Improving Compliance to Life Saving Medications: Avinash Pandey

Background: Medication non-compliance is defined as the incorrect taking of medications, whether at the correct quantity, and time as prescribed. This can lead to disease progression, limit the effect of medications and for some disease states can lead to premature death. Studies suggest that non-compliance to medications is prevalent in our society. These studies have also identified forgetfulness as a leading cause of medication non-compliance. Available systems like pill boxes, blister packs and beepers have had limited success at reducing non-compliance. In patients who have suffered a recent Myocardial Infarction (MI, heart attack), four sets of "lifesaving" drugs have been determined to be critical to long-term survival: Anti-platelets, Beta-blockers, ACE-inhibitors, and Statins reducing the risk of recurrent cardiac by events more than 50%. Despite the importance of these medications, there is as much as 50% non-compliance to them at three years.

Purpose: To determine the incidence of non-compliance to "life-saving" medications in Post-MI patients in a cardiac rehabilitation program and to determine the effectiveness of a novel, automated, computer based text message reminder system to improve compliance.

Hypotheses: Null Hypothesis: H_0: Compliance to medications will be static over time in all individuals and no significant difference will be noted with text message reminders. Alternative Hypotheses:

H_1: Compliance to medications will diminish with time in all groups.

H_2: An automated, computer-based, text message reminder system will significantly improve the compliance to medications by addressing its leading cause, forgetfulness.

Variables:

Dependent: compliance to medications and placebos.

Independent: intervention: automated, computer-based text message reminder system,

Controlled: baseline demographics, disease states

General Procedures:

Test protocol, and a written informed consent form was developed and submitted for approval to Dr. S. Sykes, University of Waterloo Human Research Ethics Board. Written informed consent was obtained from all participants before any study procedures were conducted. Demographic information was collected including age, gender, medical diagnosis, medication list, educational status, history of medication compliance, and volunteer perceived reasons for non-compliance.

Procedure Phase 1: Validating the Text Message reminder system

A computer program to send text messages to cell phones was developed using Microsoft Visual Basic 2008 Express Edition.

Test Protocol: The text message reminder system was tested over two weeks in four volunteers to determine its effectiveness to consistently deliver text messages multiple times per day.

Procedure Phase 2: Hypothesis Generating

Twenty-five random, healthy volunteers were recruited to test this model with placebos:

Test Protocol: Volunteers removed a placebo (a raisin) from pre-prepared vials four times daily and kept logs. For one week individuals removed the placebo raisins without reminders. For a second week, the same volunteers received reminder text messages. The accuracy of self reported placebo removal was determined through a "pill count" of returned vials.

Procedure Phase 3: Real World Application

Thirty random volunteers from a local medical practice were recruited.

Test Protocol: All volunteer patients were asked to take their own medications according to their regimen for one month and record their compliance in a specially designed logbook. For a second month, all volunteers received reminder text messages and recorded their compliance.

Phase 4: Proof of Concept

Thirty-four random Post-MI cardiac rehabilitation patients were recruited and randomized using a web based random number generator into one of two groups: Group A would receive reminders for three months and Group B would not. Volunteers were asked to log compliance to four lifesaving medications: Anti-platelets, B-Blockers, ACE-Inhibitors, and Statins.

Test Protocol: For three months, Group A took their medications as prescribed and recorded their compliance.

For three months, Group B received text messages daily to remind them to take medications at their prescribed time and recorded their compliance. Both groups used supplied log books.

Results: Phase 1: System Reliability Results:

The system proved to be effective at sending text messages. Of the 112 reminders sent weekly, all were received accurately.

Results Phase 2: Hypothesis Generating- Compliance to placebos

Analysis	Without Reminders	With Reminders
Total missed doses	155	67
Percentage compliance	65.4	85
% of individuals improved	N/A	87.5%

Pill counts determined that the logging of volunteers was 100% accurate, suggesting that a similar method of logging could be used for further phases of the study.

Results Phase 3: Real World Application- Compliance to Routine Medications

Analysis	Without Reminder	With Reminders
Percent Compliance	83	93.8
Absolute Improvement	N/A	10.8%
% Improved Subjects	N/A	100
Number of missed doses	311	119
Statistical Analysis	N/A	p=0.0001

Sub group analysis, phase 3:

Literature review had suggested that certain groups may be at higher risk for forgetfulness. In a prospective manner, data was collected on these subgroups. It was determined that these pre-specified high risk groups, at higher risk for forgetfulness, did indeed appear to have lower baseline medication compliance. The elderly as well as cognitive disease patients (Stroke, Dementia and Depression) were noted to have lower baseline compliance when compared to the total study population. These subgroups had greater improvement with this system, despite their lower baseline compliance. Interestingly, compliance of the less educated (less than grade twelve education) was 12% lower at baseline but had a robust 14% greater improvement in compliance than the total study population.

Results Phase 4: Proof of Concept:

Analysis:	Without Reminders	With Reminders
% Compliance Month 3	89.4	98.7
Absolute Improvement	N/A	9.3
Relative Risk Reduction	N/A	85.6
Reduction to # of missed doses	498	72
Statistical Analysis	N/A	p=0.0001

Analysis phase 4:

As had been noted in previous studies, there was a significant drop in compliance to "life saving medications" in Post-MI patients with time: 94% at month one, 92% at month two, 89% at month three (p=0.0001). Compliance remained stable in individuals receiving text message reminders with no significant drops: 99% at month one, 98% at month two and 99% at month three (p=0.149). Compliance in cognitive disease patients, the elderly, and the less educated was lower without reminders but greater improvement was noted in these groups. The greatest improvement seemed to be noted in groups with the lowest baseline compliance.

Conclusions:

Medication non-compliance was noted in healthy volunteers, stable patients, and high risk Post-MI cardiac rehabilitation patients. Certain groups of patients appeared to have lower baseline compliance: elderly, less years of education, and cognitive disease patients. Compliance to "life-saving medications" did drop significantly over time at an increasing rate. Text message reminders were reliably sent from an automated computer program and were effective at improving compliance in random healthy volunteers, stable cardiac patients and high risk Post-MI patients. There was greater improvement noted in those groups who had lower baseline compliance. Subgroups with higher non-compliance rates appeared to benefit even more than the overall study population suggesting that this system may be particularly efficacious in those at highest risk for non-compliance. A novel consistent finding of this study was the association between educational level and medication non-compliance, not previously reported in the literature. The less educated also appeared to benefit more with this novel reminder system.

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