Prevention of VTE Among Hospitalized Patients:

Electronic Alerts vs. Human Alerts

Background

- Venous thromboembolism (VTE) is a major cause of death, disability and economic burden.
- VTE constitutes the third most common type of cardiovascular illness
- Fatality rate for pulmonary embolism (PE), is approximately 15%. This exceeds the mortality rate for acute myocardial infarction

Background

- Venous thromboembolism (VTE) is often avoidable in hospitalized patients
- Safe and effective prophylaxis for VTE exists, and formal guidelines have been widely disseminated aimed at increasing prophylaxis in high risk patients
- VTE prevention remains underutilized

Background

- At Brigham and Women's Hospital, we have initiated a series of trials aimed at increasing prophylaxis by:
  - **changing MD behavior** and
  - **improving implementation** of prophylaxis

Types of Interventions

- Electronic Computer Generated Mechanism
  - Single Screen Alert
  - Multi-Screen Alert
- Interpersonal Mechanism:
  - Human Alert

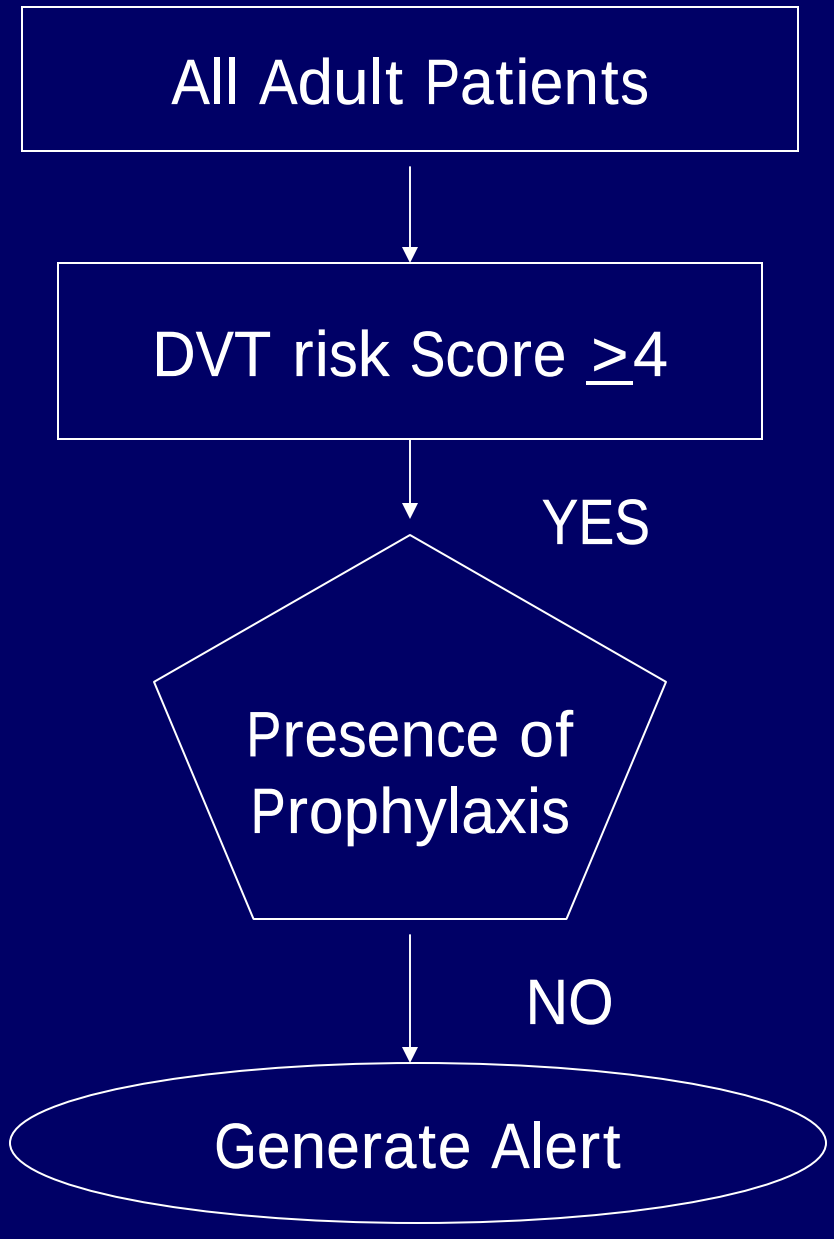
First Generation Electronic Alerts

- BWH utilizes BICS (Brigham Integrated Computing System) for all order entry functions
  - Admitting records, demographic information, lab results, medication orders, etc.
- VTE group utilized computer system to screen all patients admitted to the hospital for High Risk VTE Status

First Generation Alert: Development

- Aim: to increase rate of prophylaxis in patients at risk for DVT and PE
- Developed computer program to detect and identify which patients were at risk
- Alert the responsible physician of high risk patient (via e alert) and offer opportunity to order appropriate prophylaxis

Study Schema



DEFINITION OF "HIGH RISK"

VTE risk score ≥ 4 points:

• Cancer	3	(ICD codes)
• Prior VTE	3	(ICD codes)
• Hypercoagulability	3	(Leiden, ACLA)
• Major surgery	2	(> 60 minutes)
• Bed rest	1	("bed rest" order)
• Advanced age	1	(> 70 years)
• Obesity	1	(BMI > 29 kg/m^2)
• HRT/OC	1	(order entry)

RANDOMIZATION

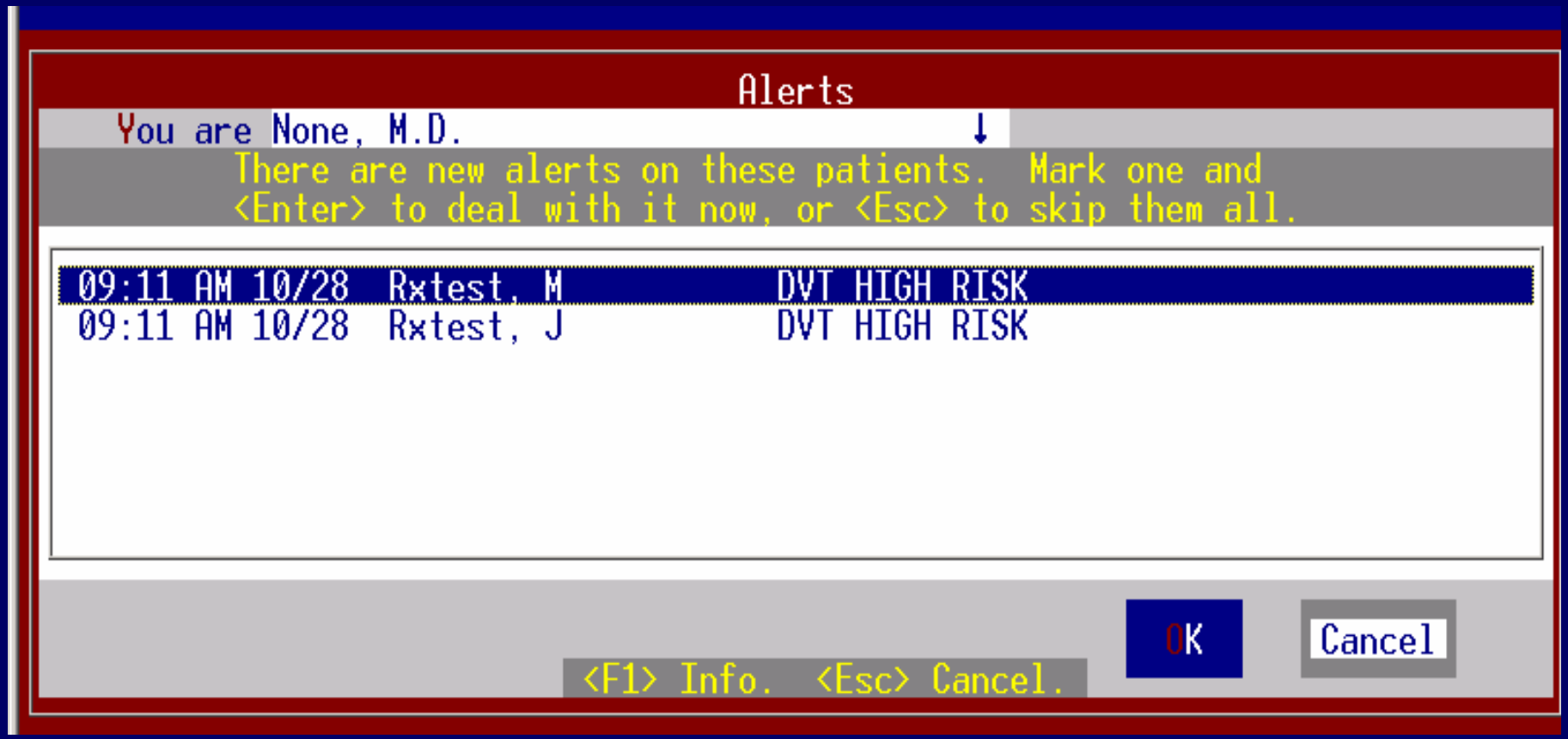
VTE risk score ≥ 4
No prophylaxis
N = 2506

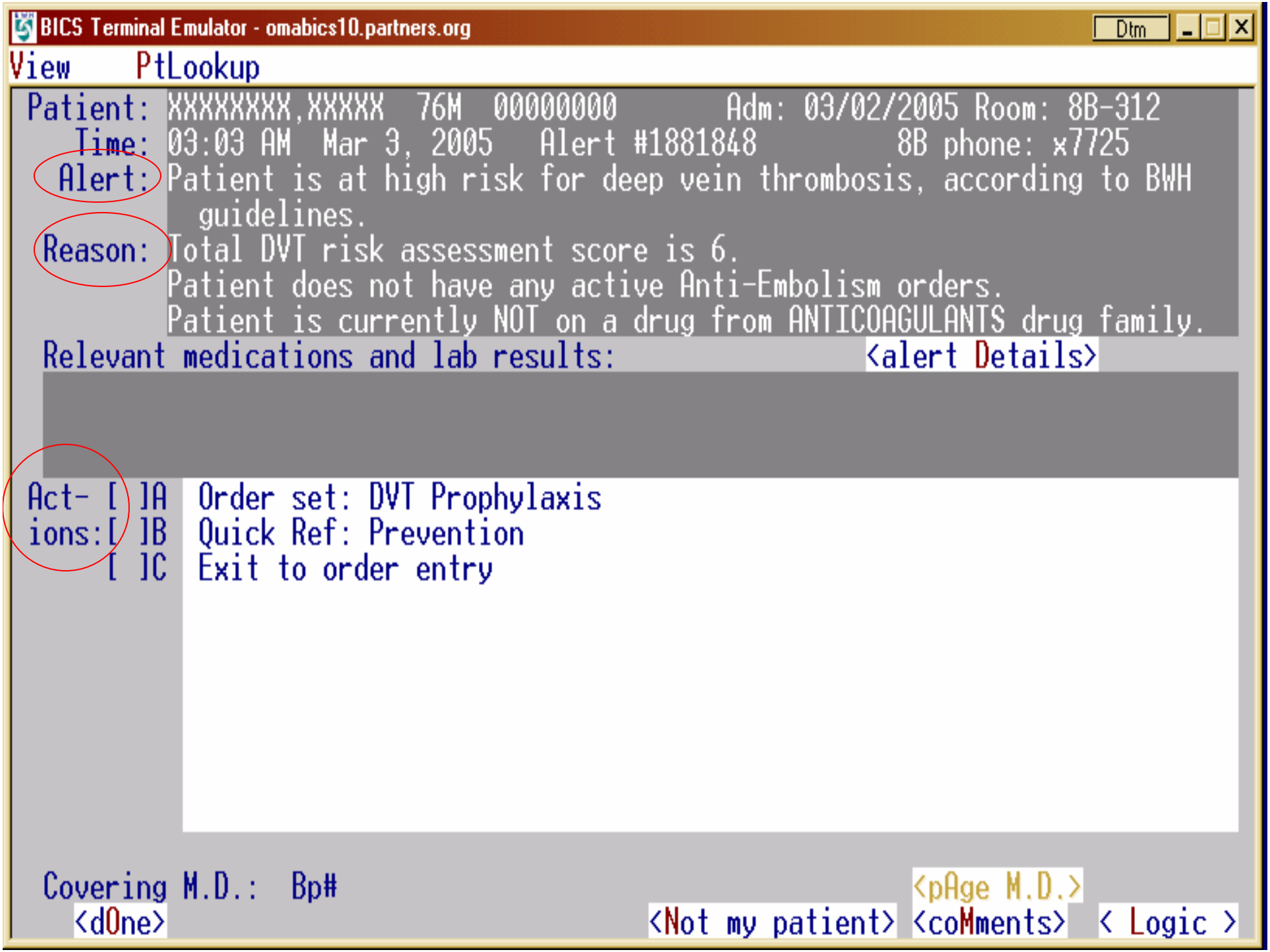
INTERVENTION
Single alert
n = 1255

CONTROL
No alert
n = 1251

(Kucher N, et al. NEJM 2005;352:969-977)

Physician Notification of Alerts




BICS Terminal Emulator - omabics10.partners.org
Dtm
View PtLookup
Patient: XXXXXXXX,XXXXX 76M 00000000 Adm: 03/02/2005 Room: 8B-312
Time: 03:03 AM Mar 3, 2005 Alert #1881848 8B phone: x7725
Alert: Patient is at high risk for deep vein thrombosis, according to BWH guidelines.
Reason: Total DVT risk assessment score is 6.
Patient does not have any active Anti-Embolism orders.
Patient is currently NOT on a drug from ANTICOAGULANTS drug family.
Relevant medications and lab results:
<alert Details>
Act- [ ]A Order set: DVT Prophylaxis
ions:[ ]B Quick Ref: Prevention
[ ]C Exit to order entry
Covering M.D.: Bp#
<pAge M.D.>
<dOne>
<Not my patient>
<coMments>
< Logic >

First Generation Computerized Alerts for VTE prevention

- Utilization of computer generated alerts to house staff reduced the incidence of VTE by 41%
- VTE prophylaxis was prescribed in 33.5% of patients in the intervention group
- Following study conclusion a multidisciplinary team was convened to enhance the VTE alerts at BWH

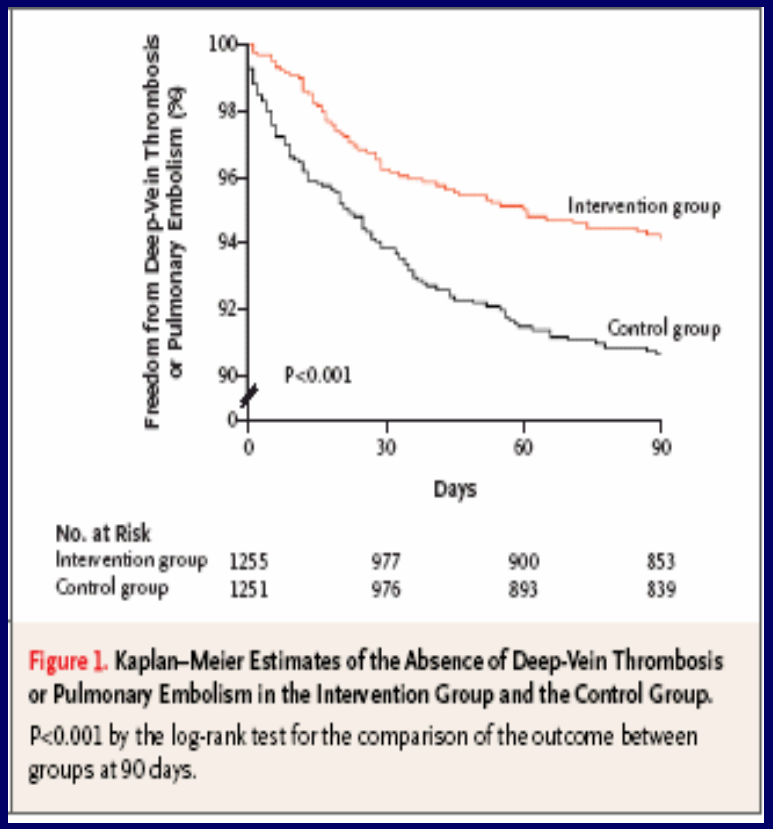


Figure 1. Kaplan–Meier Estimates of the Absence of Deep-Vein Thrombosis or Pulmonary Embolism in the Intervention Group and the Control Group.
P<0.001 by the log-rank test for the comparison of the outcome between groups at 90 days.

Kucher N, et al. NEJM. 2005;352:969-977.

CPOE Alerts

- Institutions that utilize decision support and computerized alerts during prescribing have reported high rates of physician override
- A study conducted at BIDMC reported that 94.2% of computerized alerts were overridden
- Reviewers concluded of the 189 rules studied, 36.5% of the rules were invalid and agreed with the physician's decision 97.9% of the time

Weingart SN et al. Arch of Intern Med 2003;163:2625-31.

Saving CPOE from Extinction

- CPOE must evolve to keep up with the growing demand for effective medical informatics and technology solutions
- Next steps are utilizing algorithms that take into account patient specific factors and generate prescribing recommendations to providers

Second Generation: Electronic Computer Generated Alerts

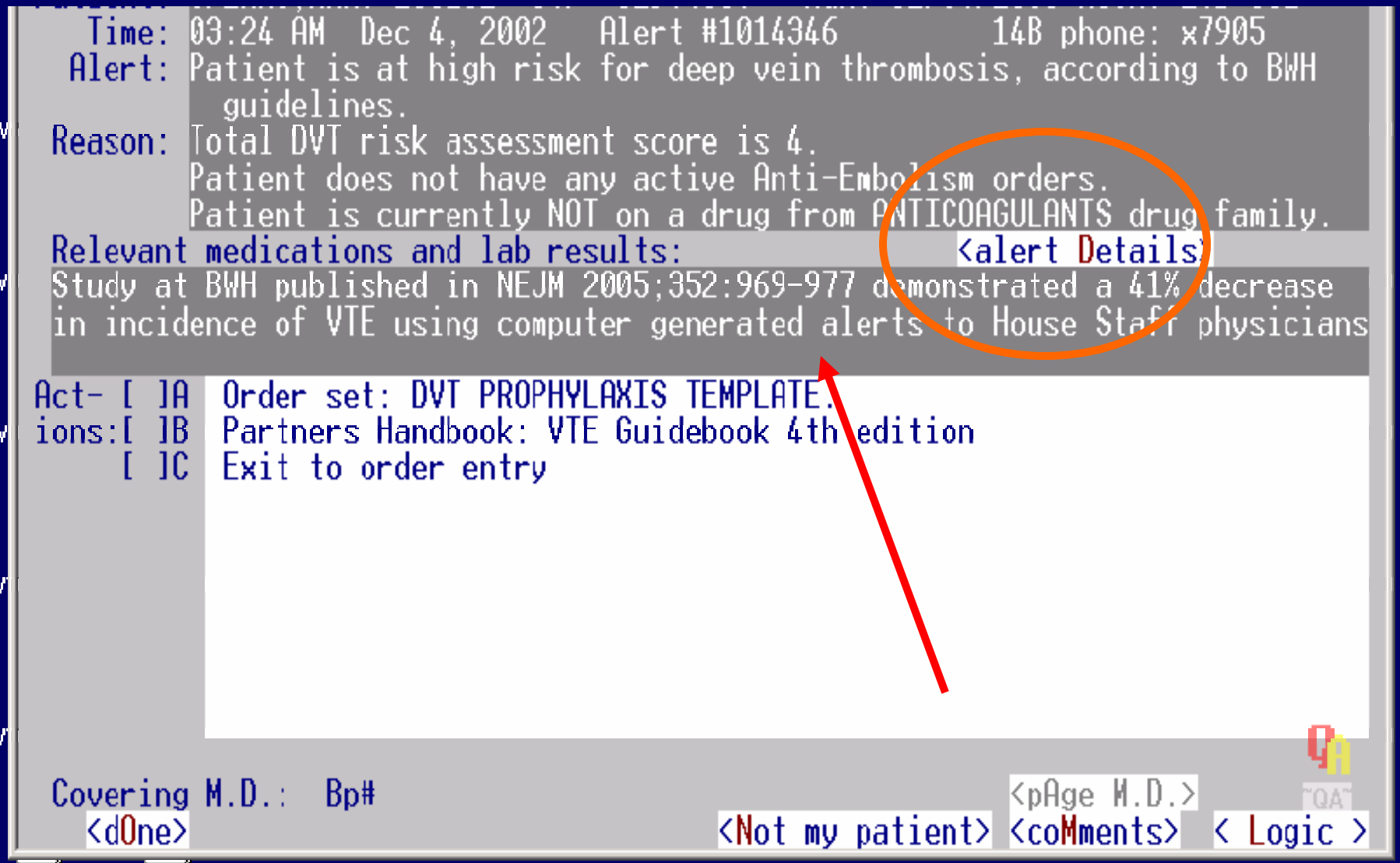
BWH VTE Alerts: The Future

- Goals:
  - Engage the house officer with an interactive alert to increase acceptance and gain feedback
  - Update the DVT prophylaxis template to meet current practice guidelines
  - Provide real-time knowledge links

Interactive Techniques

- Provide objective data to the house officer that this alert positively impacts patient outcome
- Create opportunity to capture rationale for declining alert
  - Hypothesized that many physicians fear a risk of bleeding with anticoagulation
- Provide a final opportunity to order mechanical prophylaxis
- Alert attending physician if alert is not acknowledged after 24 hours

DVT Alert Screen



Rule Logic – Alert Details

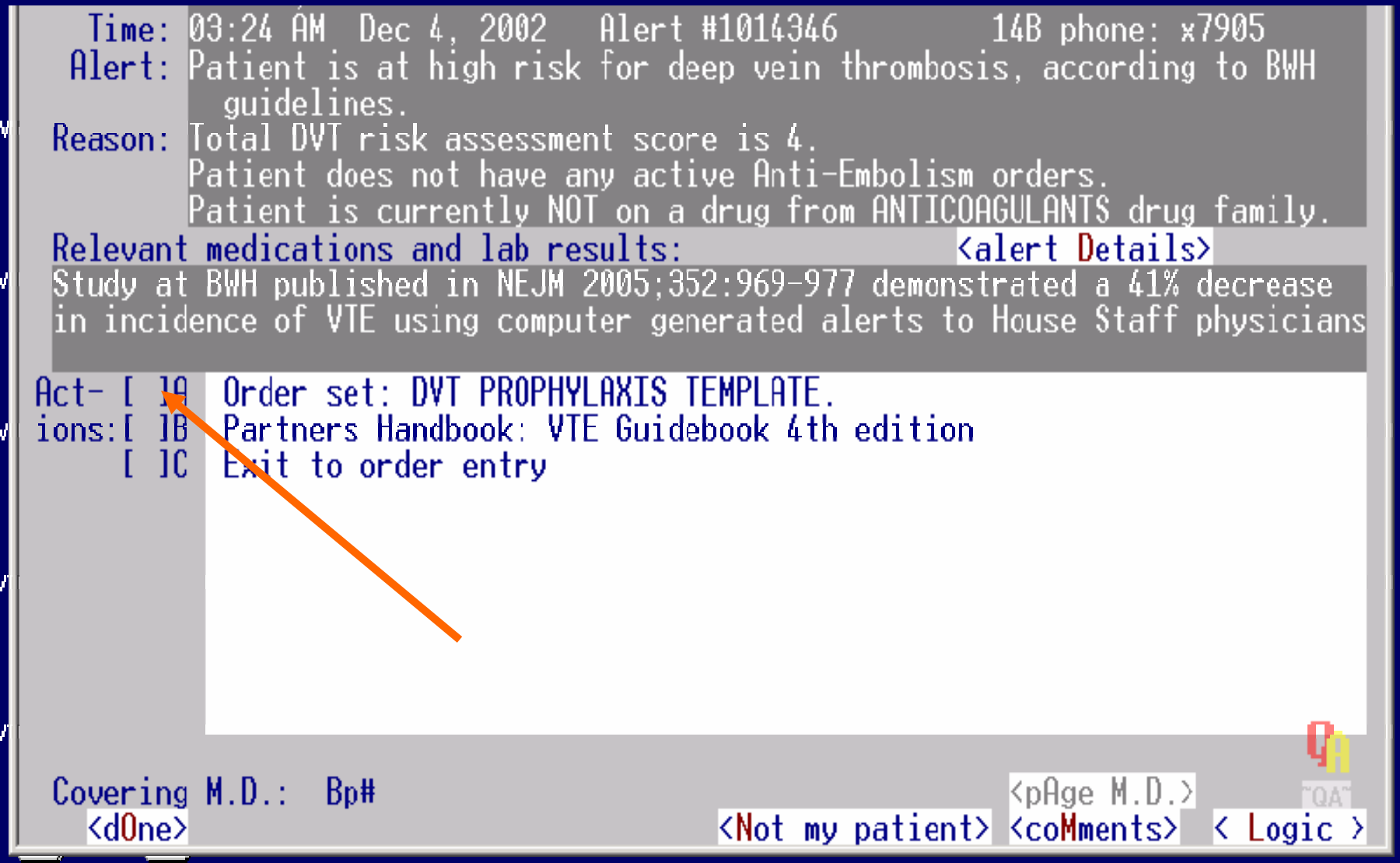
Time: 03:22 AM Nov 2, 2004 Alert #1740559 7A phone: x7695

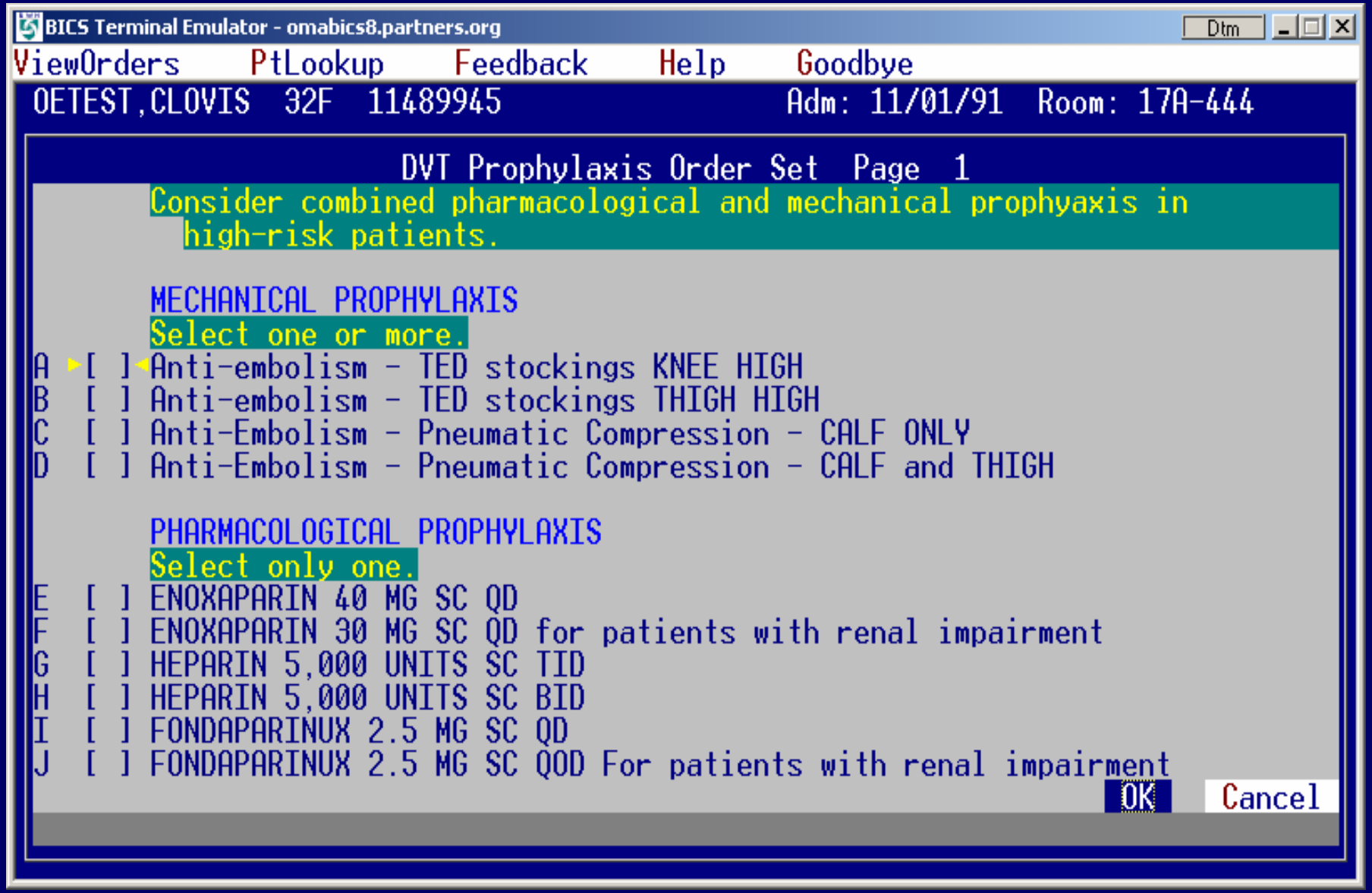
Details for alert #1740559

Rule: Patient is at high risk for deep vein thrombosis, according to BWH guidelines.

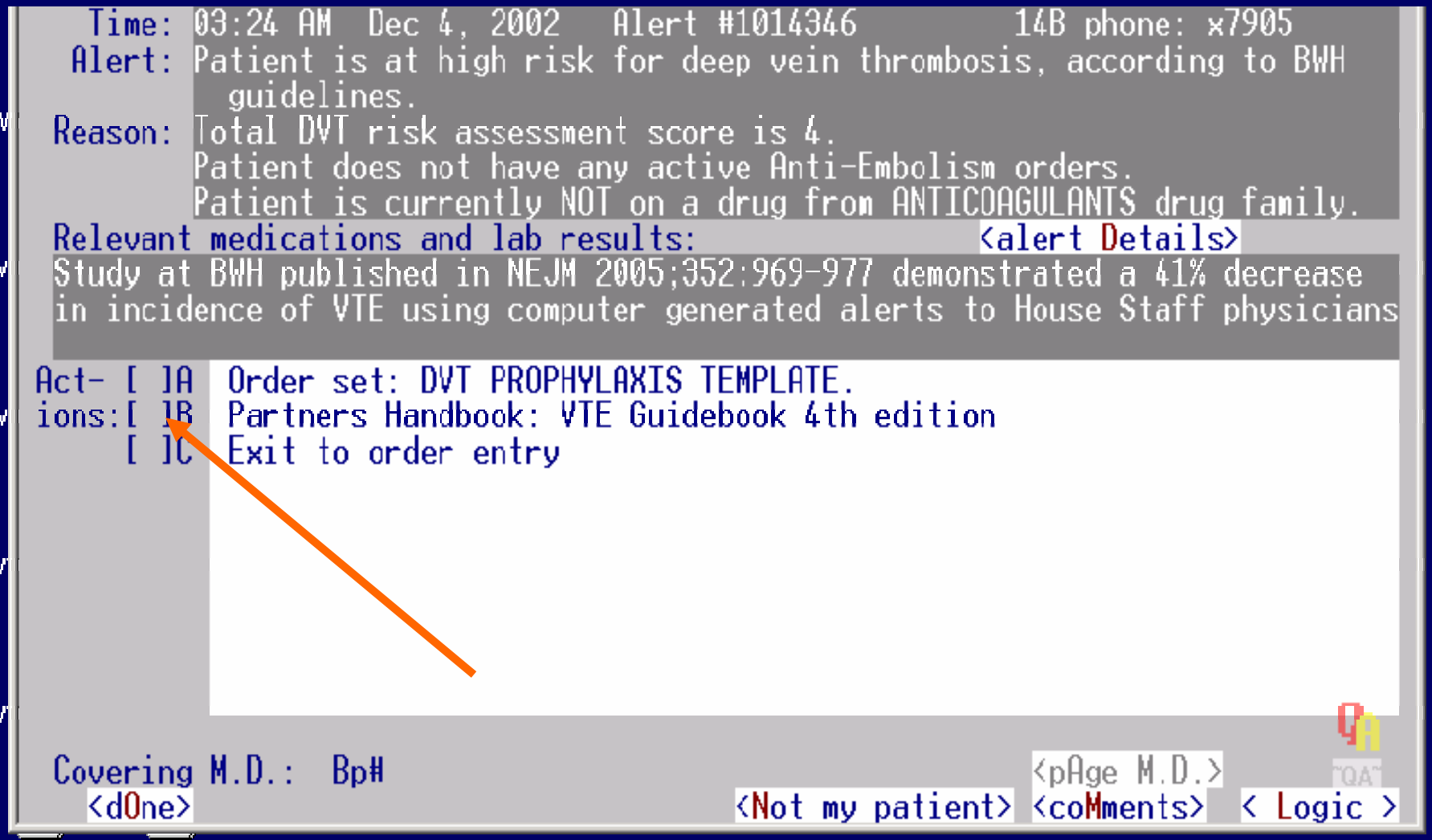
The following risk factors were found to be positive (score applied):
Patient is overweight: BMI >29 kg/m2 (1)
has history of deep vein thrombosis or pulmonary embolism (3).
-and-
Patient does not have any active Anti-Embolism orders.
-and-
Patient is currently NOT on a drug from ANTICOAGULANTS drug family.

Option A


Time: 03:24 AM Dec 4, 2002 Alert #1014346 14B phone: x7905
Alert: Patient is at high risk for deep vein thrombosis, according to BWH guidelines.
Reason: Total DVT risk assessment score is 4.
Patient does not have any active Anti-Embolism orders.
Patient is currently NOT on a drug from ANTICOAGULANTS drug family.
Relevant medications and lab results:
<alert Details>
Study at BWH published in NEJM 2005;352:969-977 demonstrated a 41% decrease in incidence of VTE using computer generated alerts to House Staff physicians
Act- [ ]A Order set: DVT PROPHYLAXIS TEMPLATE.
ions:[ ]B Partners Handbook: VTE Guidebook 4th edition
[ ]C Exit to order entry
Covering M.D.: Bp#
<dOne>
<Not my patient>
<pAge M.D.>
<coMments>
< Logic >


BICS Terminal Emulator - omabics8.partners.org
Dtm
ViewOrders PtLookup Feedback Help Goodbye
OETEST,CLOVIS 32F 11489945 Adm: 11/01/91 Room: 17A-444
DVT Prophylaxis Order Set Page 1
Consider combined pharmacological and mechanical prophyaxis in high-risk patients.
MECHANICAL PROPHYLAXIS
Select one or more.
A [ ] Anti-embolism - TED stockings KNEE HIGH
B [ ] Anti-embolism - TED stockings THIGH HIGH
C [ ] Anti-Embolism - Pneumatic Compression - CALF ONLY
D [ ] Anti-Embolism - Pneumatic Compression - CALF and THIGH
PHARMACOLOGICAL PROPHYLAXIS
Select only one.
E [ ] ENOXAPARIN 40 MG SC QD
F [ ] ENOXAPARIN 30 MG SC QD for patients with renal impairment
G [ ] HEPARIN 5,000 UNITS SC TID
H [ ] HEPARIN 5,000 UNITS SC BID
I [ ] FONDAPARINUX 2.5 MG SC QD
J [ ] FONDAPARINUX 2.5 MG SC QOD For patients with renal impairment
OK
Cancel

Option B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Relevant medications and lab results:
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[ ]C Exit to order entry
Covering M.D.: Bp#
<dOne>
<Not my patient>
<pAge M.D.>
<coMments>
< Logic >

Venous Thromboembolism Guidebook 4th Edition

Introduction

Brigham and Women's Hospital.

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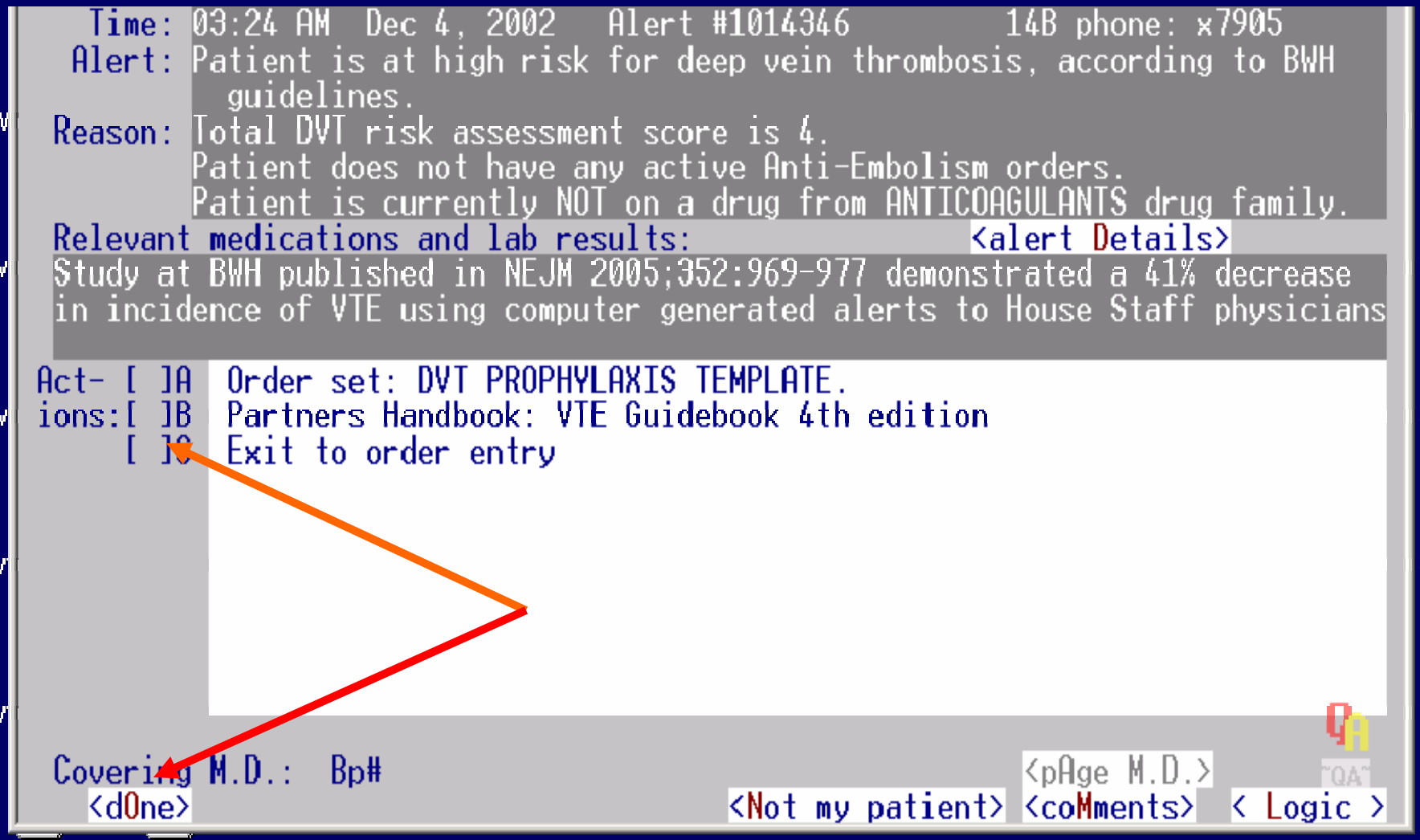
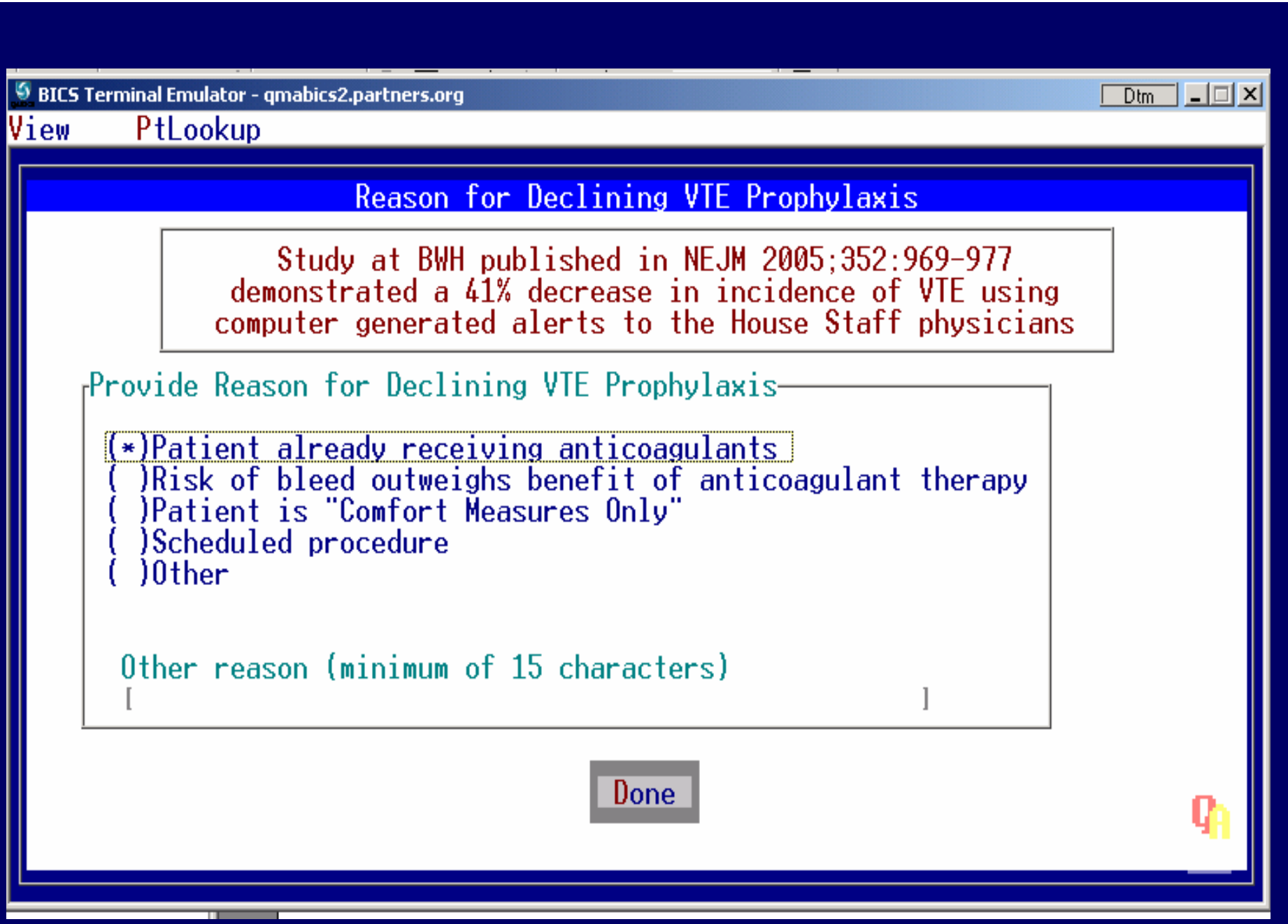
Introduction

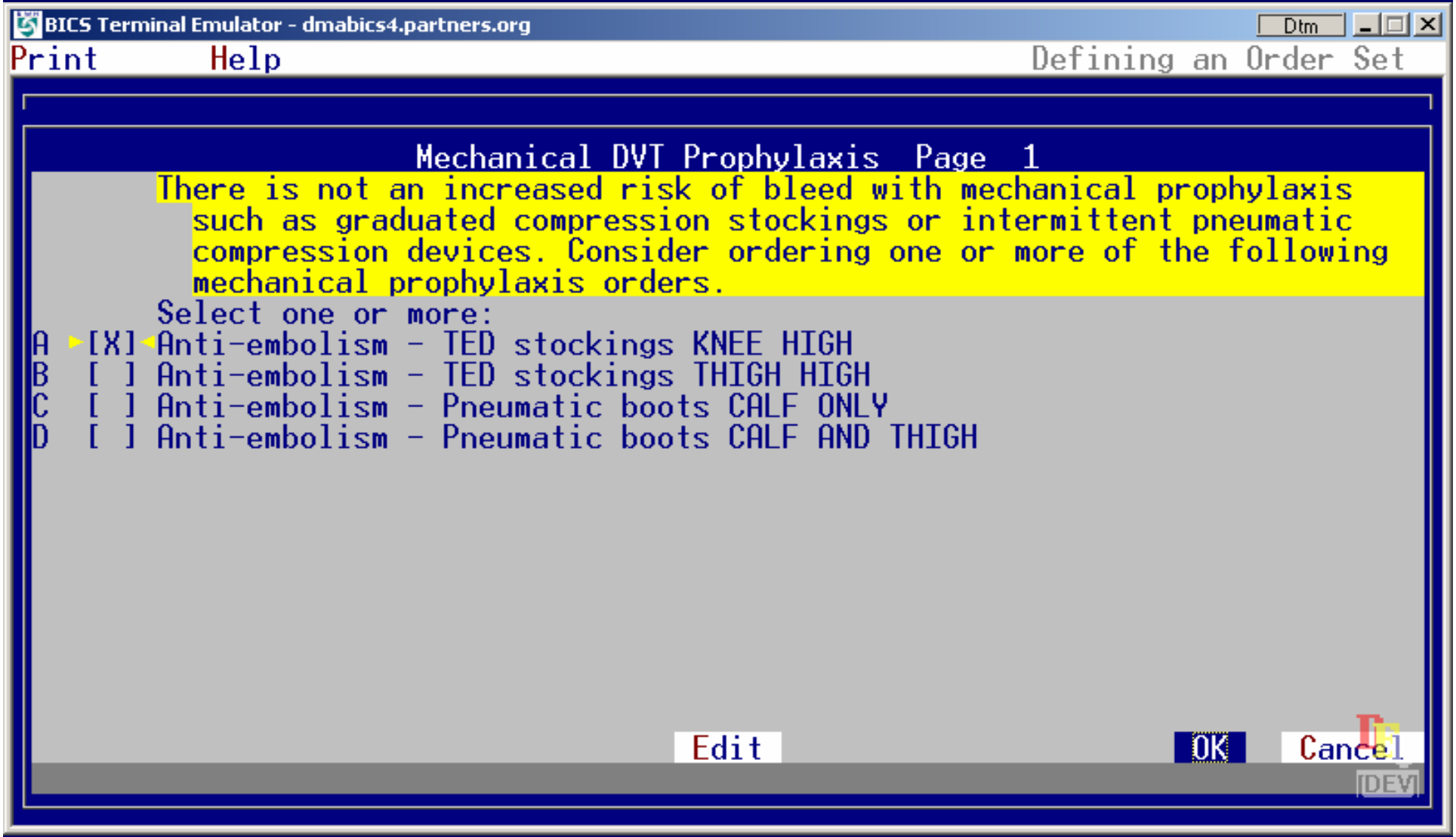
This Venous Thromboembolism Guidebook incorporates evolving contemporary concepts in diagnosis and management of pulmonary embolism (PE) and deep venous thrombosis (DVT) into a user-friendly menu. The purpose of this document is to provide a literature-based review of the current clinical approach to venous thromboembolism as well as up-to-date references for further study in this important topic.

PE Support Group

Option C or "Done"




BICS Terminal Emulator - qmabics2.partners.org
Dtm
View
PtLookup
Reason for Declining VTE Prophylaxis
Study at BWH published in NEJM 2005;352:969-977
demonstrated a 41% decrease in incidence of VTE using
computer generated alerts to the House Staff physicians
Provide Reason for Declining VTE Prophylaxis
(*)Patient already receiving anticoagulants
( )Risk of bleed outweighs benefit of anticoagulant therapy
( )Patient is "Comfort Measures Only"
( )Scheduled procedure
( )Other
Other reason (minimum of 15 characters)
[ ]
Done


BICS Terminal Emulator - dmabics4.partners.org
Dtm
Print
Help
Defining an Order Set
Mechanical DVT Prophylaxis Page 1
There is not an increased risk of bleed with mechanical prophylaxis such as graduated compression stockings or intermittent pneumatic compression devices. Consider ordering one or more of the following mechanical prophylaxis orders.
Select one or more:
A ▸[X]◂Anti-embolism - TED stockings KNEE HIGH
B [ ] Anti-embolism - TED stockings THIGH HIGH
C [ ] Anti-embolism - Pneumatic boots CALF ONLY
D [ ] Anti-embolism - Pneumatic boots CALF AND THIGH
Edit
OK
Cancel
[DEV]

Escalation and Timing of Alerts

- Alerts should be set up to generate each day at 8:30 AM
- If an alert was not acknowledged after 24 hours the attending physician on record should be text paged.

Date	Time	Recipient	Message
10/28/2005	02:37:11PM	Goldhaber, Samuel Zachary, MD	8888-19327139 MRN: 19327139 LOC: 17A-301 High risk VTE patient without prophylaxis orders.
10/28/2005	02:36:08PM	Goldhaber, Samuel Zachary, MD	8888-19327147 MRN: 19327147 LOC: 17A-311 High risk VTE patient without prophylaxis orders.

Quality Assurance

- Weekly reports are reviewed
- Allows core team to review all aspects of the alerts including:
  - type of action taken
  - rate of overrides
  - reasons for declining the alerts

VTE Prophylaxis: eALERT Perspectives

- eAlert Trial: lead article in March 10, 2005 NEJM, with accompanying Editorial and CME Exam, receives widespread attention.
- Many hospitals don't have comparable IT to replicate BWH.
- Question arises: Are BWH results applicable to other USA hospitals ?

Human Alerts

VTE Prophylaxis: hALERT

- We have initiated a multicentered RCT of human alerts (hALERT).
- **Objective:** to recruit hospitals that differ from BWH re: IT, community vs. academic, urban vs. suburban/rural, location within USA.
- Can a **human** alert be more effective than an **electroni**c alert?

Methodology

- Patients admitted to the hospital are screen by human for increased VTE risk
- High risk patients are randomized to alert or no alert
- Physicians of patients in alert group receive page alerting them of High risk status
- Records are checked for prophylaxis order 48 hours after alert
- 90 day follow up for clinically significant VTE and clinically importing bleeding

hALERT Screeners: Require Backup

- The study must be done on weekdays, non-Holidays, at a minimum.
- There must be backup screeners, in case the principal screener is ill or is on vacation.

hALERT: Capturing new prophylaxis orders

- Enrolled patients must be reexamined in 24-48 hours to determine whether prophylaxis orders were written.
- Capturing prophylaxis orders after enrollment applies to both the Intervention Group and to the Control Group.

HUMAN ALERT TRIAL

1. Human (often RN or pharmacist) issues the Alert, not a computer
2. The Attending Physician, not the Intern, receives the Alert
3. Diversity of centers: community, suburban, throughout the USA
4. Will Attendings pay more attention than House Staff?

HUMAN ALERT TRIAL

- 900 patients were enrolled from 10 institutions within the first 28 weeks of the trial (as of January 5, 2007)
- Geographic diversity: from Massachusetts to Salt Lake City
- Hospital diversity: community, academic, VAMC
- Weekly eNewsletter
- Recruiting additional sites

Conclusions

- Changing physician behavior is challenging
- Multi-disciplinary team involvement is critical to successful implementation
- Need to engage providers and obtain feedback
- Designing “smart alerts” that include decision support functionality or “human alerts” that require face to face contact may be effective

Thank you for your attention!