

Case Report ■

Characteristics of Effective Electronic Mail Messages Distributed to Healthcare Professionals in a Hospital Setting

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Abstract Electronic mailing systems (e-mail) are an important means to disseminate information within electronic networks. However, in large business communities including the hectic environment of hospitals it may be difficult to induce account holders to read the e-mail. In two mailings disseminated in a large university hospital we evaluated the impact of e-mail layout (three e-mail text versions, two e-mails with graphics) on the willingness of its ~6500 recipients to seek additional electronic information and open an integrated link. Overall access rates after 90 days were 21.1 and 23.5% with more than 70% of the respondents opening the link within 3 days. Differences between different layouts were large and artwork text, HTML text, animated GIF, and static image prompted 1.2, 1.7, 1.8, and 2.3 times more often access than the courier plain text message ($p \leq 0.001$). This study revealed that layout is a major determinant of the success of an information campaign.

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Introduction

Web-based systems and electronic mailing systems (e-mail) have revolutionized communication and, as an easily available, informal way to share information, e-mail has become a cornerstone of communication in health care settings.^{1,2} Major advantages are its simplicity of use, the multiple advantages of asynchronous communication, and growing options of exchanging visual information, rendering communication less dependent on semantics (and therefore less dependent on education of the dialogue partner). In business communities with electronic networks, e-mail may thus be valuable for communication across social strata while offering advantages to disseminate information without interruption of working processes.

With the ease of sending messages and copies to multiple persons (one-to-many-messages), e-mail users are experiencing information overload and are receiving too much information of low interest (like unsolicited commercial e-mail: spamming).³ These problems have become a major issue, wasting time and resources of e-mail recipients. Conversely, e-mail users have developed strategies to instantly screen incoming messages and to dispose of them without reading. In large and complex business companies like

hospitals, continued information exchange is an essential way to promote excellence in clinical care.⁴ Therefore, making an addressee turn his attention to a given piece of information and peruse it is as essential as the message itself.

Over recent years the appearance of e-mail messages has changed from a plain text style with unattractive fonts (courier) to more flexible hyper text markup language (HTML) options that can be defined by the sender and adjusted to the characteristics of the recipient. Hence, senders have fine-tuned the message design to make it more appealing to the target population and increase the odds of the message being read. Indeed, web surveys suggest that HTML messages with their inherent option of including graphics are preferred over plain text despite security concerns and their larger size.⁵

In a randomized controlled trial, we tested the impact of five different message layouts with e-mails containing the identical short information on the willingness of the hospital personnel to retrieve additional information from a site linked to it. In addition, we analyzed the timing of collected responses with respect to the e-mail type delivered.

Methods

We developed a web-based drug information system (*AiD-Klinik*) which is accessible in the intranet of our hospital, a 1,680-bed university hospital providing primary and tertiary care to an urban population. *AiDKlinik* provides information on the whole German drug market and can be accessed from all 4,500 workstations shared by the 6,500 accredited computer users of the hospital. The system is equipped with computerized physician order entry (CPOE) and decision support systems, e.g., for drug-drug interactions or dosage

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Table 1 ■ Characteristics of E-mail Messages Randomly Distributed in Five Different Layouts to All E-mail Accounts in a University Hospital

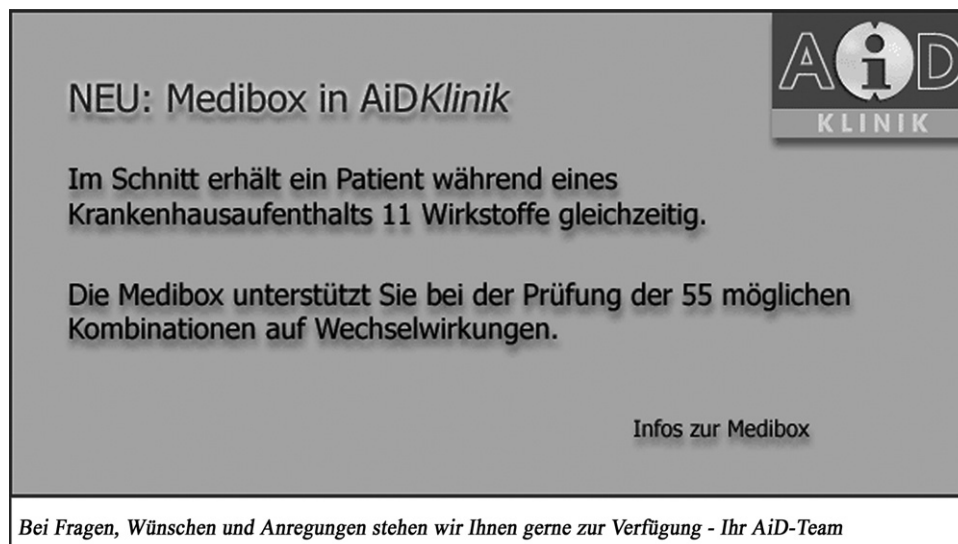
E-mail Layout	Title Font	Statement Font	Link	Graphics
Classic (black and white)	Courier	Courier	Underscored blue text as hyperlink	None
HTML text	Times New Roman	Times New Roman	HTML-Button	None
Artwork text	Arial with shadow	Arial with shadow	Whole E-mail	None
Static image	None	None	HTML-Button	Static image
Animated image	None	None	HTML-Button	Animated GIF

adjustment in renal failure. It is updated twice a month and currently supports about 2,000 searches per day. Extensions of the functionality of the system are routinely communicated in an e-mail to all ~6,500 e-mail account holders who were all equipped with MS Outlook 2000 as the standard mailing program. Separated by an interval of six months we communicated (a) the introduction of a drug interaction system and (b) the addition of pregnancy information by e-mail sent to all accounts within the intranet of our hospital. Each mailing consisted of one message in five different layouts (Table 1). Each layout consisted of five different elements: (1) a subject line, (2) an informative short title with (3) a two-sentence statement and (4) a link to access additional information, or (5) an image. Title, text, and image were variable parts: three e-mail layouts only contained title and text with the same wording but variable fonts (Table 1, Figure 1A). Two layouts only contained an image which was static in one e-mail and an animated graphics interchange format (GIF) file of 5.5 (pregnancy message) or 7.7 seconds (drug interaction message) duration in the other e-mail (Table 1, Figure 1B). Graphics were used because the visual presentation and communication of information in hospitals has been shown to be more effective.⁶ The relevant text elements were set in a large font (at least 14 point) to ensure good readability.⁷ For lettering two fonts with serifs and one font without were used.

Using identifying parameters each message was linked to the same uniform resource locator (URL) i.e., a webpage providing illustrations and details on the new knowledge

bases. While this webpage illustrated the new feature, giving a pertinent example, it neither contained data nor gave access to the respective knowledge bases. It was therefore not suitable to answer specific questions, but used the advantages of not being limited by the narrowness of the e-mail viewer's preview pane.

Messages were designed to be the same size (600 × 300 pix; equals 22 × 12 cm at 1024 × 768 display resolution), small and readable, even if the message was not opened to full screen or viewed only in the Outlook preview pane. We then imported all hospital e-mail accounts into a database, sorted them alphabetically, and divided them into five groups of roughly equal size to be mailed as independent packages. This was done to reduce mail server load. Within each package, addressees were randomized to one of the five messages to assure that all the different types of messages were included in each mailing wave. Within each package, accounts were serially numbered from 1 to 5 and were assigned to the five e-mail layouts. E-mails were only sent once to each receiver and the receivers were neither informed about the existence of different e-mails nor who else was receiving the mail. The e-mails were sent on a Monday (1st mailing) and six months later on a Wednesday (2nd mailing). For 90 days after each mailing, we anonymously logged every visit to the linked pages. This information was the primary endpoint of the study and the frequency distributions were analyzed by χ^2 -analysis. A p-value <0.05 was considered significant.



NEU: Medibox in AiDKlinik

Im Schnitt erhält ein Patient während eines Krankenhausaufenthalts 11 Wirkstoffe gleichzeitig.

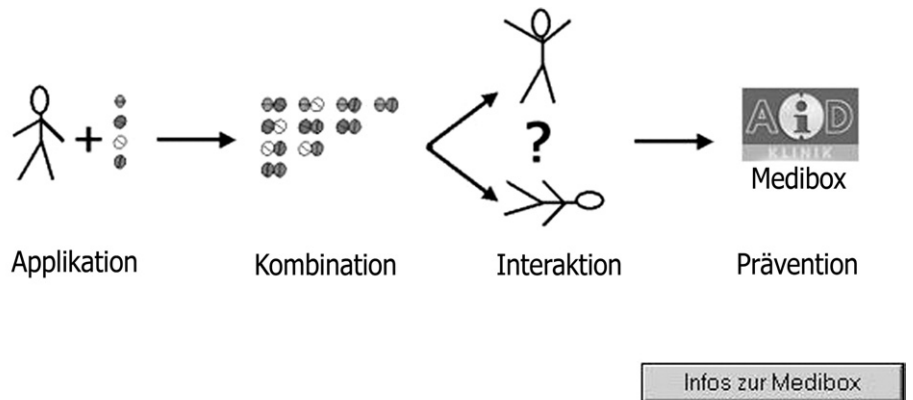
Die Medibox unterstützt Sie bei der Prüfung der 55 möglichen Kombinationen auf Wechselwirkungen.

Infos zur Medibox

Bei Fragen, Wünschen und Anregungen stehen wir Ihnen gerne zur Verfügung - Ihr AiD-Team

Figure 1A. E-mail with a text message (artwork text) sent to inform addressees about a new feature in their web-based drug information system (AiDKlinik) (1st mailing). The message states: On average hospitalized patients are exposed to eleven different drugs. The computerized physician order entry system (Medibox) supports the evaluation of the resulting 55 combination pairs for drug interactions.

Figure 1B. E-mail with a message containing a GIF file with or without animation to alert account holders to a new interaction tool in their drug information system (AiDKlinik) (1st mailing).



Bei Fragen, Wünschen und Anregungen stehen wir Ihnen gerne zur Verfügung - Ihr AiD-Team

Results

Both mailings were successfully and uneventfully concluded. Mails not deliverable were excluded from further analysis, leaving 6309 (1st mailing, drug interaction message) and 6767 (2nd mailing, pregnancy information message) e-mail accounts (set to 100%) in the data set.

Overall, the linked pages were accessed 1,333 times (1st) and 1,590 times (2nd) by responders during the 90 days after each mailing, rendering an average response rate of 21.1% (1st) and 23.5% (2nd). Response rates varied considerably between the five message formats (Figure 2, Table 2). Total and individual responses showed circadian fluctuations and after approximately 96 hours, 67–80% of the total responses were received, irrespective of the mailing type (Figure 2). In both mailings the plain text (courier font) version had the lowest response rate, which was significantly lower than all others (Table 2). The highest rate of response observed was that to the e-mail with the static image, through which the linked page was accessed by 372 (1st) and 469 (2nd) recipients. The combined analysis of both mailings revealed that artwork text, HTML text, animated GIF, and static image were accessed 1.2, 1.7, 1.8, and 2.3 times more often than courier plain text (Table 2).

Discussion

Rapid dissemination of information is critical in any hospital because of the need to coordinate complex services and react to the rapidly changing information in health care. E-mail is a convenient, rapid, and inexpensive way to reach a target population and by providing links instead of attachments the processor load can be kept to a minimum. However, if attachments are not opened or links not accessed, information may not be spread in the intended way because it will not reach the addressee.

In order to objectively assess the number of employees who were attracted by the e-mail and scrutinized its content, we calculated a response rate similar to e-mail surveys.^{8,9} E-mail surveys have generally lower response rates than mail surveys^{8,10} and their response rates have continuously declined over the past 20 years, recently reaching values between 20 and 30%.^{9,11} Although we deliberately did not use any of the common methods to

boost responses, such as personalized messages, pre-notice letters before the mailing, or reminders thereafter,⁸ our average response rate of 22% was in the currently expected range.^{9,11} Compared to different other settings like an e-mail survey in an academic environment (response rate 27%)¹² and considering that we did not explicitly solicit for a response this is a favorable result which may even underestimate response rates because not all addressees are involved in patient care.

Our mailing was intended to inform users about a new feature implemented in our hospital-wide drug information and prescription system (AiDKlinik). Because this system is designed to be used without formal training, we heavily rely on e-mail communication to announce new functionalities to the hospital staff. Similar to earlier survey responses, over 70% of the responses were received within the first 96 hours after mailing.¹¹ However, response rates varied considerably between the different message formats, indicating that design is a rather important modulator. Indeed, compared to the employees receiving the plain text courier message, more than twice as many users receiving the HTML version with a static image were induced to access the corresponding webpage with extended information. It is more difficult to design an e-mail message with graphics; but even if the e-mail had been sent as a plain text HTML, message 70% more employees would have been reached. These results match a recent internet survey where roughly three times as many respondents (66.8%) favored e-mail messages in an HTML format over those who preferred plain text messages (only 22.7%).⁵ The main reasons given for this preference were better readability (78%), more attractive display (68%), ease of scanning (64%), and overall design (64%).

Whenever e-mail is used as a vehicle, the message has to withstand being classified as unwanted spam. Thus, we were somewhat surprised that layout may have such a substantial impact. We also learned that the most laborious design (because of the animation) was not the most successful. E-mail messages with a static figure consistently prompted the most people to access the additional information page. Hence, using graphics was the most successful way to reach employees. Whether it is worthwhile spending

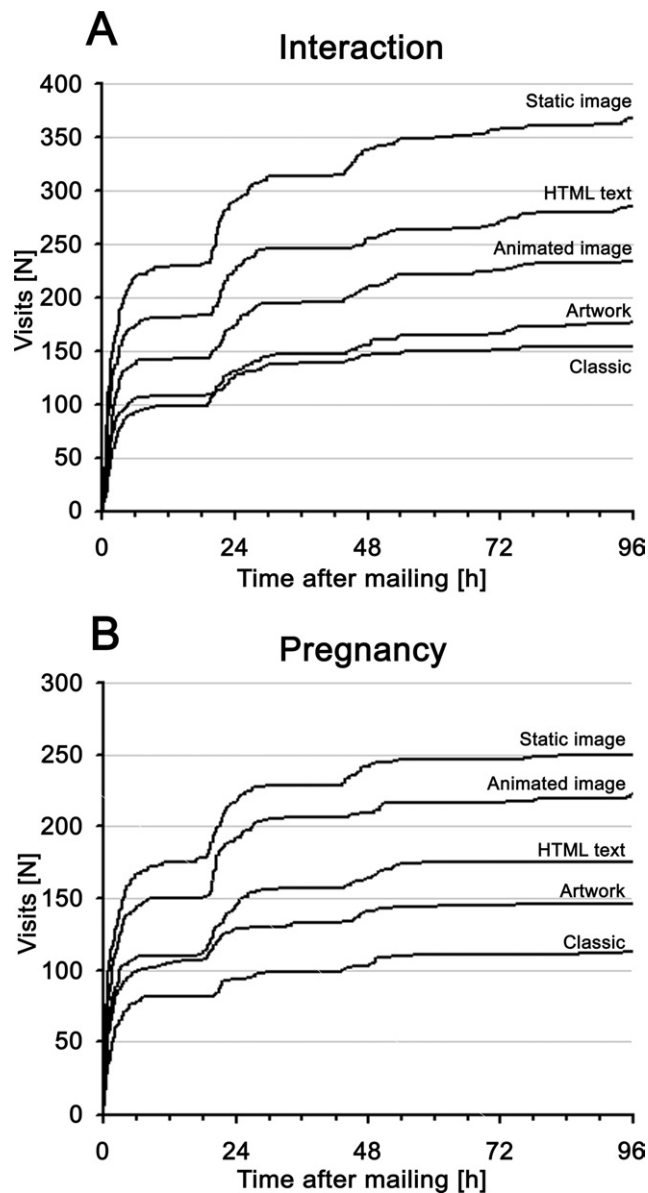


Figure 2. Cumulative calls of the link page in the first 96 hours after sending the first (interaction; panel A) and second mailing (pregnancy; panel B).

additional resources to design graphics to a specific message will depend on the aims of the information campaign and particularly on how critical it is to reach a large audience.

There were also considerable differences between the three different text messages which are in agreement with general predictors of successful web design.⁷ However, even though both the Courier and Times New Roman formats had lettering with serifs, the Times New Roman messages prompted the addressee to access the information page 1.7 times more frequently. This suggests that the Courier font is less aesthetic and should be avoided. On the other hand, the shadowed Arial font was only slightly more successful than Courier, perhaps because its contrast to the blue message background was less distinct, reducing its readability.⁷

Several limitations of this report merit mentioning. First, because logging was done anonymously we did not distinguish between individual users. Hence access rates to the link may exceed the actual number of users if individuals viewed the page, which only advertised the new enhancement, more than once. Because this webpage did not contain clinically useful data and only expanded the information repeated access by the same user was unlikely.

We were not able to track the pattern or rates of use of the new AiDKlinik knowledge sources due to the following reasons: in our CPOE system drug interaction messages are delivered whenever drug pairs with interaction information have been prescribed (immediate feedback). Therefore such information is always delivered and tracking not possible. Pregnancy information was delivered as an icon and the combination of color and code of the icon already revealed the risk category.

Second, we do not know to what occupational group the readers belonged and whether professional background would modify the preferences in layout. But since drug interactions are a critical issue in all medical disciplines and should therefore be prevented in all sectors, stratification by healthcare provider specialty could have actually introduced another source of bias. As another example, drug induced risks in pregnancy as exemplified by endocarditis prophylaxis which has to be considered by dentists just as much as by cardiologists, surgeons, or any other prescribing specialty.

In conclusion, this study showed that a substantial proportion of the hospital staff may be reached by e-mail within a short period of time and that the layout of the message will substantially influence the extent to which the addressees give appropriate attention to the content of the e-mail message and seek additional information.

Table 2 ■ Response Rates of E-mail Account Holders in a University Hospital to E-mails Sent in Five Different Layouts

E-mails Sent		Responses after 96 Hours		Total Responses after 90 Days	
Layout	N	N (% of Column Total)	% of Total Responses	N (% of Column Total)	% of E-mails Sent (= Response Rate)
Classic	2616	268 (12.5%)	74.0%	362 (12.4%)	13.8%
HTML text	2616	464 (21.6%)	74.8%	620* (21.2%)	23.7%
Artwork text	2615	324 (15.1%)	71.7%	452* (15.5%)	17.3%
Static image	2615	625 (29.1%)	74.3%	841* (28.8%)	32.2%
Animated image	2614	466 (21.7%)	71.9%	648* (22.2%)	24.8%
Total	13076	2147 (100%)	73.5%	2923 (100%)	22.4%

The results of two independent e-mail campaigns are combined.

* χ^2 -test: $p < 0.001$ vs. classic version.

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