Impact of a Multi-Modality Intervention on Physician Knowledge and Practice in Managing Hepatitis C

M. Rebecca Daniel, MD, FACP
Bonita Singal, MD, PhD
Varsha Moudgal, MD
Thomas M. Shehab, MD, FACP, FACG

Abstract

Background

The majority of patients with chronic hepatitis C virus (HCV) infection remain undiagnosed. Studies have shown that primary care providers (PCPs) lack knowledge about HCV and do not comply with current practice guidelines for identifying and screening individuals at risk.

Objective

The aim of this study is to assess whether a multi-faceted intervention directed at PCPs (internal medicine residents and attending physicians) could improve knowledge about HCV risk factors and indications for screening and improve markers of patient care.

Design

Controlled trial of a multifaceted intervention directed at PCPs.

Setting

Three general internal medicine clinics in southeastern Michigan. Interventions were applied to two of the clinics and the third, affiliated with the community hospital training program, served as the control clinic.

Participants

Internal medicine (IM) residents and attending physicians.

Measurements

A validated survey to measure knowledge about HCV risk factors, screening, and treatment of HCV, administered before and after the intervention to physicians from the intervention clinics; a structured retrospective review of outpatient records, from before and after the intervention, to measure and compare compliance with screening guidelines for HCV in the intervention clinics.

Intervention

A six-week multi-faceted intervention consisting of educational articles, lectures, quizzes, and chart prompts.

Results of Survey

Sixty out of 76 physicians completed both the pre- and post-intervention knowledge survey. There were improvements in understanding the role of the PCP in screening and referral, in recognizing some important risk factors for HCV such as blood product transfusion before 1992 and IV drug use, but not sexual exposure or history of hepatitis B. Respondents were more confident in the post-intervention surveys of their knowledge of risk

factors, diagnostic testing, and when to refer. They did not report significant changes in the way they practice except regarding routine care offered to patients with HCV.

Results of Record Review

Patient records numbering 1285 were studied before the intervention and 703 after. There was significant improvement in the intervention clinics with respect to eliciting risk factors after the intervention. No change was noted in the control clinic. Overall, residents demonstrated greater improvement than the attending physicians.

Conclusions

The multifaceted educational intervention improved several aspects of physician knowledge about HCV and was associated with a significant change in physician practice.

Introduction

Approximately 4.1 million Americans (1.6%) have antibodies for the hepatitis C virus (HCV).[1] Based on The National Health and Nutrition Examination Surveys (NHANES III), 2.7 million Americans are chronically infected and account for 40% of the chronic liver disease cases in the United States.[2] Cirrhosis due to HCV is one of the most common indications for liver transplantation.[3]

Despite the impact of this disease and the multiple advances in knowledge regarding diagnosis, natural history, and treatment, the majority of HCV patients remain undiagnosed.[4] Many professional societies and government agencies, including the American Association for the Study of Liver Diseases (AASLD), Center for Disease Control (CDC), National Institute of Health (NIH), and the American College of Preventative Medicine have endorsed routine screening of patients with risk factors.[5,6] While these groups recommend screening in high-risk populations, they differ in their definition of this population. The AASLD and CDC agree that intravenous drug use (even remote or one-time use), blood and organ transplants, occupational exposure, children of HCV mothers , HIV positive individuals, individuals receiving clotting factors prior to 1987, individuals with persistently elevated ALT are all patients that should be tested. In addition, AASLD also recommends that patients with a history of hemodialysis and long-term spouse/household contact with HCV are risk factors for transmission. NIH limits its definition of the high- risk population as individuals who have used intravenous drugs (even remote or one-time use), received blood and organ transplants, had multiple sexual partners, live with long-term spouse/household contact with HCV, and those who use intranasal cocaine or share a straw. While it may be difficult to inquire about risk factors on each visit, it is recommended that all new patient visits and health maintenance examinations should include HCV risk assessment. If any of the risk factors are present on inquiry and the patient has not been tested since the risk factor was identified, it is recommended that the patient has HCV screening test.

The expected benefits of early diagnosis include: modification of high-risk behaviors thought to hasten progression of the disease, modification of transmission risk, and early access to treatment. In addition, patients now have a greater than 40% probability of eradication with treatment.

HCV is usually diagnosed at an advanced stage of liver disease. This is probably because the disease can remain asymptomatic for years. Physicians and patients lack knowledge about the disease and its risk factors, and patients fail to acknowledge high-risk behaviors. Previous studies have shown significant knowledge deficits and suboptimal management of HCV by primary care physicians (PCPs).[7-9] Due to knowledge deficits, health care providers are also unaware of the benefits of early diagnosis to their patients. In a study reviewing primary care management, only 1% of physicians documented that they inquired about HCV risk factors during a health maintenance exam. Other research has shown most testing was based on evidence of liver damage, such as elevated transaminases, rather than recognition of HCV risk factors (less than 20%).[10,11] With expert opinion favoring early screening and intervention but research indicating a lag in clinical practice and knowledge, we felt an educational intervention could potentially bridge knowledge gaps regarding recent guidelines and result in better physician practices regarding HCV.

Historically, simple interventions to change physician behavior or practice have not been successful.[12] In 1989 Eisenberg recommended utilizing six integral components to change physician behavior: education, feedback, financial reward, financial penalty, administrative change, and physician participation.[13] Although not all aspects are necessary for success, the rate increases with the number of modalities in the intervention. Those with at least three modalities improved behavior in an average of 71% of participants, but even these more complex programs have not been uniformly successful.[14,15] Typically, physician behavior has been shown to return to pre-intervention baseline typically by six months to one year. Hence, systems that utilize reminders in addition to components Eisenberg has described have the best chance for sustained change.

In the past, routine interventions have failed to improve HCV screening and diagnosis in the primary care setting.[9,11] In an attempt to address this situation, we designed and implemented a multifaceted intervention directed at PCPs and internal medicine residents to improve their knowledge about HCV risk factors, indications for screening, and referral and treatment options. The aims of this study were: 1) to measure the impact of this intervention on physician knowledge about HCV and 2) to measure the impact of this intervention on how patients are screened for HCV in clinical practice.

Methods

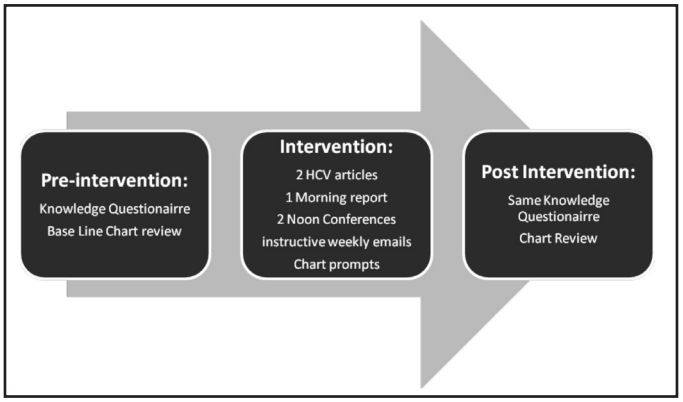
Study Design & Subjects

This study was a non-blinded controlled clinical trial with a before and after comparison of outcomes. The subjects of this

intervention were primary care teaching faculty and IM residents at St. Joseph Mercy Hospital (SJMH), a 529-bed teaching hospital located in Ann Arbor/Ypsilanti, Michigan. The Institutional Review Board at SJMH approved the study.

Two intervention clinics, A and B, and one control clinic, C, were chosen because of their affiliation with the IM training program at our institution. Clinics A and C are faculty clinics with no resident participation and Clinic B is primarily a resident clinic under direct faculty supervision. The PCPs (residents and attending) were assigned to only one of the three clinics with no overlap.

Appendix A: Structure of Clinical Intervention Trial(PHQ-9).



Appendix B: (Pink Chart Prompts) Screening Inquiries for Hepatitis C Risk Factors.

(Pink Chart Prompts)
Screening Inquiries for Hepatitis C Risk Factors

1. Did you ever have a transfusion of blood or blood products before 1992?
2. Have you ever been told you have problems with your liver or liver blood tests?
3. Have you had any sexual contact with a person who had or you believe may have had hepatitis C?
4. Have you ever, even once, used a needle to inject recreational drugs?
5. Have you ever had a job where you were exposed to blood or body fluids?
6. Have you ever, even once, snorted cocaine of other recreational drugs?

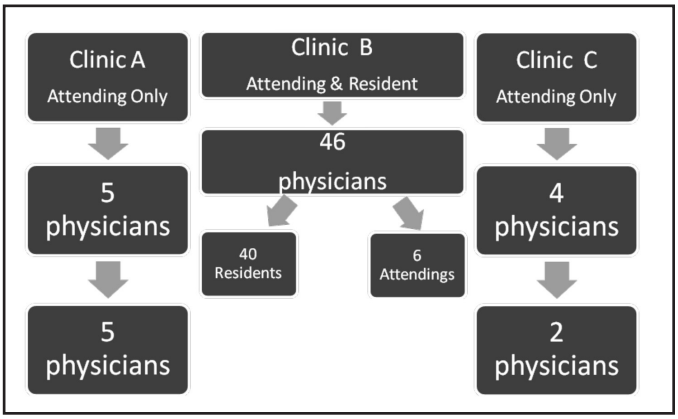
Intervention

An eight-week long intervention consisting of an intense educational program and a reminder system was initiated one week after the administration of the baseline knowledge assessment survey. The components of the educational intervention included the distribution of two HCV review articles to all the physicians in the two intervention clinics. There was also one HCV-focused morning report aimed at the IM residents, where appropriate evaluation of HCV in the outpatient setting was emphasized. We sponsored two one-hour interactive noon conference lectures about HCV screening and testing, where attendance by residents was mandatory, and many attending physicians from the intervention clinics participated. In addition, we supplemented this educational program with instructive weekly emails (web resources which were followed by trivia games with non-monetary prizes) to all physicians in the intervention clinics (Appendix A). The reminder system, which was in place during the chart review period, consisted of 5x7 inserts printed on fluorescent pink stickers, containing six specifically worded questions regarding the most common HCV risk factors (Appendix B). These prompts reminded physicians to inquire about HCV risk factors and to offer testing for HCV if any of the responses were positive.

Pre- and Post-Intervention Physician HCV Knowledge Assessment

One week before the start of the intervention and one month after it was completed, we administered a 30-question, validated survey,[16] consisting of multiple choice questions and clinical vignettes to all attending and IM resident physicians from the intervention clinics. This survey addressed HCV risk factor identification, current HCV diagnostic testing options, and options for the care and referral of HCV positive patients.

Appendix C: Structure of Study Clinics.



Pre- and Post-Intervention Physician HCV Chart Review

We completed medical record reviews and data abstraction for a total of 1285 patient visits in the six months prior to the intervention and 703 patient visits after the intervention. We reviewed the records of all patients seen by residents during these periods and every third patient of the attending physicians. This included approximately 30 to 40 patients assigned to each attending physician, and four to 30 for each resident in each time period. There were five physicians represented from clin-

ic A, and 46 from clinic B, including 40 residents (Appendix C). When the study was designed, there were four physicians from clinic C; however, two of them left the practice before the evaluation was completed, and their patients did not contribute to the analysis. Members of the research team, including an IM resident, a research assistant, and a gastroenterologist, abstracted the data from medical records and laboratory databases, using a previously designed structured data collection tool (available on request). This information included patient demographics, clinic, type of physician (resident versus attending), previous testing for HCV, documentation of presence or absence of HCV risk factors (Appendix B), and whether HCV serology was ordered.

Statistical Methods

All statistical analyses were done using SAS® 9.1. Baseline physician and patient characteristics were summarized using means and percentages as indicated. Responses to the survey questions were summarized using means and percentages, as appropriate.

Survey Analysis

All responses were analyzed as repeated measures. We used the non-parametric signed rank test for questions answered on a Likert scale and McNemar's test for binary responses. Statistical significance was set at 0.05, throughout.

Analysis of record review

Differences between clinics was tested using Wilcoxon Rank Sum test for scalar variables and Chi-square test for categorical variables. Two major outcomes were defined to compare compliance with risk factor screening in patients seen in the clinics, before and after the intervention. The first outcome was positive if any HCV risk factor was documented and the second outcome was positive if all six risk factors were documented. We used generalized estimating equations with physician of record as a random effect, and then tested whether the intervention, clinic, physician type (attending or resident), or age, gender, race, or insurance status of the patient influenced outcome. We also tested the interaction between the intervention and physician type and the intervention and clinic to see whether there was a difference in response to the intervention between residents and attendings and between clinic A and Clinic B. Odds ratios were reported for all independent variables that reached statistical significance, set at 0.05. We also reported the percent of patients at each clinic, before and after the intervention, with a HCV test ordered, and the percent positive for that test.

Table 2: Changes in HCV Knowledge Questionnaire.

Question	Mean value on pre-test scale 1-5	Mean difference between pre and post-test scales	p-value Signed rank test for paired differences
Big problem to society	3.41	0.05	0.64
Role of PCP		+ means more likely to agree	
Screening	4.33	0.25	0.02
Diagnosis	4.53	-0.08	0.47
Monitoring	4.00	-0.19	0.27
Treat with antivirals	2.70	-0.13	0.41
Referral for all management	3.28	-0.36	0.02
Referral for co-management	4.20	0.10	0.38
Reasons to test		+ means more likely to test	
Blood Transfusion before 1992	2.99	0.56	<0.01
Blood Transfusion after 1992	1.60	-0.26	0.17
History of IVDU	3.46	0.31	<0.01
Tattoos	2.53	0.06	0.80
Sex Partner with HCV	3.29	0.02	0.95
Prenatal	1.87	0.25	0.09
Abnormal LFT	3.15	0.04	0.99
Hemodialysis	1.98	0.27	0.11
HBV	3.17	0.20	0.15
HIV	3.28	0.27	0.03
Level of confidence		+ means more confident	
Knowledge risk factors	3.72	0.45	<0.01
Knowledge diagnostic tests	3.39	0.36	<0.01
Knowledge monitoring	2.78	0.51	<0.01
Deciding when to refer	3.36	0.34	0.03
Ability to give antivirals	1.56	0.27	0.06
Community incidence	2.87	0.34	0.07

Results

Survey Data

Seventy-one pre-intervention and 63 post-intervention surveys were completed. Sixty physicians completed both the pre- and the post-intervention surveys and were included in the repeated measures analysis. At baseline, the mean age of the 54 respondents who provided a birth year was 34. On average, surveyed physicians were 5.5 years out of medical school. Fifty-two percent were female, 14% were attending physicians, and 80% practiced at the academic internal medicine clinic.

Table 2 shows the results of questions scored on a Likert scale concerning the role of the PCP in eliciting risk factors, testing for HCV, and caring for patients with HCV. From the pre- to the post- intervention periods, physicians were more likely to agree that the role of the primary care physician was to screen for risk factors and less likely to agree that the PCP should refer to a specialist for all HCV management decisions; p = 0.02 and 0.02, respectively. Agreement with other roles for the PCP in HCV diagnosis, monitoring, treatment, and referral did not change.

Surveyed physicians were more likely to test for HCV after the intervention under three conditions: blood transfusion before 1992, history of IV drug use, and patients who are HIV positive; p= 0.01, 0.01, and 0.03, respectively. There was no change in their likelihood of testing for tattoos, pregnancy, hemodialysis, sexual exposure, alcoholism, hepatitis B, or abnormal liver function tests. Their level of confidence about their knowledge of risk factors, diagnostic tests, monitoring, and deciding when to refer, improved after the intervention; p< 0.01, 0.01, 0.01, and 0.03, respectively.

Table 3 shows the percentage of physicians who endorsed various practice patterns before and after the intervention, and the results of McNemar's test for paired comparisons. Fifteen percent more physicians reported using a standard risk sheet (p<0.05) and 18% more reported that they asked all new patients about risk factors (p=0.04). Post-intervention, 7% percent more physicians were incorrectly choosing RIBA testing to screen for HCV (p<0.05). Physicians reported that 44% more would council HCV patients to avoid alcohol (p<0.01), and 36%, 43%, and 27% more would routinely order HBV, HIV, and syphilis testing, respectively, for their HCV patients (p<0.01, 0.01 and 0.05, respectively). For the majority of practice choices, however, physicians did not report a change in behavior.

Chart Review Data

A total of 1285 patients were studied before the intervention, 203 from Clinic A, 978 from Clinic B and 104 from Clinic C. After the intervention, 703 patients were studied, 150 from Clinic A, 465 from Clinic B and 88 from Clinic C. Residents saw 78% of patients studied in Clinic B. A comparison of patient characteristics between the clinics is shown in Table 1. The clinics differed significantly in their patient mix. Clinic A patients were more likely to be older, female, and white. Clinic B patients were more likely to have no insurance and to be new to the practice. At baseline, Clinic B physicians were much more likely to ask about any hepatitis C risk factors than physicians at the other clinics.

Table 1: Characteristics of 60 participants completing both surveys.

CHARACTERISTIC	PERCENTAGE
Gender	
Male	48
Female	52
Professional Ranking	
Attending	18
Resident	82
Current number HCV patients	
0	34
1-5	50
6-10	14
>10	2
New HCV patients in the past year	
0	64
1-5	36
6-10	0
>10	0

Table 5 summarizes the screening and testing results for all three clinics before and after the intervention. No risk factor screening was done for any patient at Clinic C either before or after the intervention. There appeared to be an increase in partial and complete screening for risk factors in both clinics A and B after the intervention.

In the pre-intervention phase, twelve tests for HCV were ordered, eleven in Clinic B (1.1%) and one in Clinic A (0.5%). After the intervention, thirteen tests were ordered, twelve from Clinic B (2.6%) and one from which clinic A. Seven of eight EIAs and two of two PCRs done before the intervention were positive, all from Clinic B. Four of eight EIAs, and 0 of one PCR done after the intervention from Clinic B were positive, and the single EIA and PCR from Clinic A were each negative.

The result that no patient from clinic C was screened for any risk factor, either before or after the intervention, caused problems with estimation of the multivariable logistic regression model (the Hessian matrix was not positive definite). Therefore, patients from clinic C were excluded from this analysis. In data from the remaining two clinics, inquiry about any risk factor was strongly associated with the intervention (OR= 20.5, 95%CI: 1.18-355). We also found that any inquiry was more likely in younger patients (p=0.0073) and clinic 2 patients (P=0.0011), and those treated by residents (p=0.0251). There was a significant interaction between the intervention and type of physician with residents having a greater response to the intervention than attending physicians (p=0.0052).

In the analysis where inquiry about all risk factors was the dependent variable, we were unable to include an interaction

Table 3: Changes in Reported Practice Patterns.

	Pre-intervention % responding yes	Post-intervention % responding yes	p-value McNemar Test
Identifying patients to test			
Use standard risk sheet	25.4	41.7	0.05
Ask all new patients	43.3	61.7	0.04
Offer to all at high risk	56.7	56.7	1.00
Test all adults	0.0	0.0	-
Test all who request	33.3	26.7	0.29
Test all with elevated LFT	55.0	43.3	0.13
Ask about risk factors	58.3	55.0	0.69
Blood tests used to Screen			
Do not order tests	8.3	5.0	0.41
Anti HCV	75.0	78.3	0.53
RIBA	1.7	8.3	0.05
PCR-qualitative	21.7	13.3	0.22
PCR-quantitative	8.3	8.3	1.00
Viral Load	8.3	5.0	0.41
LFT/ALT	41.7	31.7	0.20
Let lab choose	0.0	0.0	-
Always send to a specialist	0.0	0.0	-
Materials to help diagnose/manage			
None	23.3	15.0	0.17
CDC guidelines	11.7	18.3	0.21
NIH Consensus Statement	13.3	10.0	0.48
MMWR recommendations	5.0	8.3	0.32
Up-to-date	70.0	76.7	0.35
Care routinely offered to HCV patients			
Alcohol avoidance	53.3	97.4	<0.01
Acetaminophen avoidance	45.0	79.5	0.06
HAV testing/vaccination	33.3	51.4	0.48
HBV testing/vaccination	38.3	73.7	0.02
HIV testing	38.3	81.6	<0.01
VDRL/RPR	5.0	31.4	0.01
Referral patterns in 39 physicians who made referrals in the past			
Always when HCV +	66.7	47.5	0.09
When LFTs elevated	25.7	40.0	0.44
If liver biopsy is needed	43.6	47.5	0.78
If patient requests	28.2	35.0	0.78
For end stage liver disease	51.3	40.0	0.11
Barriers to Referral			
No barriers	53.9	40.0	0.09
Takes too long	10.3	17.5	0.48
Insurance does not cover	10.3	15.0	0.71
Lack of insurance	18.0	35.0	0.06
Too far to travel	2.6	5.0	0.56
Specialists avoid chemical dependent patients	5.1	5.1	1.00
Patients do not want to see specialist	15.4	10.0	0.18

Table 4: Patient Characteristics at Baseline.

Variable	Clinic A n=203	Clinic B n=978	Clinic C n= 104	p-value
Age (mean)	55	50	52	<0.01
Female sex n (%)	137(67.5)	525 (54.2)	62 (60.2)	<0.01
Black race n (%)	25 (12.3)	228 (23.6)	23 (23.7)	<0.01
No Insurance n (%)	1 (0.5)	122 (12.5)	0 (0.0)	<0.01
Visit type				<0.01
% new n (%)	15 (7.4)	226 (23.1)	7 (6.7)	
% return n (%)	174 (85.7)	717 (73.3)	93 (89.4)	
% complete physical n (%)	14 (6.9)	35 (3.6)	4 (3.9)	
Previous HCV test n (%)	17 (8.4)	78 (8.0)	11 (10.6)	0.66
Physician type Resident n (%)	0 (0.0)	748 (77.6)	0 (0.0)	<0.01
Inquire for any risk factor n (%)	1 (0.5)	184 (18.8)	0 (0.0)	<0.01

Table 5: Results of screening for risk factors and HCV testing before and after the intervention.

	BEFORE INTERVENTION			AFTER INTERVENTION		
Variable	Clinic A N=203	Clinic B N=978	Clinic C N= 104	Clinic A N=150	Clinic B N=464	Clinic C N=88
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Any Screening for risk factors	1 (0.5)	185 (18.8)	0 (0.0)	8 (5.3)	198 (32.3)	0 (0.0
Complete screening for risk factors	0 (0.0)	1 (0.1)	-	6 (4.0)	158 (34.1)	-
At least one risk factor positive	0 (0.0)	48 (4.9)	-	4 (2.6)	75 (16.2)	-
New HCV test ordered	1(0.5)	11(1.1)	-	1 (0.7)	12(2.6)	-
New HCV test done	0 (0.0)	18 (1.4)	-	1 (0.7)	8 (1.7)	-
EIA+	0 (0.0)	13 (1.3)	-	0 (0.0)	3 (0.6)	-
PCR+	0 (0.0)	5 (0.5)	-	0 (0.0)	0 (0.0)	-

Table 6: Results of Multivariable Repeated Measures Generalized Estimating Equations.

	Any Risk Factor	All Risk Factors
Variables	ODDS RATIOS (95% CI)	ODDS RATIOS (95% CI)
Intervention	20.5 (1.18-355)	565 (69-4591)
Resident versus Attending	1.99(1.09-3.65)	15.5 (4.1-59.3)
Clinic B versus Clinic A	30.6(3.95-237)	NS
Patient gender (male versus female)	NS	NS
Patient age per year increase	0.98 (0.97-0.99)	NS
Patient race (black versus white)	0.69 (0.50-0.95	NS
Visit type (return versus new)	0.02 (0.01-0.03)	NS
Insurance (none versus any)	0.59 (0.38-0.90)	NS

term because the low prevalence of the desired outcome in the pre-intervention period caused problems with estimation. Therefore, a model without interactions was tested. Inquiry about all risk factors was much more likely after the intervention (OR=565, 95% CI: 69-4591), and if the physician was a resident (OR=15.5, 95% CI: 4.1-59.3). No other variables were related to complete screening.

Discussion

We were able to show that a multi-modality intervention improved aspects of physicians' knowledge about HCV risk factors, screening, testing, treatment, and referral. Physicians also reported an improved confidence in managing HCV patients. The chart reviews displayed a substantial impact on physician behavior in eliciting HCV risk factors but we were unable to show a significant increase in testing for HCV or diagnosis of HCV in outpatients.

While the control clinic physicians did not screen any patients for risk factors either before or after the intervention, the clinic physicians exposed to the intervention increased their odds of inquiring about any risk factors by 20-fold and doing a complete risk factor evaluation by over 500-fold. Unfortunately, only two faculty physicians staffed the control clinic at the time of data collection, so the rationale for having a control group in order to strengthen inferences about the relative impact of the intervention is greatly diminished. However, it is highly unlikely that the large effects we demonstrated could be completely explained by secular trends independent of the intervention.

We obtained such large odds ratios for the intervention in the complete inquiry analysis because the outcome was so rare in

the pre-intervention period, approximately 0.08%. Also, controlling for possible confounding variables such as age, race and insurance had a great influence on the odds ratio for the intervention, which was only about 2.5 when no other variables were in the model.

The impact among residents was much greater than among attending physicians. Residents were exposed to a more intensive educational experience than most attending physicians; however, all attendings in the intervention group did receive the educational materials and frequent HCV-related emails. It is likely that residents in contrast with attending physicians had less preconceived ideas regarding best practices and were more easily influenced by the intervention. Attending physicians also dealt with a higher patient census, and they may have limited time and inclination to broach lifestyle issues. It was noted that residents tended to see more new patients, whereas attending physicians saw mostly established patients. Attending physicians may incorrectly assume their established patients lack any risk factors or feel uncomfortable addressing questions that may have never been addressed in the past.

The findings of this study may not be generalizable to other practices because it was done in one geographic location in clinics affiliated with a single independent academic medical center. The intervention was designed specifically for a teaching hospital setting where there were regular conferences and teaching rounds for dissemination of information. Also, we are unable to determine which aspects of the multifaceted intervention contributed the most to improving practice. If the chart reminder was a key factor, then this could easily be implemented in another practice setting. In addition, methods for physician education in non-teaching institutions could include continued medical education requirements, educational emails, and grand rounds.

We must acknowledge that, although compliance with guidelines was substantially improved by the intervention, the final result was modest. Even after the intervention, only about 30% to 40% of the patients in the most compliant clinic were actually screened for all risk factors and only a minority of patients with any positive risk factor had a test for HCV.

This is the first report of a multifaceted intervention that was shown to both improve physician knowledge about HCV and to demonstrate a significant change in clinical practice. It will be important to build on this success, first to improve the intervention so that the impact on patient care will be greater and to create a model that can be used in a variety of practice settings.

A. M. Rebecca Daniel, MD, FACP, is Director of Clinical Research and Associate Program Director, Department of Internal Medicine, St. Joseph Mercy Hospital, Ann Arbor, Michigan.

Bonita Singal, MD, PhD, is Associate Director for Clinical Research, Saint Joseph Mercy Health System, Ann Arbor, Michigan.

Varsha Moudgal, MD, is Program Director for the Infectious Diseases Fellowship Program, Saint Joseph Mercy Hospital, Ann Arbor, Michigan.

Thomas M. Shehab, MD, is a gastroenterologist and Vice Chair, Department of Internal Medicine, Saint Joseph Mercy Hospital, Ypsilanti, Michigan.

Potential Financial Conflicts of Interest: By AJCM policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article that might create any potential conflict of interest. Dr. Moudgal reported having received support in the form of a speaker honorarium from Genentec. No other conflicts were reported.

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