

NeuroTracker – A Case Study



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In 2007 I began a project with the Neurotrauma center at San Francisco General Hospital and BASIC (Brain & Spinal Injury Center) to create

a DBMS (Data Based Management System) to track TBI (Traumatic Brain Injury) patients for purposes of treatment and research.



Over the last seven years we have created an elaborate and sophisticated system that replaced the 3 home brewed databases and several excel sheets that were being used for previous tracking.

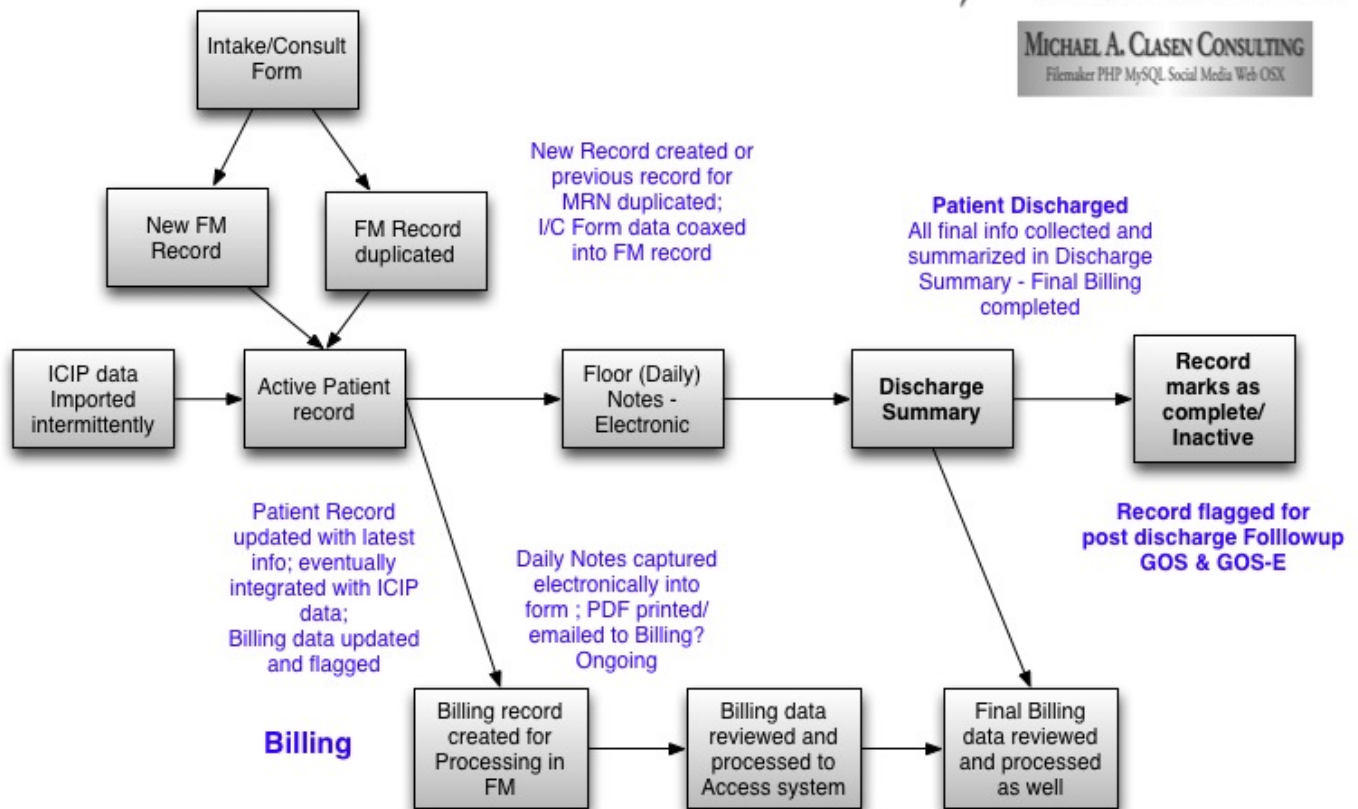
The system employs three systems:

- Patient Info: to track each hospital visit/ stay and the info associated with a patient across

multiple visits

- Consult Form: A series of forms employed for the initial consult/entry into the system
- Progress Notes: a set of daily progress forms tracking and assessing the TBI patients in ICU (Intensive Care Unit) and on the Floor

Neurotracker™ is an integrated Filemaker-based management system to track details and measurements which goes far beyond the Hospital forms to enhance treatment for the patients and enable study and analysis to better improve current and future patient care.



NeuroTracker flow

Features of the overall system (details of the 3 main systems explained below)

- There is a many-to-one relationship used for patients. Each patient has a unique MRN (Medical Record Number) and a unique Visit ID number so that One visit equals one record

and a patient can be tracked across multiple visits


- A Consult form is created at the same time as a new Patient Record. If there is a previous visit/record old info is rolled over to the new record for verification and updating, preserving old info for comparison
- A PDF printout summary of the Consult is created and uploaded to the hospital system for reference as well as a billing record so that the consult can be submitted to the billing department
- Some information is imported into the Patient record (Insurance Info) via an ODBC connection to the SFGH Hospital system
- A Progress Note is created for that day and for the next day's rounds. Data from the consult is rolled into the next day's Progress note to aid entry. As a progress note is completed and electronically signed, a new progress note is created for the next day with selected data rolled into the new record until the patient is discharged
- Selected elements in the progress note are flagged for the billing department
- entry is performed on Laptops, iPads and on desktop computers
- Progress notes summaries are printed to paper and PDFs for inclusion in the patient's physical and electronic records. For many elements only THAT day's events are recorded so as to better track a day's treatment. A history of a patients Progress forms can easily be pulled up and Reviewed on-screen
- Upon discharge, a well formatted Summary of all data is created and saved to PDF for inclusion with the patient's records.

The Consult Forms



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The Consult Forms overview:



Neurosurgery Consultation

Go New Form START

Back FWD

Record 1 of 4

Field(s) Incomplete-Flagged in Red

Select An Action...

CONSULT FORM BEING PROCESSED

Medical Record #

Last Name

Gender
 Male Female Other

Language

English
 Spanish
 Cantonese
 Mandarin
 Russian
 Tagalog

Vietnamese
 Other
 Unknown

Admit Type
 Trauma Consult Elective

DxCAT

TBI
 Spine

SCI
 Tumor

Vascular
 Other

Encounter Num

First Name

Date Consult Created

DOB

Race

Caucasian (1)
 Black/African American (2)
 Asian (3)
 American Indian/Alaska Native (1)
 Native Hawaiian/Pacific Islander (2)
 Hispanic/Latino (3)

Other (4)
 Not Reported/NAL (9)

Consult Location
 emergency inpatient outpatient N/A

Spine
 NSU Ortho CoManage

Date Closed

TraumaName

Date of Injury

Date Last Printed

z_ContactID

Update Patient Info

The consult form consists of a series of 7 onscreen entry pages which are designed to require entry without interfering with entry on any one page. Fields left empty are flagged in red and required to be finished before the Consult can be closed.

The image displays two screenshots of a medical consult form. The left screenshot shows a patient information section with fields for Name, DOB, and various checkboxes. The right screenshot shows a physical exam section with a diagram of a human head and neck, and a table for recording findings.

and menus to enable accurate format of data. Merge fields are used for presentation on the final printout.

Other details

- Many systems require entry with just looking for a value in the field. The consult system checks the value of entries and requires other values to further explain. For example when Other is checked or selected then the Other Comments field must have a value.
- Many times patients are unconscious or Unable To Assess (UTA) so a checkbox is included to override sections, BUT if data is actually entered the real data overrides UTA as some patients become available during an exam. This aids in ease of input as it does not require unchecking override boxes, just entering data
- Data entered into portals are summarized into nice neat text summaries that are easier to read than entry forms
- When the Consult is signed, closed and finalized an electronic signature is attached and Consult data is copied to the Patient record and data from the three Physical Exam pages are copied to the next days Progress form to give it a jump start
- Completed and Incomplete forms are managed by an Admin and finalized and printed as a group to PDFs for upload to the Hospital system. The form lock can be overridden in special cases to insure the most accurate data.

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Patient Info



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Patient Info

The Patient Info was the first system developed and became a catchall for managing patient data. It is a series of entry screens with a main menu for initial navigation.

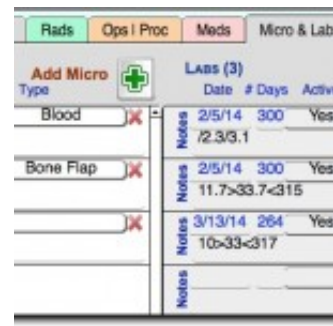
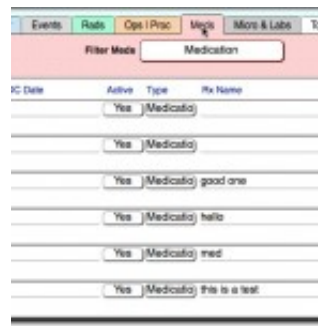
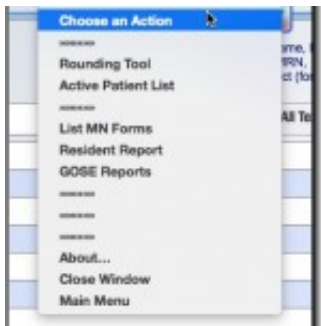
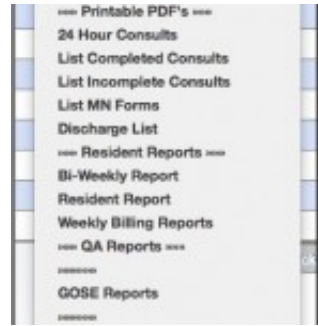
Different Main Menus are presented based on the User, i.e. Nurses, Doctors and Developers might see a different screens based on there needed functionality. This applies to the popup Go Menu navigation system which is driven by Privilege sets, allowing control over navigation based on what is need by the user and the user privilege set.

The details are either entered here or presented for review on a multi-tabbed interface. Data from the Consult Intake form is transferred to the patient record upon completion as well as data from Daily progress reports.

Other tasks:

- To-Dos for patients can be reviewed here
- Prog notes can be navigated to by portal
- Discharge summaries can be updated and printed
- QA ensuring accuracy is overseen here
- Admin functions are displayed here for navigation if their Privilege set allows

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Daily Progress Note

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The progress note system is the last to be included in the system allowing for the daily requirement of updating Patient Info as the Doctors make their rounds. A dual system supports the ICU (Intensive Care Unit) patients as well as the standard Floor patients.

Features include:

- Color coded listing of active patients automatically found and sorted
- Overview page designed for quick review non computer or iPad
- A progress note is created when the Consult Intake form is signed and finalized
- Physical exam data from the Consult is rolled into the days and next days progress note upon creation
- When a Progress note is closed and signed and new Note is created for the next day and selected data is rolled over to the next day's note to aid ease of use
- Entry is performed on 8 tabbed layouts, the last of which includes an electronic signature system
- Summary data from portals is continually updated with server scripts and when signing/finalizing a Note
- Overview is a calculated presentation which combines data from fields and portals presenting relevant data and filtering out blank sections of data Unable to Assess
- Completed Progress notes can easily be found sorted and printed to paper records and PDFs for upload to hospital systems
- System is optimized for data entry, presentation, printing and review
- Data is captured not only for the Patient record but for research and analysis to better develop health strategies

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More Actions

Back FWD

Active Patient List

Current Search Pt List

Consult QA Disch Prog Notes

Quit Close Menu Admin

Select An Action...

Michael Alan, Classen

TI Name: 000000

DOB: 8/27/1983

Visit #: 1251223

PROCEDURES

1/25/2014 (PCD 251) Procedure: Cranial Procedures - Cranial Reconstruction Cranioplasty

Blurbs summaries

Click the header of a section to manually update it

Update Labs

Update Meds

Update Radiology

Update Medication

Update Proc

), vac placement

Neurosurgery Critical Care Note

Name: Michael Alan, Classen

TI Name: 000000

DOB: 8/27/1983

Visit #: 1251223

Physical Exam:

Vitals: Stable

Neurological Exam:

Level: 2

Degree of Injury: C

View Blurbs

1/26 CBC y0333 tanoy

2/5/2014 (PCD 294) Han

3/12/2014 (PCD 251) Procedure: Cranial Procedures - Cranial Reconstruction Cranioplasty

Provider	Trains Hours	RNH	Admit Service	Active	ADMIT	Spec Code	Proc	Rate	Credit POF
Classen, Mike	CR	Good	80000	NSU Primary	Inactive	8/1/10	11/22/14	818.000	Out Prog
Classen, Michael Alan	PRC	Good	80000		Inactive	8/1/12	11/22/14	818.000	Out Prog
Classen, Mike	PRC	Good	80000		Inactive	8/1/12	11/22/14	818.000	Out Prog
Classen, Mike	PRC	Good	80000		Inactive	8/1/12	11/22/14	818.000	Out Prog
Classen, Mike	PRC	Good	80000		Inactive	8/1/12	11/22/14	818.000	Out Prog
Classen, Michael	SA Test Trauma	Good	80000		Inactive	11/22/14	11/22/14	818.000	Out Prog
Classen, Michael	SA Test Trauma	Good	80000		Inactive	11/22/14	11/22/14	818.000	Out Prog
Classen, Michael	SA Test Trauma	Good	80000		Inactive	11/22/14	11/22/14	818.000	Out Prog
Classen, Michael	SA Test Trauma	Good	80000		Inactive	11/22/14	11/22/14	818.000	Out Prog
Classen, Michael	SA Test Trauma	Good	80000		Inactive	11/22/14	11/22/14	818.000	Out Prog
Classen, Michael	SA Test Trauma	Good	80000		Inactive	11/22/14	11/22/14	818.000	Out Prog
Classen, Michael	SA Test Trauma	Good	80000		Inactive	11/22/14	11/22/14	818.000	Out Prog

SCU Progress Note Form
Overview
1 of 12
PACU 123 456 Classes, Mike Good N 99999 80201863 HD 882 8/1/2012

Physical Exam is Normal - Repeat All

Musculoskeletal
Musculoskeletal Defensiveness: Absent Present
Whisper: No Yes
Comments:

Muscle Strength
Right: 0 1 2 3 4 5 6 7 8 9 10
Left: 0 1 2 3 4 5 6 7 8 9 10
New Ref: Normal Hypertonic Hypotonic
New Lab: Normal Hypertonic Hypotonic
Tone R/L: Normal Hypertonic Hypotonic
New Lab: Normal Hypertonic Hypotonic
Pronator Drift R: No Yes
Pronator Drift L: No Yes
MMF Suppronator R: Yes No
MMF Suppronator L: Yes No
Comments:

Cerebellar Exam
RAM Deciduosubstantia: No Yes
FTH/Dysmetria: No Yes
Trunc: No Yes
Asymmetry: No Yes

Sensory Exam
Head to Light Touch: Yes No
Pain: Yes No
Vibration: Yes No
Stereognosis: Yes No
Comments:

Reflexes
Biceps: 0 1 2 3 4 5
Ankle: 0 1 2 3 4 5
Deltoid: 0 1 2 3 4 5
Clench: 0 1 2 3 4 5
Comments:

Rectal Tone
Anorectal: Present Absent
Comments:

ASA
ASA: I II III IV
Comments:

SCU Progress Note Form
Overview
1 of 12
PACU 123 456 Classes, Mike Good N 99999 80201863 HD 882 8/1/2012

Code Status
Code Status:

Radiology Imaging reviewed by me:

Problems List & Plan
Problem:

Time Spent
CPT Code: 99211 PF-PF-SFLOW: 15 minutes
Enter Add. Min. Multiplier:
I spent this # of minutes caring for this critically ill patient with a high probability of imminent life threatening deterioration:
Date: 01/08/2014 5:01:23 PM
Name: Michael A. Clasen, MD
Attending: *Michael A. Clasen*
Sign Form/Attending:
Michael A. Clasen, MD, PhD

SCU Progress Note Form
Overview
1 of 12
PACU 123 456 Classes, Mike Good N 99999 80201863 HD 882 8/1/2012

Micro (2)
Date: 3/5/14
Active: Yes
Type: Blood
Notes: wbc 5.9w
Date: 3/5/14
Active: Yes
Type: Bone Flap refile

Radiology Report today(1)
Date: 10/6/1
Region: Head Face
Type: CT
Description: 1.9 cm (AP by transverse). There is minimal
Active: Yes

Allergies
Allergy:

Medications (4)
Date/Time: 5/29/14
Days: 196
Active: Yes
Type: Medication
Name: Colisthione 2 gms IV q 12 hrs
Date/Time: 3/8/14
Days: 278
Active: Yes
Type: Medication
Name: Ceftriaxone 2 gms IV q 12 hrs
Date/Time: 3/8/14
Days: 278
Active: Yes
Type: Medication
Name: oxycodone 5mg po q2 PRN pain
Date/Time: 3/8/14
Days: 278
Active: Yes
Type: Medication
Name: Senna 2 tabs nightly

SCU Progress Note Form
Overview
1 of 12
PACU 123 456 Classes, Mike Good N 99999 80201863 HD 882 8/1/2012

Neurological Exam
Meningeal Exam
Meningeal Exam: Unable to assess
MNI: Eye: Normal Abnormal
Fundus: Normal Abnormal
Comments:

Cranial Nerve Exam
CN II: Able to assess
CN III: Normal Abnormal
CN IV: Normal Abnormal
CN V: Normal Abnormal
CN VI: Normal Abnormal
CN VII: Normal Abnormal
CN VIII: Normal Abnormal
CN IX: Normal Abnormal
CN X: Normal Abnormal
CN XI: Normal Abnormal
CN XII: Normal Abnormal
Comments:

Brainstem reflexes
R Corneal: Present Absent
L Corneal: Present Absent
R Gag: Present Absent
L Gag: Present Absent
Comments:

pupils
Right: Round Irregular
Left: Round Irregular
Comments:

ICU Progress Note Form
Overview 1 of 12

[1] PACU 123 456 Classen, Mike Dood N 9999 8/20/1953 HD 862 8/1/2012

Vitals

T Max C 55 T Current C 56
 Art SBP 100 Art MAP 110 CVP 120
 Art DBP 180
 NBP SBP 200 NBP MAP 432 MAP Goal >85
 NBP DBP 280
 HR 111 Rhythm 20
 RR Spont 222 O2 Sat 866 Supp O2 777

Neuro Monitors

ICP Parameters: 456 Mannitol 23.4%
 CPP Parameters: 80-80 Pressor Ant-Htn
 CSF Parameters: 321
 PBT2 Syva CSF

ICU Progress Note Form
Overview 1 of 12

[1] PACU 123 456 Classen, Mike Dood N 9999 8/20/1953 HD 862 8/1/2012

Input

PO 99 IVF 86 Tube Feed 87 Propofol 98
 Free H2O 95 Pharyl 84 Dex 80 Propofol 82
 PO: 99, IVF: 86, Tube Feed: 87, Propofol: 98, Free H2O: 95, Pharyl: 84, Dex: 80, Propofol: 82
 Enter Total In

Output

LO 10 Stool 20 EVD 30 LD 40
 JP 1 50 JP 2 80 JP 3 70 JP 4 80
 UOI: 10, Stool: 20, EVD: 30, LD: 40, JP 1: 50, JP 2: 80, JP 3: 70, JP 4: 80
 Enter Total Out
 24 hr Fl Bar (calc)
 LOS Fl Bar (calc) -195

Weight

Admin: 200 Today: Balance: -200

Labs (4)

Date / Active	View Labs	LabName	Type	Add Lab
11/25/11 Yes		yadda turkay	CBC	Yes
10/26/11 Yes		10>33<317	Troponin	Yes
2/5/14 Yes		(2.3) 1	CD4 Count	Yes
2/5/14 Yes		11.7>33.7<315	Coegs	Yes

Floor Progress Note Form
Overview 5 of 12

[5] SA 5 98 Classen, Michael Test Trauma 99999 8/20/1953 HD

Vitals

T Max C T Current
 NBP SBP NBP MAP 432
 NBP DBP
 HR Rhythm 20
 RR Spont O2 Sat Supp O2

INSURANCE - (S) Medicare - (S) Blue Cross - (S) Blue Cross
 MEDICATIONS - (S) Fentanyl 50mcg IV Push - (S) Morphine 2mg IV Push - (S) Propofol 1mg/kg/hr IV
 PROCEDURES - (S) Endotracheal Intubation - (S) Central Venous Catheterization - (S) Chest Tube Insertion
 RECENT EVENTS - (S) [1] 10/29/2014 11:21 AM
 VITALS - (S) T Max Current 56, Art SBP 100, Art MAP 110, Art DBP 180, NBP SBP 200, NBP MAP 432, NBP DBP 280, HR 111, Rhythm 20, RR Spont 222, O2 Sat 866, Supp O2 777

Floor Progress Note Form
Overview 5 of 12

[5] SA 5 98 Classen, Michael Test Trauma 99999 8/20/1953 HD

Patient Info

Chief Complaint: My chief complaint

Events (since 6 am yesterday)

Current Events (1)

Date / Active	Add Event
10/29/2014 11:21:16	Yes

Graphs & Reports

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An elaborate system of reporting is updating daily on the server grabbing relevant data from patient info, hiding Patient Info and graphing the data into a series of visual reports for analysis

- data is updated every 24 hours
- patient records can be identified which populate the graphs
- sets of data from year to year, month to month is easily navigated
- tables of data can be reviewed and exported for further analysis
- graphs are easily printed en masse

Neuro Tracker | Consult Form | Patient Info | Progress Note | Graphs & Reports

