Patient Use of Secure Electronic Messaging Within a Shared Medical Record: A Cross-sectional Study

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BACKGROUND: Most patients would like to be able to exchange electronic messages with personal physicians. Few patients and providers are exchanging electronic communications.

OBJECTIVE: To evaluate patient characteristics associated with the use of secure electronic messaging between patients and health care providers.

DESIGN, SETTING, AND PATIENTS: Cross-sectional cohort study of enrollees over 18 years of age who were enrolled in an integrated delivery system in 2005.

MEASUREMENTS AND MAIN RESULTS: Among eligible enrollees, 14% (25,075) exchanged one or more secure messages with a primary or specialty care provider between January 1, 2004 and March 31, 2005. Higher secure messaging use by enrollees was associated with female gender (OR, 1.15; 95% CI, 1.10–1.19), greater overall morbidity (OR, 5.64; 95% CI, 5.07–6.28, comparing high or very high to very low overall morbidity), and the primary care provider's use of secure messaging with other patients (OR, 1.94; 95% CI, 1.67–2.26, comparing 20–50% vs. ≤10% encounters through secure messaging). Less secure messaging use was associated with enrollee age over 65 years (OR, 0.65; CI, 0.59–0.71) and Medicaid insurance vs. commercial insurance (OR, 0.81; 95% CI, 0.68–0.96).

CONCLUSIONS: In this integrated group practice, use of patient–provider secure messaging varied according to individual patient clinical and sociodemographic characteristics. Future studies should clarify variation in the use of electronic patient–provider messaging and its impact on the quality and cost of care received.

BACKGROUND

Effective communication between patients and providers is an important component of health care. Current health care systems, with their focus on the clinic visit, do not meet the needs of many patients, especially those living with chronic conditions. A recent report from the Institute of Medicine suggested redesigning health care toward more continuous relationships between patients and providers[1]. Electronic communications between patients and providers may play a key role in meeting patients' ongoing health needs and preferences.

Several health care systems have recently begun to address the known barriers[2] to wider use of electronic communication between patients and providers. These systems use patient Web sites to provide a secure and confidential environment for communications[3–8]. Although few studies have examined the quality of chronic care provided through electronic communication, recent trials suggest a positive impact on control of blood pressure in patients with hypertension[9] and glycemic control in patients with type 2 diabetes[10]. Several health care organizations are piloting or implementing reimbursement for electronic communication with patients. Despite the promise and early spread of secure electronic communications between patients and providers, access to this form of care may be constrained to a younger, healthier, and more literate population[11]. Many of those most in need of care may not be the ones who have the ability to use electronic patient–provider communication.

We describe a retrospective analysis of secure patient–provider electronic messaging in an integrated group practice. The secure messaging application is part of a secure patient Web site, which includes access to an electronic medical record shared between patients and providers. We hypothesized that patient messaging use would be positively associated with patient and primary care provider characteristics related to Internet access and traditional health care utilization.

RESEARCH DESIGN AND METHODS

Setting

This study was conducted at Group Health, a mixed-model health care financing and delivery organization in Washington state and north Idaho. Over 300,000 members receive care through Group Health's integrated delivery system, which includes 20 Group Health-owned facilities and over 500 Group Health physicians. Beginning in August of 2003, all patients with a primary care provider in a Group Health-owned clinic

were eligible to access the services of the shared electronic medical record through the patient Web site.

Group Health primary care and specialty care providers were salaried and expected to engage in secure messaging with patients. Patients and providers could initiate secure messages (SM) to one another on the patient Web site. Every patient SM exchange was triaged by support staff, routed to the appropriate provider, and automatically placed in the patient's electronic medical record. Secure messages were subsequently viewable by all clinicians involved in a patient's care. Individual providers were responsible for handling secure messages from patients or referring the message to a nurse for an appropriate reply. Physicians and other staff were accountable for meeting expectations for communication through messaging. To facilitate this goal, providers were given an incentive of $5 per message beyond their salary to encourage messaging. Response time was tracked every day by administrative staff. If physicians or health care teams had outstanding messages (more than one business day old, without a response to the patient), they were contacted and offered assistance in meeting patient expectations. Patients and providers were otherwise free to incorporate SM into care processes as they saw fit within each patient–provider relationship.

Patients

The study sample included enrollees over 18 years old who were continuously enrolled in Group Health between 1/1/ 2003 and 3/31/2005 and received primary care in a Group Health-owned medical center. To minimize the impact of very early adopters[12], the study period began 21 months after the implementation of SM and ended on 3/31/2005. Patients included in the cohort were enrolled in a Group Health-owned and operated clinic and had the same primary care provider for all 15 months of the study (1/1/2004 to 3/31/2005).

Design

Primary analyses compared users of secure messaging (SM) to patients who had not used SM but had registered for access to Group Health's patient Web site (www.ghc.org). This referent group had Internet access and had shown both interest in and capability of using the patient Web site. The services on the patient Website included prescription refills, appointment scheduling, medical records access, and SM with health care team members. Registering for the patient Web site began with confirmation of personal identity at a Group Health clinic or through the United States mail, followed by patients entering a temporary password provided by Group Health and signing a user agreement. A full description of the Group Health electronic medical record and the patient Web site is available elsewhere[6]. Secondary analyses compared users of SM to enrollees who had not registered for the patient Web site. We hypothesized that SM users would be more like non-users who had registered for the patient Web site than those who had not registered for the patient Web site.

Based on prior studies assessing patient and provider characteristics associated with Internet use, health care utilization, and patient–provider electronic communication[7,13–18], we hypothesized that SM use would be positively associated with younger age (less than 65 years), female gender, higher neighborhood socioeconomic status, distance from home to

clinic greater than 17 miles, rural location, higher overall morbidity, commercial insurance compared to Medicaid or Medicare insurance, higher primary care provider SM use with other patients, and shorter primary care provider SM response time. All data were from automated data sources at Group Health. Group Health does not collect individual information about the ethnicity or race of individual members. This study was reviewed and approved by the Group Health Center for Health Studies Institutional Review Board.

Measures

Secure Messaging. Patients were counted as SM users if they exchanged one or more message threads with a Group Health primary or specialty care provider during the study period. The SM thread with a primary or specialty care provider was the unit of analysis for SM activity. This metric was based on a taxonomy of messaging activity developed through an understanding of the messaging application and its use during the 2004 calendar year[19]. A SM thread was a set of messages related to an original message by successive replies. A SM thread could include multiple different strands of conversation between a patient and a set of providers as long as all conversations originated from the same message. A SM thread was truncated if it had no further message activity for 30 days. Providers' percent of messaging encounters was calculated by dividing each provider's number of message threads by the sum of outpatient, in-person encounters and message threads.

Variables Potentially Associated with SM Use. Neighborhood socioeconomic status (SES) was derived from patient ZIP Code in combination with SES indicators from the 2000 census[20]. Distance from the primary medical center was calculated using each patient's home address. The location of each patient's community was determined to be rural or urban according to the United States Census Bureau's definition of Metropolitan Statistical Areas. Distance to clinic was calculated using home address and location of primary care provider; a distance of 17 or more miles from the clinic was chosen to approximate 30 or more minutes of driving time to a clinic.

The John's Hopkins' Adjusted Clinical Group's (ACG) case mix system was used to measure each individual's overall level of morbidity burden based on an individual's expected need for health care. In this algorithm, every ICD-9 code belongs to a group of conditions that usually require similar amounts of health care. The ACG software assigns each individual a level of overall morbidity between 1 (none) and 6 (very high), depending on age, gender, and number and types of groups populated by the ICD-9 codes over a 12-month period. This measure takes into account interactions between chronic and acute conditions in relation to future health care resource use[21–23]. History of depression, diabetes, and congestive heart failure were defined by three or more outpatient visits with an ICD-9 diagnosis of the condition between 01/01/03 to 03/31/ 05. Types of insurance included commercial plan, Medicare, and Medicaid. Primary care provider characteristics included physician age, high versus low use of SM with other patients, and physician time to respond to patient SM.

Statistical Methods

Characteristics potentially related to SM use were identified prior to analyses[24]. Descriptive statistics were used to compare the characteristics of SM users and non users and to examine the variability in patient panels across providers. Logistic regression models were used to estimate the association between SM use and both patient and primary care provider covariates. Poisson models were used to estimate the association between patient characteristics and rates of SM among patients who had sent at least one secure message. Regression models were estimated using generalized estimating equations with an identity working correlation matrix and robust covariance estimation used to account for clustering of patients within providers[25,26]. Regression models included primary care provider-level means of patient characteristics to estimate the association between patient's expected SM use and overall characteristics of their provider's panel. These provider-level means included the following patient characteristics: age, gender (proportion women), overall morbidity score (0–5), years of enrollment in the Health Plan (Group Health), and years of tenure with the primary care provider. We did not include provider-level means for rural location, distance from care facility greater than 17 miles, low neighborhood SES, or Medicaid or Medicare insurance coverage because these

factors were either relatively rare or, in the case of Medicare insurance, showed little variability across providers.

RESULTS

Secure Messaging Use. Table 1 shows demographic and health characteristics of patients who did and did not use SM. 175,909 Group Health enrollees were eligible for the study. 25,075 (14%) of these exchanged one or more secure messages with one or more providers. 26,425 (15%) had registered for the patient Web site but had not used SM during the study period. 124,409 (71%) had not registered for the patient Web site. SM threads had a median of 2.0 individual messages per thread (interquartile range, 2.0–2.8 messages per thread). Over the 15-month study period, patients had 77,044 (74%) SM threads with primary care providers and 27,610 (26%) threads with specialty care providers. Providers initiated 11% of message threads in which they had one or more messages to a patient.

Primary Care Provider Messaging Activity. Table 2 shows the characteristics of the 162 primary care providers who had

Table 1. Secure Messaging Users and Non-Users

	Not Registered for Patient Web Site	Registered for Patient Web Site*			
		Not Using Secure Messaging	Secure Messaging Users (number of threads)†		
			1–3	4–8	>8
	(n=124,409)	(n=26,425)	(n=18,039)	(n=4,891)	(n=2,145)
Age					
18–35 years, %	20	15	15	13	11
36–50	29	30	31	31	29
51–65	28	37	40	42	43
>65	23	18	14	14	17
Female gender, %	53	55	60	64	65
Low neighborhood SES‡ %	8	5	6	6	6
Rural location %	2	2	2	3	3
Distance from patient's home to clinic ≥ 17 miles %	7	7	7	7	7
Overall morbidity§					
None %	16	8	3	1	0
Very low	7	6	4	1	1
Low	16	17	13	7	2
Moderate	44	51	58	57	42
High or very high	17	18	22	34	55
History of depression %	5	6	9	13	18
History of diabetes %	7	8	9	12	15
History of congestive heart failure %	2	1	1	1	2
Enrollment with Health Plan,					
0–3 years, %	15	12	12	12	11
4–8	22	19	19	19	19
9–12	12	12	13	12	12
>12	51	56	56	57	59
Insurance					
Commercial %	73	78	82	82	77
Medicare	25	21	17	17	21
Medicaid	2	1	1	1	1

*Registered for patient Web site: Following confirmation of personal identity at a Group Health clinic or through the United States mail, patients entered a temporary password provided by Group Health and signed a user agreement
†Annualized secure messaging count
‡SES: Socioeconomic status
§*Overall morbidity: Based on six Resource Utilization Bands of the Adjusted Clinical Groups case mix system*

Table 2. Primary Care Provider and Primary Care Provider Panel Characteristics

	<20% Messaging Encounters*		≥20% Messaging Encounters*	
Primary Care Provider	*n=120*		*N=42*	
Age, No. (%)				
29–44 years	25	(21)	10	(24)
45–50	26	(22)	12	(29)
51–55	33	(28)	13	(31)
56–63	36	(30)	7	(17)
Female gender, No. (%)[†]	43	(36)	25	(60)
Patient tenure, years, mean (SD)	5.7	(4.8)	5.8	(4.9)
Messaging response time, hours, mean (SD)	9.0	(5.0)	6.4	(3.3)
Primary care provider panel	*n=134,987*		*n=40,922*	
Age, No. (%)				
18–35 years	24,180	(18)	8,130	(20)
36–50	40,114	(30)	12,069	(29)
51–65	41,984	(31)	12,913	(32)
>65	28,709	(21)	7,810	(19)
Female gender, No. (%)	71,470	(53)	24,944	(61)
Low neighborhood SES[‡], No. (%)	10,460	(8)	2,618	(6)
Rural location, No. (%)	3,058	(2.3)	1,016	(2.6)
Overall morbidity[§], No. (%)				
None	17,790	(13)	4,850	(12)
Very Low	8,109	(6)	2,631	(6)
Low	20,781	(15)	6,584	(16)
Moderate	62,429	(46)	19,575	(48)
High or very high	25,878	(19)	7,282	(18)
Enrollment with Health Plan, No. (%)				
0–3 years	19,143	(14)	5,512	(13)
4–8	28,613	(21)	8,245	(20)
9–12	16,660	(12)	5,150	(13)
>12	70,571	(52)	22,015	(54)
Insurance, No. (%)				
Commercial	100,328	(74)	31,446	(77)
Medicare	31,744	(24)	8,658	(21)
Medicaid	2,915	(2)	818	(2)

*Messaging encounters: each provider's number of message threads divided by the sum of outpatient in-person encounters and message threads

†Limited to 111 Primary care providers with available gender data

‡SES: Socioeconomic status

§*Overall morbidity: based on six Resource Utilization Bands of the Adjusted Clinical Groups case mix system*

eligible patients in the final study quarter and who had age data available. During the five quarters of the study, these providers had 75,861 SM threads, accounting for 15% of their primary care outpatient encounters. In the last study quarter, individual physicians had between 2.8% and 52% of all patient encounters through secure messaging.

Analysis of Patient Messaging. Results from logistic regression models are shown in Table 3. Compared to other patients registered for the patient Web site, SM users were more likely to be middle aged (between 50 and 65 years old), more likely to be female, less likely to be insured by Medicaid, and more likely to have a higher overall level of morbidity. Relative to those with no measurable level of morbidity, the odds of secure messaging increased for each subsequent morbidity category:

OR=1.61 (very low), OR=2.07 (low), OR=3.69 (moderate), OR= 5.64 (high or very high). Patients treated by providers with higher levels of SM were more likely to use SM relative to patients whose providers had lower levels of secure messaging. In addition, patients treated by providers who had panels with a higher proportion of younger patients were more likely to use SM (OR 1.25, CI 1.58 to 56.13 for each 10% increase in the proportion of paneled patients between 18 and 35 years).

Table 3. Adjusted Analysis Showing Odds Ratio of Secure Messaging Use to Non-use

	Comparison Group Not Using Secure Messaging					
	Registered for Patient Web Site*			Not Registered for Patient Web Site		
	OR	95% CI		OR	95% CI	
Age						
18–35 years	0.89	0.83	0.94	0.67	0.63	0.72
36–50	0.96	0.92	1.01	0.88	0.84	0.91
51–65	ref[†]			ref[†]		
>65	0.65	0.59	0.71	0.36	0.33	0.39
Female	1.15	1.10	1.19	1.14	1.09	1.19
Rural location	1.14	0.96	1.35	1.13	0.96	1.32
Distance from patient's home to clinic ≥ 17 miles	1.01	0.91	1.12	0.93	0.86	0.99
Low neighborhood SES[‡]	1.07	0.98	1.16	0.73	0.68	0.78
Overall morbidity[§]						
None	ref[†]			ref[†]		
Very low	1.61	1.42	1.83	3.17	2.83	3.56
Low	2.07	1.86	2.31	4.39	4.01	4.81
Moderate	3.69	3.33	4.09	9.27	8.50	10.11
High or very high	5.64	5.07	6.28	14.70	13.36	16.17
Tenure with primary care provider						
0–3 years				ref†		
4–8	1.04	0.97	1.13	1.05	0.97	1.13
>8	1.02	0.97	1.07	1.00	0.95	1.06
Enrollment with Health Plan						
0–3 years	ref[†]			ref[†]		
4–8	0.96	0.89	1.03	1.02	0.96	1.07
9–12	1.01	0.94	1.08	1.10	1.03	1.17
>12	0.98	0.92	1.04	1.19	1.11	1.27
Insurance						
Commercial	ref[†]			ref[†]		
Medicare	0.92	0.84	1.01	0.81	0.75	0.88
Medicaid	0.81	0.68	0.96	0.44	0.38	0.50
Female primary care provider	1.12	0.90	1.39	1.41	1.10	1.81
Primary care provider's mean response time						
< 6 hours	ref[†]			ref[†]		
6–12	1.02	0.92	1.14	1.01	0.91	1.11
13–24	1.02	0.87	1.19	0.93	0.82	1.07
> 24	1.02	0.75	1.39	1.15	0.81	1.63
Primary care provider's encounters through secure messaging						
≤ 10	ref†			ref†		
10–20	1.22	1.09	1.38	1.30	1.16	1.45
20–50	1.94	1.67	2.26	2.33	2.02	2.69

	Comparison Group Not Using Secure Messaging				
	Registered for Patient Web Site*			Not Registered for Patient Web Site	
	OR	95% CI		OR	95% CI
Primary care provider's panel characteristics‖					
Age					
18–35 years	1.25	1.58	56.13	1.13	0.94	1.35
36–50	1.06	0.30	11.32	0.73	0.60	0.89
51–65	ref†			ref†	
>65	1.11	0.43	17.20	0.88	0.75	1.03
Female gender‖	0.97	0.37	1.47	0.93	0.85	1.01
Overall morbidity§ (0–5 scale)	1.30	0.22	7.78	2.36	0.40	13.93
Patient enrollment with Health Plan, years	1.05	0.98	1.12	1.04	0.98	1.10
Tenure with primary care provider, years	1.01	0.97	1.05	0.99	0.95	1.02

*Registered for Patient Web Site: Following confirmation of personal identity at a Group Health clinic or through the United States mail, patients entered a temporary password provided by Group Health and signed a user agreement
†Ref: reference group
‡SES: Socioeconomic status
§*Overall morbidity: Based on six Resource Utilization Bands of the Adjusted Clinical Group's case mix system*
‖ *Odds ratio for 10% increase in the proportion of the characteristic*

Confidence intervals for panel-level effects are large due to minimal panel variation (Table 2).

Secondary analysis, comparing SM users to those not registered for the patient Web site, tended to find stronger associations compared to the primary analysis (Table 3). Unlike the primary analysis, however, low neighborhood SES was associated with lower SM use (OR 0.73 95% CI 0.68–0.78).

Poisson models for the rate of secure messaging among SM users produce a similar pattern of results, but one not always statistically significant in this smaller sample (Table 4). Patients between 50 and 65 had the highest rates of SM, and rates of SM increased with increasing morbidity. Shorter provider response time to SM and higher provider rates of SM with other patients were both associated with higher patient rates of SM. Providers with patients having longer enrollment also had higher rates of SM (RR 1.06 95% CI 1.02–1.10 for each additional year of enrollment).

CONCLUSIONS

We evaluated use of a secure messaging within the context of an integrated group practice using an advanced electronic health record system and identified significant variability according to individual patient characteristics. Greater overall morbidity was the strongest predictor of patients' use of SM. These results contrast with prior research among patients with chronic conditions demonstrating lower use of the Internet[27] and lower[7] or similar[28,29] use of electronic messaging with providers. Although these former studies suggest that electronic communication between patients and providers reflects

Table 4. Adjusted Analysis Showing Relative Rates of SM Use Among SM Users

	RR*	95% CI†	
Age, years			
18–35	0.88	0.83	0.93
36–50	0.99	0.95	1.04
51–65	ref‡		
>65	0.86	0.78	0.95
Female	1.04	0.99	1.09
Rural location	1.00	0.89	1.12
Distance from patient's home to clinic ≥ 17 miles	1.00	0.93	1.07
Low neighborhood SES§	1.04	0.96	1.12
Overall morbidity‖			
None	ref‡		
Very Low	1.13	1.04	1.24
Low	1.30	1.20	1.40
Moderate	1.95	1.82	2.09
High or very high	3.30	3.05	3.57
Tenure with primary care provider, mean			
0–3 years	ref‡		
4–8	0.99	0.93	1.05
> 8	0.96	0.92	1.00
Enrollment with Health Plan			
0–3 years	ref‡		
4–8	1.04	0.98	1.11
9–12	1.00	0.94	1.06
> 12	1.03	0.97	1.09
Insurance			
Commercial	ref‡		
Medicare	1.03	0.94	1.13
Medicaid	1.17	0.95	1.43
Female primary care provider	1.04	0.93	1.16
Primary care provider's mean response time			
< 6 hours	ref‡		
6–12	0.99	0.94	1.03
13–24	0.92	0.85	1.00
> 24	0.85	0.74	0.98
Primary care provider's encounters through secure messaging			
≤ 10	ref‡		
10–20	1.04	0.95	1.14
20–50	1.23	1.14	1.34
Primary care provider's panel characteristics			
Age, comparing 10% change in proportion	ref‡		
18–35 years	1.13	1.04	1.23
36–50	1.11	1.02	1.20
51–65	ref‡		
>65	1.09	1.02	1.17
Female gender, comparing 10% change in proportion	0.97	0.94	1.00
Overall morbidity (0–5 scale)‖	0.96	0.51	1.80
Patient enrollment with Health Plan, years	1.06	1.02	1.10
Tenure with primary care provider, years	0.99	0.97	1.01

*RR: relative rate
†CI: confidence interval
‡ref: reference group
§*SES: socioeconomic status*
‖ *Overall morbidity: based on six Resource Utilization Bands of the Adjusted Clinical Groups case mix system*

some of the same patterns as overall Internet use, including higher use among the younger population and those living in metropolitan areas[30,31], they may not reflect the pattern of SM use when it is widely offered by providers. A 2008 survey reported that 90% of all patients online want to be able to e-mail providers[32]. Yet, in 2003, only 5.5% visits were to providers who reported doing Internet or e-mail consultations[29]. In most healthcare settings, providers remain

concerned about the lack of reimbursement, increased work-load, and insufficient security associated with patient e-mail[2].

In the current study, all patients and providers were actively encouraged to use SM. Group Health's SM access and online shared medical record with patients were part of a larger organizational redesign focusing on patient-centered access. This organizational commitment, including provider incentives to engage in SM, may have contributed to greater use of SM for follow-up and proactive care of patients with chronic conditions[33–35]. Despite the uniform organizational commitment, primary care providers had widely differing amounts of SM with patients (2.8% to 52% of SM outpatient encounters). This variable participation in SM by primary care providers was an independent predictor of whether a patient used SM. Differences between provider panels did not account for this variation. Other characteristics of physicians and patients not evaluated in this study are likely influencing whether patients and physicians engage in SM.

Patients had a few other important differences in SM use. Patients with Medicaid insurance and those over the age of 65 years were less likely to engage in SM. Most importantly, Internet access does not appear to entirely account for this difference in SM use. Even when these populations had registered for the patient Website, they used SM less compared with those who were younger or had commercial insurance. Patients with low neighborhood SES were also less likely to use SM in the analysis comparing SM users to patients not registered for the Website. Since census measures of SES are poor predictors of individual income and education in the Group Health population[36], less SM use among patients living in low SES neighborhoods may be due to differences in the resources available to these communities, such as broad band internet access. Future work should clarify the factors—such as health literacy, technical literacy, patient activation, broad-band Internet access and physical disability—that may account for these differences[13,14]. Because many elderly patients and those on Medicaid live with chronic conditions, understanding how electronic communication interacts with known disparities in access to care is critical.

Our study has several limitations. Because the study used only automated data, several factors important for assessing Internet access were not available, such as individual-level socioeconomic indicators, physical disability, health literacy, technical literacy, and race/ethnicity[13,14]. The cross-sectional design also limited the ability to ascribe causality; patients who want to engage online may have selected providers that would engage online. Although the demographics of the Group Health population are similar to the surrounding area, the results of our study may not be generalizable to other health care systems. SM was studied during a period of rapid adoption. In 2004 alone, Group Health doubled the number of patients engaging in SM with providers. Future evaluations with a similar study design may yield different results. Provider incentives for SM may also limit the application of our results to other systems that use different financial incentives for electronic encounters. SM was also available in the context of a patient Web site with a shared online medical record between patients and providers. This constellation of online services and personal health information may have attracted a particular population of patient users. Last, phone calls with patients were not included in the primary care providers' measure of total outpatient encounters. Future studies should include all contact with patients: those in person, over the phone, and through electronic messaging.

In this integrated group practice, patients living with greater overall morbidity were the most active users of patient–provider SM. These findings support the potential role of SM in the Patient-Centered Medical Home[37] and the Institute of Medicine's vision for redesigning health care[1]. Future studies should clarify variation in access to and use of SM as well as its impact on the cost and quality of care received.

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