The MedAlert project is firmly grounded on research and clinical studies conducted over the last 30 years. MindAscent has won national and European recognition for its innovative and cost effective solutions tailored for the health industry. Our specialism lies in integrating human behavioural patterns with technology solutions. The end result is that technology is made more focused, powerful and effective.

The health industry is a classic example where MedAlert has the potential to produce measurable results. Any successful long term medical intervention requires patients to build upon and continue life long adherence, whether it is taking medication or adopting healthy lifestyles. Unfortunately, many patients, for one reason or another, fail to take their medication appropriately, fail to attend appointments, and fail to follow advice on how to live active and healthy lifestyles. MedAlert makes compliance easy, interesting and informative.

MedAlert - Overview

MedAlert is designed to be extremely easy to use. Most tasks are automated and require minimal intervention. Its modular design allows for easy integration with existing IT solutions. As soon as patient rules are entered into MedAlert, a task which on average takes under 2 minutes, the system automates the delivery of all medication reminders and lifestyle information direct to the patient. There is no need for practitioners to re-enter duplicate information for each and every patient. Patient personal information is digitally encrypted and only accessible to authorised users.



Non-Compliance – A Growing Problem

Patient non-compliance is a well documented problem. Although there seems to be general consensus among the medical professional that it is a serious and growing problem, few studies have examined the underlying causes of non-compliance or even examined potential interventions to tackle it. Most studies are from North America, however, where possible, material from UK and European clinical studies will be examined so that a more accurate extrapolation can be made.

Definition of Compliance

A literature review produced two definitions of compliance:

- “the extent to which a person’s behaviour coincides with medical or health advice” (Haynes 1979).
- “following medical advice sufficiently to achieve the therapeutic goal” (Kelly 1995).

Magnitude of Non-Compliance

According to a prominent report by two leading researchers in this area, the level of non-compliance for prescription drugs is around 50% (Sackett & Snow 1979). In organ transplant patients, a group where one would assume a general high degree of motivation, non-compliance for immunosuppressive therapy was 18%, of whom 91% suffered from some form of graft loss or late acute rejection episode (Rovelli 1989). Patients over the age of 40 have been shown to be at lower risk of non-compliance in post-transplant therapy than adolescent patients, who show the highest rate of non-compliance (Didlake *et al* 1988, Ettenger *et al* 1991, Hesse *et al* 1990)

Importance of Patient Compliance

Diseases such as tuberculosis or hypertension require a lengthy and uniform pattern of drug adherence for effective results. Hypertension is very amenable to drugs, however 80% of the medication course needs to be successfully completed for effective blood pressure control (Sackett 1976). The importance of compliance for transplant patients is even more important, where it is a major problem area, and has led one researcher to comment that:

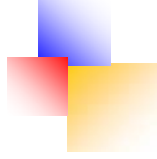
“Non-compliance with immunosuppressive medication is a major cause of late acute rejection episodes and graft failure in solid organ transplant recipients” (De Geest *et al* 1999).

The evidence for the statement is quite startling. Late acute rejection episodes for renal transplant patients classified as ‘non-compliers’ was 24%, compared to ‘compliers’ at 6% (De Geest 1995).

A 1996 study looked at the tolerance deviation of heart transplant patients who were ‘excellent’ compliers, ‘minor’ subclinical compliers and ‘moderate’ subclinical compliers (De Geest 1996).

Derived cluster	Rejection incidence
Excellent compliers (84%)	1.19%
Minor non-compliers (7%)	14.28%
Moderate non-compliers (9%)	22.22%

The study reveals that overall a 3% or greater variation in dosing intervals, or an occurrence of q drug holiday involving no medication intake for more than 24 hours, was associated with an increased risk of acute late rejection. In a related study, it was determined that non-compliance with immunosuppressive therapy was an etiological factor in nine out of ten acute late rejection episodes (De Geest 1997). A recent analysis of the International



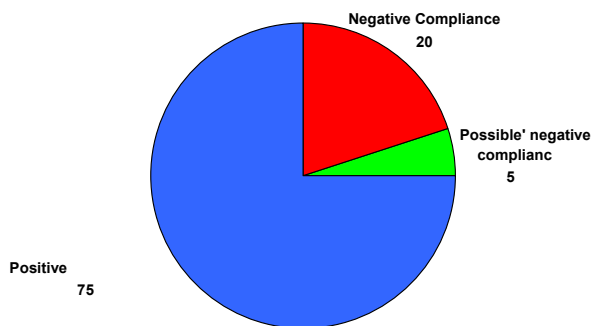
Society of Heart and Lung Transplantation Registry data has revealed that 9% of mortality more than a year after transplant is due to acute late rejection episodes. Although the etiology of these episodes is not elucidated by this analysis, it is likely that the contribution of non-compliance is significant (Hosenpud *et al* 1997).

Economic impact of non-compliance

UK and European research in this area is scarce. Studies in the USA have shown that non-compliance of 10 common prescription drugs leads to an annual wastage of \$396-\$492 million (Ley 1988).

According to one United Kingdom study, of 205 patients admitted to a hospital ward, approximately 20% were due to non-compliance, with a further 5% 'possibly' due to non-compliance (Ausburn 1981).

Hospital Admissions Due to Drug Non-Compliance



Source; Ausburn 2981

It is possible to conclude that the financial and opportunity cost of non-compliance is significant, not only in the UK but throughout Europe and the rest of the world.

Determinants of non-compliance

There are three broad areas of focus when looking at why patients are non-compliant.

Patient related factors:

- Lack of adequate knowledge (Meichenbaum *et al* 1987). Patients need to understand the nature of their therapeutic regimen and the behaviours it requires.
- A major determinant of future compliance is past compliance and compliance at initiation of the medication regimen (Dunbar 1990). There is some evidence from the transplant literature that indicates that appointment non-compliance and drug non-compliance are related in some manner (De Geest 1996, Dunn 1990).
- Social support and patient compliance have been shown by a host of studies to be linked (Levy 1985). Examples of social support include friends and family reminding patients or preparing medication. Explicit informational, emotional and appraisal support facilitates compliance with medication regimens (Aronson 1989, Levy 1985). Social isolation is a risk factor, not only due to the lack of social support but the higher prevalence of depression symptoms in socially isolated patients (Turner & Marino 1994).
- Side-effects associated with therapies, such as immunosuppressive drugs have been identified as a possible cause of non-compliance (Sketris *et al* 1994). It is often the subjective cost/benefit appraisal performed by patients which will lead to intentional non-compliance (Moons *et al* 1988).
- Common sense, defined as the dynamic cognitive structures that can be adjusted by new experiences, information from the mass media and healthcare workers, is an important trigger for non-compliance.



Patient perceptions regarding their illness and treatment may be incongruous with the healthcare worker's recommendations, and lead to intentional non-compliance (De Geest *et al* 1999).

- Patient self-efficacy beliefs are very important determinants of compliance. Studies have shown that therapies involving immunosuppressive drugs are heavily influenced by self-efficacy beliefs (De Geest *et al* 1998). Self-efficacy beliefs are generated from four sources. *Performance accomplishments* by patients; *vicarious experience* and role modelling of other patients; *verbal persuasion*, which includes patient education designed to strengthen beliefs; *physiological state*, being the magnitude of visceral arousal in stressful situations, for example anxiety inhibits learning.

Treatment related factors

- The duration and complexity of therapeutic regimens has been shown to have a negative effect on compliance with long term intake of medication (Cheung *et al* 1988).

Health care environment

- A healthcare worker's communication style can affect patient compliance. With good communication the impact of educational interventions can be maximised, especially if the approach of the healthcare worker is open and empathic (Burke & Dunbar 1995).

Strategies to enhance compliance

There are three broad categories of compliance strategies that have been shown to be effective, these are educational, behavioural and social support strategies, and variants of each have been shown to enhance compliance (Rehder 1980).



Behavioural strategies

Behavioural strategies focus on how patients can be better informed about how to integrate the demands of drug therapy into their daily routines, and adopting new lifestyle routines (Mazucca 1982). Behavioural strategies tend to improve patient self-efficacy beliefs. For example, a self medication program combined with patient education can increase a patient's confidence in managing their medication regimen (Lowe *et al* 1995). Combined with role modelling (e.g. video tapes of patients who have undergone similar therapies), and mastery experiences (e.g. bedside management of medication regimen), potentially increase self-efficacy and may have a positive bearing on compliance. Self monitoring strategies, such as a personalised medication diary, and cueing (e.g.



leaving medication containers in a particular location, setting alarm clocks, or some electronic reminder device such as e-mail or a text message) are useful strategies which can help compliance (Burke & Dunbar 1995, Rogers & Bullmann 1995).

Education strategies

Education and knowledge can also lead to increased adherence to drug therapies. However, results rapidly decay if the knowledge or counselling intervention is not repeated regularly (Haynes 1996). Patient literature seems to have little effect (Raynor 1993). Leaflets tend to be poorly written, emphasize negative effects, and are generally too mundane and uninteresting (Ley 1982). According to a 1997 Royal Pharmaceutical Society of Great Britain report, prompts and reminders have been shown to improve compliance, for example telephone and postcard reminders. SMS text message reminders can also be added to this list.

Social support interventions

Active involvement of friends and family in patient education and self-medication is important, as it has been shown to positively influence compliance and well-being (Turner & Marino 1994). Good communication and patient satisfaction is very important for compliance and the education of patients and their friends and family. The aim is to create a therapeutic alliance between patients, their families and healthcare workers in order to improve the chances of patient compliance.



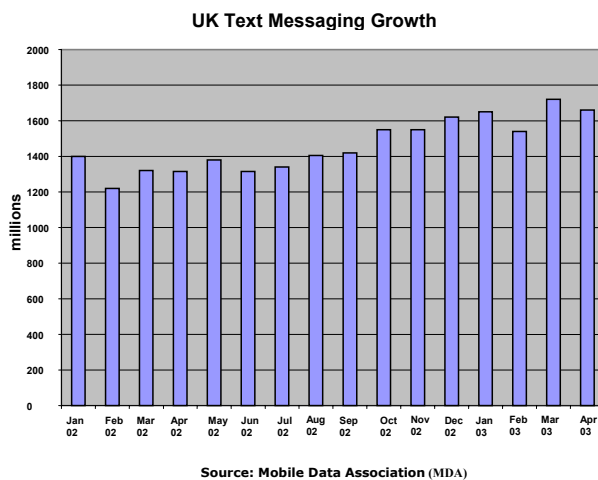


A different approach: MedAlert

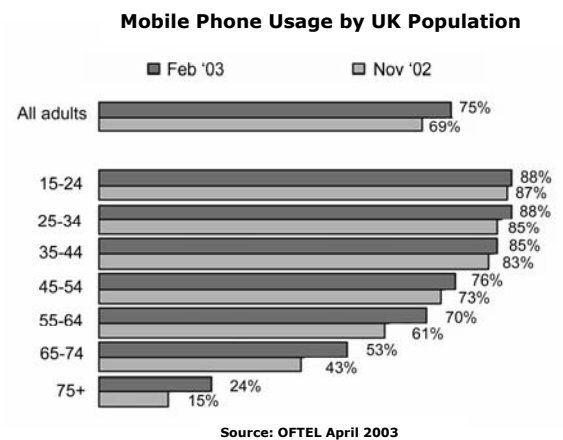
From the literature review it appears that a 'stepped care' approach, involving aspects of behavioural, educational and social strategies (e.g. feedback, supportive communication, reminders, counselling, self-monitoring strategies and education), are the most effective way of reducing patient non-compliance (Hayes 1976, Logan 1979).

MedAlert adopts the strategies that create a 'stepped care' approach to compliance. It incorporates much of the learning and strategies used in successful compliance interventions over the last 30 years. The MedAlert service uses automated text message reminders, which are enhanced with educational, motivational and lifestyle content. Support and counselling channels can also be utilised.

Around 1.6 billion text messages are sent and received each month in the UK. Research shows that text message is the most persuasive medium for young people after television, and its influence is increasing for other age groups (MDA 2001).



Mobile text message usage is not only confined to the young. OFTEL statistics show that the fastest growth area is the >45 age group. All indications show that adoption rates for text message will continue to show remarkable growth, in part due to the low cost (8-12p per message) and the ease practical communication via text message. Approximately 75% of UK adults own/use a mobile phone, and 83% of households have mobile phones (OFTEL 2003).



MedAlert is able to reach a wide cross section of patients. With integrated educational content and self-efficacy enhancing material, all combined with friendly reminders, a patient's compliance to therapeutic regimen can be markedly increased. MedAlert can be fully customised to meet the specific requirements of all healthcare workers. Medication reminders can have advanced scheduling rules applied to them. In order to ensure prompt message, all reminders are sent using MindAscent's robust SMS engine. MedAlert creates a new technological paradigm, in which 'therapeutic alliances' can be formed.



MedAlert – Compliance Reminder

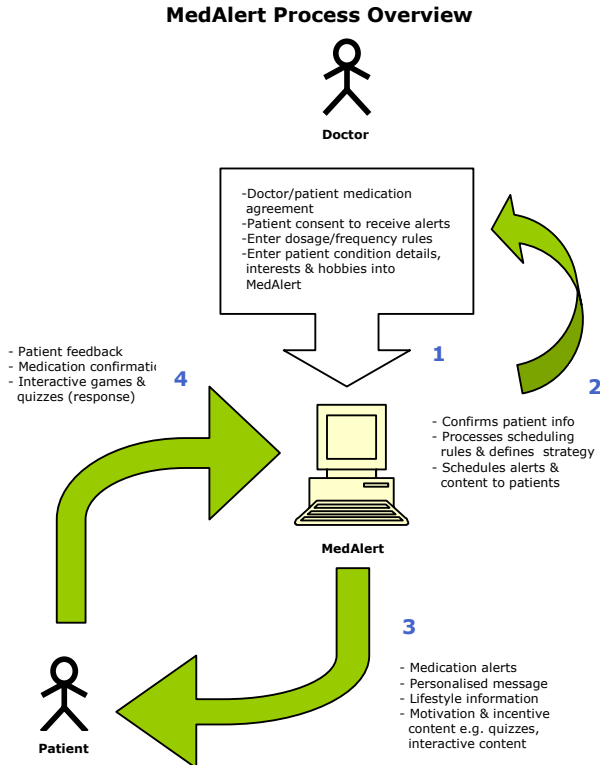
MedAlert is a communication facilitator. It acts as an intermediary program, which conveys specific therapeutic advice to patients. From a patient's point of view, the medication reminders, the lifestyle information, and motivation content is sent transparently. It almost appears as if their health practitioner is sending personalised alerts to their phones. A relationship based on trust and understanding can be developed which may help fortify a patient's self-efficacy beliefs.

All reminders, including patient specific content is automated. A wizard guides the user with a simple 3 step process to set up regimen rules. Each and every aspect of the configuration can be customised. A typical MedAlert setup for a hypertensive patient usually takes under 5 minutes.

Compliance Content & Delivery

MindAscent has close links with the University of Huddersfield, where we have been instrumental in developing a field of human computer interaction research called CAPTOLOGY, a synonym for 'Computers As Persuasive Technology' (Fogg 2003). The focus being on how technology can be developed to employ strategies to subtly persuade and influence users, for example to help quit smoking, or deterring teen pregnancies.

The MedAlert service is built on CAPTOLOGY research. The system can intelligently profile patients and select the most appropriate and effective strategies for each person. It treats each patient as an individual, with unique capabilities and unique beliefs. MedAlert collates feedback from patients and health practitioners. It uses feedback to automatically improve and refine its profiling engine.



As the literature review clearly shows, simple reminders, or patient education do not work on their own. A 'stepped care' approach is the most effective way of improving patient compliance. MedAlert goes one step further. With MedAlert, a 'therapeutic alliance' between medical practitioners, patients and their families can be created. Communication channels are made far more accessible, far more efficient and far more cheaper than before. Research has shown that carefully designed technology, which offers interesting and useful advice, is generally viewed by user as a social actor with human properties (Reeves *et al* 1996). With MedAlert, initial findings have shown that people tend to view it either as a 'friend', an important 'counsellor' or an extension of the 'doctor' (Fogg *et al* 1997). The personal relationship created between MedAlert and patients creates a strong sense of understanding and increased confidence. A patient's motivation and energy to comply with therapeutic regimen is increased.



Administration and maintenance of MedAlert by staff is designed to be kept to a minimum, although it can be tailored to suite each and every requirement. MedAlert is designed to be easy to operate, yet it is more powerful and functional than any other similar messaging or reminder system. The underlying capabilities of MedAlert are extremely advanced. We understand the magnitude of patient non-compliance, and hence, offer a truly unique and innovative solution to address this problem.



Scheduling and Delivery

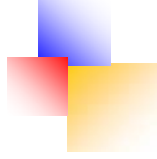
The MedAlert SMS engine and advanced scheduler can process and handle over 5 million message requests a day. Around 99.83% of messages are scheduled for delivery within 10 minutes of receiving the request. The service has a number of extensive safeguards to ensure integrity of message content and delivery.

- Service agreements with leading network operators. If one network is busy, MedAlert automatically switches to another network operator.
- When setting up alert rules, practitioners are reminded to check the details of each patient are correct.
- Patients receive a confirmation text message on setup. Patients are able to reply to the confirmation and inform the MedAlert administrator of any incorrect details.
- MedAlert generates detailed logs and reports for all messages sent by the system. Message records can be traced from setting up alert rules, through to therapy completion.
- An SMS 'inbox' allows practitioners to view and manage patient messages.
- The MedAlert servers are 'clustered'. This means that if a MedAlert server fails, the system automatically routes to backup servers based in different geographic regions.

Ethical & Data Protection Issues

MedAlert complies with all aspects of the Data Protection Act 1998. We take extreme care to ensure no patient or confidential information is stored on our database beyond its useful lifespan. MindAscent adheres to a strict confidentiality and privacy policy. Only medical practitioners and their system administrators have access to stored message logs. All logged information is stored in an encrypted form on the client's premises.

MedAlert uses simple alerts, alongside with subtle relationship creating strategies, and lifestyle content, which is checked by our team of medical experts for quality assurance. All content is updated regularly to ensure it is in line with current medical practise. In no way does MedAlert use deceit, force or any other form of unethical strategies to compel patients to take their medication. In our opinion, overt and forceful compliance of patients is unhelpful and most likely to prove ineffective in the long run.



MedAlert: Features

With an easy to use, intuitive user interface, MedAlert creates, manages and sends compliance alerts. These alerts can be customised to send medication alerts, appointment alerts, test results, patient feedback information, and lifestyle and motivational information.

MedAlert's main features include:

- **Instantaneous scheduled alerts to mobile devices.**
- **Advanced scheduling – simple 'Click 'n Forget' technology ensures transparent delivery.**
- **Patient grouping and profiling – ability to send multiple alerts to groups of patients.**
- **Incentive and motivational content – games, quizzes, charitable donations and other monetary incentives.**
- **Lifestyle information and patient education content – customised for each patient.**
- **Statistical analysis and reporting tools – keeps track of patient compliance.**
- **Ultra-secure user management console.**
- **Integrated personal organiser and booking system.**
- **Predefined message templates with the option to customise templates.**
- **2-Way Patient/Practitioner communication, with practitioner message 'inbox' to receive text message replies.**



The MedAlert service can be accessed in one of three ways:

As a standalone client application. The client connects to the MedAlert server via an internet connection.

A web client which can be accessed from the MedAlert website. Users will need a username and password to access the service.

- MindAscent's support team can receive faxed or written confirmation of alert rules and enter this information into the system on behalf of users (subject to confidentiality and user/patient authorisation).



Service & Support

MindAscent has the resources to help implement, and configure MedAlert at the client site. Our consultants will ensure that your organisation's staff receive comprehensive training on how to use MedAlert. From its inception, MedAlert was designed to be extremely easy to use. Provided users have basic skills in IT, most can become proficient users of MedAlert within 30 minutes. We will not put any time limit on any education and training schedules. Our training programme will continue until you feel confident enough to use MedAlert.

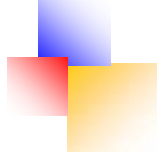
Our technical support staff are on-call 24 hours a day, 7 days a week. If you have questions or problems they will always be at your service. If remote support fails to address your problem, we send a team of MindAscent technicians to your site within 24 hours of reporting the problem.

What to do now?

Seeing is believing, and we at MindAscent understand this. We can help you implement, conduct and manage clinical trials. MedAlert is geared to produce results, and results are exactly what we want you and your healthcare organisation to achieve. If you require MindAscent's technical assistance during any stage of clinical trials, we are more than happy to help.

If you feel that MedAlert can be of help to you, please feel free to contact us. We can discuss your requirements face-to-face, over the phone or via e-mail. Our sales team will always be at hand to answer queries you may have.





About Us

Who We Are

MindAscent Ltd is a mobile communication technology firm based in Huddersfield, England. Our products and services have won us national and European recognition. MindAscent recently won the prestigious Business Link Innovation Award for MedAlert, and we have close associations, including funding from the University of Huddersfield. Our team of highly skilled professionals, assembled from the medical, legal and technology sectors provide a unique contribution to our product and service offerings. In essence, we try to understand your problems and issues, and then attempt to develop practical solutions to solve them.



If you feel you have a compliance problem then MedAlert could be your ideal solution. We want to hear from you. Please contact us either by phone, fax or e-mail.

Where We Are

MindAscent Ltd is based in the heart of Yorkshire's technology centre. We are located in the Huddersfield Media Centre technology park. You can find us here:



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