Refereed paper

MedlinePlus-based health information prescriptions: a comparison of email vs paper delivery

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ABSTRACT

Background The internet can provide evidence-based patient education to overcome time constraints of busy ambulatory practices. Health information prescriptions (HIPs) can be effectively integrated into clinic workflow, but compliance to visit health information sites such as MedlinePlus is limited.

Objective Compare the efficacy of paper (pHIP) and email (eHIP) links to deliver HIPs; evaluate patient satisfaction with the HIP process and MedlinePlus information; assess reasons for non-compliance to HIPs.

Method Of 948 patients approached at two internal medicine clinics affiliated with an academic medical

centre, 592 gave informed consent after meeting the inclusion criteria. In this randomised controlled trial, subjects were randomised to receive pHIP or eHIP for accessing an intermediate website that provided up to five MedlinePlus links for physician-selected HIP conditions. Patients accessing the intermediate website were surveyed by email to assess satisfaction with the health information. Survey non-responders were contacted by telephone to determine the reasons for no response.

Results One hundred and eighty-one patients accessed the website, with significantly more 'filling' eHIP than pHIP (38% vs 23%; $P < 0.001$). Most (82%) survey respondents found the website information useful, with 77% favouring email for future HIPs delivery. Lack of time, forgot, lost instructions or changed mind were reasons given for not accessing the websites.

Conclusions Delivery of MedlinePlus-based HIPs in clinic is more effective using email prescriptions than paper. Satisfaction with the HIP information was high, but overall response was low and deserves further investigation to improve compliance and related outcomes.

Keywords: access to information, electronic mail, health education, information dissemination, information-seeking behaviour, internet, MedlinePlus, patient education as topic, prescriptions, questionnaires

What does this paper add?

This study is a randomised controlled trial comparing the efficacy of paper health information prescriptions (HIPs) to email HIPs in outpatient primary care medical practices.

We found that patients were more than one and a half times more likely to access the prescribed health information if prescribed via email as compared with paper. Patient satisfaction with the HIP information was high, and most patients favoured email for delivery of future HIPs. This study demonstrates that patient compliance is improved with email delivery.

Previous studies evaluating HIPs have reported positive outcomes, but the most effective and efficient strategies to integrate them into busy clinic workflow and increase patient compliance have previously not been well defined.

Introduction

Practising evidence-based medicine and helping patients make informed decisions are recommended practices,[1] as well as a patient expectation. Educating patients to include the provision of relevant information about their condition(s) is foundational to evidence-based and informed decision processes. An increasingly important means of patient education is the internet. A recent survey reports that 83% of adult Americans seek health information online before a doctor's visit.[2] However, the health information available on the internet is of varying quality, and may be unreliable or misleading.[3] The fast pace of emerging and increasingly complex evidence also make it difficult for patients to assess whether the health information provided on the internet accurately addresses their specific medical condition or concern.

Medlineplus.gov, an official National Institute of Health website, offers a promising solution by providing free, reliable and up-to-date evidence-based health information for patients.[4] Physicians can refer their patients to MedlinePlus which provides tailored health information about specific conditions. A physician-to-patient referral to seek health information is called a health information prescription (HIP). Recent evidence suggests physicians can save time,[5] improve patient education[6] and patient satisfaction via HIPs.[4,7]

While some studies report positive outcomes with the use of HIPs,[4,8,9] the most effective strategies to engender patient compliance after receiving an HIP are not well defined. In a previous study, the authors effectively integrated the provision of HIP into the workflow of a clinic. However, the self-reported overall compliance with an HIP request (i.e. to 'fill' the prescription) found in that study was low. The primary objective of this randomised controlled trial was to compare the efficacy of delivering the HIP internet link via a paper instruction (pHIP) provided in the clinic with the same instruction provided by email over the internet (eHIP). Because the extant literature provides little guidance about this issue, we proposed the following research hypothesis: patients who received pHIP would be no less likely to obtain information using MedlinePlus than those who received the same

customised information through eHIP. Thus, we hypothesised that paper was non-inferior to email.

Methods

A single-masked (physician), randomised, controlled trial design was used to compare the efficacy of paper with email instruction, which was measured by whether patients accessed a designated, intermediate HIP website. Block randomisation was used to ensure an approximately balanced group assignment throughout the study. Concealed allocation (sealed envelope) of patients to group assignment was made using a computer-generated random permutation, where the envelope was unsealed at the end of the appointment visit. The study design also included telephone surveys of patients who did not access the HIP site to determine reasons for non-compliance. For those who accessed the site, an online survey assessed their impressions about the quality of information obtained from MedlinePlus via the intermediate site, as well as their experiences in receiving an HIP. The University of Missouri Health Sciences Institutional Review Board approved this study.

Site and sample

The study's sites were two internal medicine clinics affiliated with an academic medical centre. The physicians prescribing the HIP included attending and resident physicians in internal medicine. Patients were eligible if they had an email address, were 18 years or older, and were being seen for at least one of the preselected conditions on the HIP order form. Patients were selected if their physician determined it was appropriate for them to receive health information and they gave informed consent.

Sample size

The planned sample size was 320 patients in each group, so as to yield 85% power for a margin of non-inferiority of –10% with a Type I error of 5%.

Intervention

During a scheduled clinic visit, before being seen by their usual physician, patients were invited by a research assistant to participate in the study. The research assistant explained that patients who agreed to participate would receive an HIP (by either email or paper prescription) from their physician, as deemed necessary. The prescription contained links to specific health information provided on the internet that included recommendations for health information from the MedlinePlus website. Patients were also informed that the internet sites used in the study did not contain personal health information or information from their clinic visit. The research assistant confirmed eligibility, shared consent information and recorded demographic information for age, ethnicity, race and education level, along with an email address on a standardised data collection form. For all patients who had an email address and gave consent, an HIP order form was given to the physician before entering a patient's room.

Physicians were asked to consider an HIP for any patient who had an HIP order form at the door, but the final decision was made by the physician based on perceived patient capabilities and benefit. The HIP order form contained 45 of the most common conditions seen at the two clinics. Physicians were asked to inform patients if an HIP was ordered. When a physician visit concluded, a research assistant returned to the room to randomise each patient (using a sealed-envelope system) into one of two arms: (1) email prescription (eHIP) group, or (2) paper prescription (pHIP) group. The research assistant provided instructions on how to access the prescribed health information at the conclusion of the visit and how to access a medical librarian to retrieve additional information.

Patients randomised to pHIP were given a paper prescription with directions on how to access the intermediate (or study) website at the conclusion of their clinic visit. Patients randomised to eHIP were told they would receive an email within 24 hours of their visit; the email contained a direct clickable link to the study website. The study website (where all patients were directed) was an intermediate location that contained health information links for all 45 common conditions. After selecting their condition, each patient was presented with as many as five links (as prescribed) to MedlinePlus that had been previously reviewed and selected by clinic physicians. The study was approved by the Institutional Review Board (IRB) and patient consent was obtained to participate in the study.

Data collection

After completion of the clinic visit, research assistants entered the patient demographic information, email address and group randomisation into a secure database. All HIP order forms were numbered; each patient was given a unique password that was linked to the number on the HIP order form. This password was included in the patient instructions to access the intermediate website and was entered into a database.

The password was required to log-in to the intermediate website providing the capacity to track a patient's access to the prescribed information. Respondent rates for the two intervention groups were determined by analysis of the log-ins into the intermediate website for all patients entered into the study, which ensured verifiable HIP use, rather than *self-reported* HIP use previously reported.[7] We also collected clickstream data originating from the intermediate site.

All patients who accessed the intermediate website were sent an email inviting them to complete an 18-question survey after their first log in. The survey assessed perceptions of the quality of information found on the intermediate website and MedlinePlus; and opinion regarding receiving an HIP from their physician. All patients who did not log in were sent an email reminder one week after their clinic appointment. Patients enrolled during the first month of the study who did not access the HIP and did not respond after the email reminder were contacted by telephone to complete a non-responder survey assessing reasons for non-compliance.

Data analysis

Patient demographic data was collected and entered into a custom, secure database, where it was matched with patient log-in and clickstream data. All analyses were carried out using SAS[10] and NCSS 2007.[11] Two-sided 95% confidence intervals (CI) were used to estimate the difference in proportions, based on the modified Wilson score/Newcombe hybrid method.[12] For test of non-inferiority, the score test of Farrington and Manning was used.[13] For demographic comparisons between groups, a two-sample *t*-test was used for age, while a chi-square test was used for ethnicity, race, gender, internet access at home and education. Values of $P < 0.05$ were considered statistically significant.

Results

Characteristics of participants

Of 948 patients, 724 met the inclusion requirement and 708 agreed to participate. Of these, 592 had at least one study condition included in the resource list and provided a valid email address. A total of 292 were randomised to the pHIP group, and 300 were randomised to the eHIP group.

To verify that randomisation resulted in no appreciable differences between the groups with respect to several key demographic variables, we assessed summary statistics of these variables for each group and compared them, as shown in Table 1. There were no significant differences. A similar comparison was made between the 592 patients who participated in the trial and the remaining 356 patients who were asked to participate but did not or could not for various reasons. We found no significant differences between groups for any of the variables listed in Table 1, except for education level ($P < 0.001$). Well-educated patients were more likely to be in the study than less-educated patients.

Primary endpoint

Of the 592 patients, 181 (31%) logged in to the HIP website ('filled their HIP'): 23% (68/292) in the pHIP group and 38% (113/300) in the eHIP group. The difference between paper and email was –14.4% (95% CI from –21.8% to –6.7%; $P < 0.001$), which suggests that email was statistically better than paper. Hence, the null hypothesis that paper was no worse than email (in terms of how participants filled an HIP) was not rejected ($P = 0.87$), or the differences were too large to suggest that paper was non-inferior to email.

Comparisons of proportions in a prospective trial, such as ours, also can be interpreted in terms of relative risk or number needed to treat. Based on a relative risk (RR) interpretation, patients receiving the email HIP were 1.62 times more likely (95% CI of RR from 1.25 to 2.09) to fill their HIP than those receiving the paper HIP. Based on an number needed to treat (NNT) interpretation, the data suggested that for every 6.96 patients who received an email HIP, rather than a paper HIP, one additional patient was expected to fill their HIP (95% CI of NNT from 4.60 to 15.02).

Because more educated people were more likely to participate in the study, we also compared pHIP with eHIP after stratifying education level to ensure any conclusions about the fill rate were not seriously impacted by heterogeneous differences across educational strata. We found that paper and email were different after controlling for education (Cochran–Mantel–Haenszel test, $P < 0.0001$); and all differences were *not* heterogeneous across strata (Breslow–Day test $P = 0.86$).

Click stream data

Most patients (68%) were prescribed an HIP for a single condition, and there was no difference in the distribution of the number of conditions between pHIP and eHIP ($P = 0.63$). Table 2 shows the conditions for which at least one HIP was written, sorted in descending order of the number of written prescriptions. Also shown is the click rate by condition (whether a patient actually clicked on the condition

Table 1 Patient characteristics between treatment groups

	Paper HIP ($n = 292$)	Email HIP ($n = 300$)	*P*	Responses missing*
Age	51 (14)	52 (15)	0.46	3
Gender (Female)	164 (57%)	158 (53%)	0.41	5
Education			0.68	24
Professional/graduate school		97 (35%)	94 (33%)	
College graduate		75 (27%)	78 (27%)	
Some college		58 (21%)	50 (17%)	
Technical/trade school		11 (4%)	14 (5%)	
High school diploma/GED		29 (10%)	41 (14%)	
Some high school or less		11 (4%)	10 (3%)	
Race			0.79	7
Caucasian	253 (88%)	265 (89%)		
African American	20 (7%)	20 (7%)		
Other	15 (5%)	12 (4%)		
Ethnicity (non-Hispanic)	279 (98%)	281 (97%)	0.30	18
Internet access at home (Yes)	275 (94%)	283 (94%)	0.94	0

* Missing values are not counted in either the numerator or denominator when computing percentages.

link after logging in), and the click rates broken down by email and paper within a condition. Continuing the analogy to a traditional prescription, the click rate conceptually represents the proportion of patients who actually take the prescribed medication after filling it.

The top five conditions clicked included: hyperlipidaemia, hypertension, diabetes, diet and nutrition, and exercise; which accounted for 45% of total conditions prescribed (354/788). Note that these results are aggregated based on *conditions* (not patients) so that the total number of conditions exceeds the number of patients in the study. Once on the site, patients could click on conditions that they were not prescribed, and Table 2 does not address these issues.

Taking a more patient-centric approach to the click stream data, we found that 139 patients (77%) clicked on at least one link related to the condition they were prescribed. Fifteen additional patients (12 email, three paper) clicked only on topics they were not prescribed. Therefore, of the 181 who logged in, 85% clicked on at least one link. Among the 139 participants who clicked on at least one of their prescribed conditions, 120 (86%) stayed within one condition. The mean number of clicks per patient was 1.72, with a maximum of 7.

Patient information seeking

The patients who accessed the site ($n = 181$) were sent a patient survey about HIPs and the health information they found via the intermediate website and MedlinePlus. Among the 115 who completed the survey (64% response rate), 86% correctly recalled they had received an HIP.

About 88% acknowledged their physician explained the purpose of an HIP, which is to help patients find information about their medical condition on the internet. About 97% acknowledged that they 'obtained information about the condition for which their doctor gave them the internet prescription' and 86% found the information to be of benefit to them.

However, only 56% found the information to be more interesting/appealing because their physician prescribed it. In addition, there were a large number ($n = 41$) of missing responses for the question about whether patients 'obtained information about the condition for which their doctor gave them the internet prescription,' suggesting that the true percentage responding 'yes' to the question may be significantly lower than the reported 97%.

About 67% of participating patients reported they were more confident to look up health information on

Table 2 Click stream data for HIP conditions

	Paper HIP		Email HIP		Total	
Condition	*n*	% clicked	*n*	% clicked	*n*	% clicked
Hyperlipidaemia	51	24	63	33	114	29
Hypertension	41	20	44	29	85	25
Diabetes mellitus	30	13	33	27	63	21
Healthy diet/nutrition	28	29	27	19	55	24
Exercise	18	33	20	25	38	29
Back pain	17	24	19	26	36	25
Depression	13	15	20	5	33	9
Allergic rhinitis	16	6	16	31	32	9
Oesophageal reflux	14	14	12	42	26	27
Anxiety	13	23	12	17	25	20
Sinusitis	13	15	10	30	23	22
Tobacco use	11	18	10	40	21	29
Obesity	10	20	9	11	19	16
Insomnia	5	0	10	20	15	13
Asthma	11	18	4	50	15	27
Osteoporosis	7	14	7	29	14	21
Benign prostatic hypertrophy	6	17	6	33	12	25
Hypothyroidism	6	0	6	33	12	17
Screening for prostate cancer	5	0	5	40	10	20
Osteoarthritis	6	33	4	0	10	20
Chronic cough	7	14	2	100	9	33
Nasal saline irrigation instructions	4	50	5	0	9	33
Sleep apnea	3	0	5	20	8	13
Urinary tract infection	4	75	3	33	7	57
Adult immunisations	2	0	5	20	7	14
Screening for colon cancer	3	0	4	50	7	29
Screening for breast cancer	3	0	4	25	7	14
Screening for cervical cancer	3	33	4	0	7	14
Headache	4	25	3	33	7	29

Table 2 Continued

COPD	3	0	3	33	6	17
Shoulder pain	3	0	2	0	5	0
Warts	1	0	3	33	4	25
Community-acquired MRSA	1	0	3	33	4	25
Chronic kidney disease	2	0	2	0	4	0
Acne	3	0	0		3	0
Screening for osteoporosis	1	100	2	50	3	67
Constipation	3	33	0		3	33
Irritable bowel syndrome	0		2	0	2	0
Vaginitis	1	0	1	0	2	0
Dermatitis	0		2	0	2	0
Haemorrhoids	0		2	50	2	50
Bursitis	0		1	100	1	100
Urinary incontinence	1	0	0		1	0
Miscoded	0		1	0	1	0
Total	383	20	405	27	788	23

Note: Only 43 conditions are listed in the table although 75 were available to be prescribed. Those not listed were not prescribed during the study period.

the internet after receiving instruction from their physician. Fewer than half the patients visited other sites on the internet to obtain additional information for their condition (39%) or used the HIP intermediate website to find information about other conditions in which they may have interest (41%).

Patient satisfaction

Eighty-one percent found the HIP intermediate website easy or very easy to use, 82% found the information on the MedlinePlus website to be very useful or mostly useful, and 85% indicated that they would use another HIP if prescribed by their physician for a different condition. More patients would prefer to receive future HIPs by email (77%) in contrast to paper (23%), although a large number of patients did not answer this question ($n = 31$).

Health behaviour outcomes

Twenty-four percent talked to others (e.g. family, friends, physician) about what they learned from the website regarding their condition.

Non-responders

During the first month of implementation, 53 non-responders were contacted via a telephone survey. They cited a lack of time, forgotten or lost instructions, or changing their mind as reasons to not fill their HIP.

Discussion

Principal findings

This study aimed to facilitate the use of internet-based disease-specific information by patients seen in pri-

mary care medicine clinics. The results of this randomised controlled trial suggest patients who receive HIPs via email are more than one and a half times more likely to access the health information as those who receive a link via a paper prescription. For every seven patients who receive HIP via email, one more patient is expected to access the health information prescribed than those who are given a paper instruction. Also, participants were satisfied with the information they received from an intermediate site with links to information provided by MedlinePlus, which is somewhat consistent with other studies where patients directly linked to MedlinePlus.[4,7]

Implications of the findings

Given the increasing number of patients that use internet and email to access health information,[4,14] these results are timely and encouraging. However, only slightly more than one third of the patients who received the email prescription actually visited the HIP information website. Interestingly, in the authors' previous study about an eHIP, 40% of patients self-reported accessing their assigned links.[7] In comparison, a recent study found patients filled 72% of e-prescriptions for new medications.[15] The apparently low level of patient compliance to fill HIPs may reflect several considerations. These include: the level of physician engagement in the intervention, the emphasis placed on filling the prescription, education of the patients regarding the role of the prescriptions in their care and other factors known to influence patient compliance with traditional prescriptions.

Comparison with the literature

Results of a recent national survey suggest that 78% of adult Americans use the internet regularly and 92% receive or send an email on a daily basis.[2] Other surveys suggest patients want to communicate with their providers via email, thus providing an important opportunity to use email and available internet resources to deliver HIPs to improve health outcomes.[16–18]

Limitations of the method

There are several limitations to consider regarding the conduct of this study. Patient demographic and clinical characteristics were not assessed, so possible differences attributed to these variables were unavailable. There were no significant differences in the proportion of prescriptions by condition between the two groups who received the intervention.

Despite a standardised process for care delivery implementation, it is conceivable that differences in operations between the two clinic sites might have influenced the study's results. Attending physicians at both clinic sites belonged to a single practice group, and some physicians practiced at both clinic sites. In addition, resident physician practices were located at both clinic sites.

The findings may not be generalisable to those who do not have access to internet/email. Moreover, these patients may be less educated and less interested in health educational interventions than the study's participants. The patient population in our study was highly educated with more than half of patients reporting completion of college or higher degrees.

Finally, the study did not address the important related questions of effectiveness of the two interventions on clinical outcomes or management of the prescribed conditions.

Call for further research

Additional research is needed to discern how to improve HIP efficacy, in terms of both initial access and to assess the overall efficacy of the intervention to improve health outcomes. A recent Cochrane review found that internet-based interventions facilitated smoking cessation, especially if information was tailored to patients. In these studies, the 'number of log-ins' was used as a surrogate marker for participant's degree of engagement and was found to be associated with higher abstinence rates.[19]

Conclusions

Delivery of MedlinePlus-based HIPs by email is more efficacious than paper-based prescriptions. While patient satisfaction with HIPs was high regardless of prescription method, the overall patient response to the HIP was low and deserves further investigation to improve compliance and assess efficacy.

ACKNOWLEDGEMENTS

This research was funded by a contract from the National Library of Medicine, and was registered on ClinicalTrials.gov with identifier NCTO1050465.

CONFLICT OF INTEREST

None.

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Accepted February 2013