

Outpatient Clinical Decision Systems that Work: Lessons learned from research and experience

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Conflict of Interest

- Patrick O'Connor reports no industry funding, travel/honoraria from WHO, CDC, NIH; Research Grants from NCI, NHLBI, NIDDK, NICHD, AHRQ, NIMH, NIDA, and PCORI
- JoAnn Sperl-Hillen reports no industry funding, Research Funding from PCORI, NIDDK, NHLBI, NCI, AHRQ, NIDA, and NIMH
- Both employed at HealthPartners, Minnesota



CDS History

- 1991 EMR CDS will change the world (IOM)
- 1997 EMR implementation worsens care
 - O'Connor et al
 - Crossan, Crabtree et al
- 2000-2010 CDS does not improve chronic disease outcomes (increases test rates)
 - Mayo, Mass General, Regenstreif, + dozens



Look Under the Hood in Primary Care

- 4+ problems per clinical encounter
- 200 clicks per encounter (RJ Koopman, 2011)
- 15 minutes “face time” per visit
- 5 hours a day on EMR documentation, tasks
- Overestimate own quality of care
- Respond to “patient agenda” and priorities
- Value autonomy
- Trying to get home before 8 pm

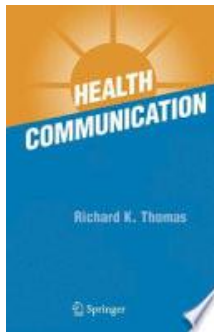
Designing CDS for Primary Care

- Develop CDS systems that are:
 - Fires only when potential large benefit (CV risk)
 - Save time (goal: zero clicks)
 - 1 CDS per patient, NOT 1 CDS per disease
 - Prioritized
- ➔ High CDS Use Rates
- ➔ Improve Quality of Care, QOL, Cost, and Patient Experience of Care (+ home before 8)



Communication with Patients

- Keep messages short and simple
- Repeat the same message as often as possible
- Make the message relevant to the person
- Recommend specific action
- Make sure the message presenter is a credible source of information



[Richard K. Thomas](#)

Springer Science & Business Media, Oct 21, 2006 - [Medical](#) - 212 pages



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Cardiovascular (CV) CDS

What does it do?

- Identifies and targets Individuals with the greatest potential for CV benefit (Reversible Risk)
- Prioritizes CV risk factors based on potential benefit
- Displays personalized treatment options (medication intensification, behavioral/lifestyle change, safety alerts, referrals, and testing due)
- Provides tools to both the patient and clinician to support patient engagement and shared decision making (Greenfield & Kaplan, 1988)

Lipids

Blood
Pressure

Glucose

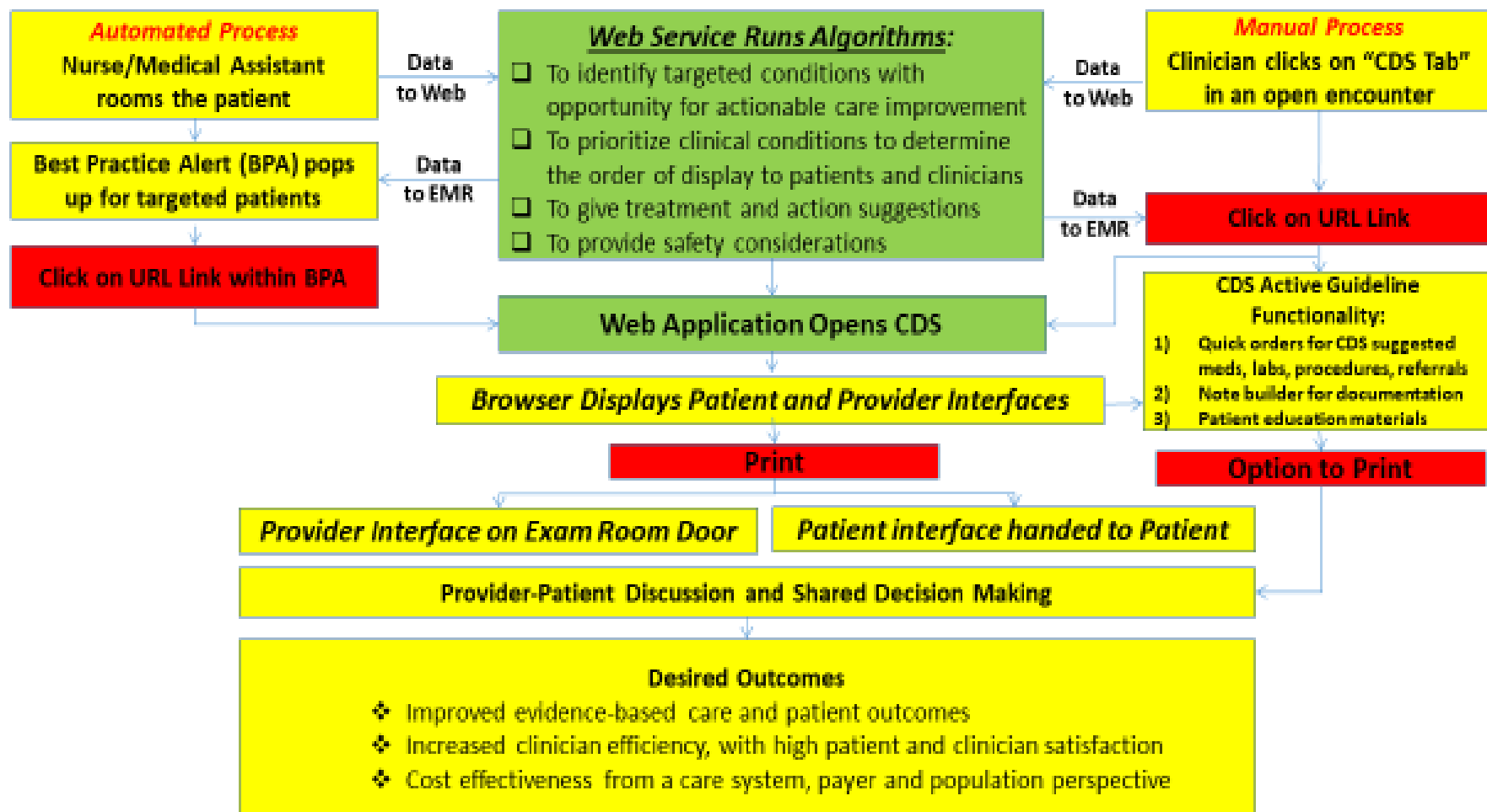
Weight

Smoking

Aspirin
















Figure 2: Workflow for CDS Use In Primary Care Encounters




First Iteration of CV Wizard – patient interface

CV Wizard

[Print Patient Only & Close](#)
[Print Provider Only & Close](#)
[Print All & Close \(double sided printer\)](#)
[Print All & Close \(single sided printer\)](#)
[Provider](#)
[Patient](#)
[Feedback](#)
[Statin Risk Assessment Tool](#)

Patient Name CVW,TESTONE	Age 64	Lifetime Cardiovascular(CV) Risk* Calculated for ages 20-59	10 Year CV Risk* 33.1%
<p>Can you reduce danger of heart attack and stroke?</p> <p>Yes, you can! If you want to reduce your chance of a stroke or heart attack, talk to your provider about what you can do about the things with the  signs. The things with the  are ok.</p>			
Cholesterol	Priority 2	Blood Pressure	Blood Sugar
   Recommendations: A cholesterol lowering drug called a statin may be beneficial for you. Talk to your doctor.		Goal: BP < 140/90 Your BP: (110/80) 	Goal: A1C <= 7.9 Your A1C: 8.8  
Weight	Priority 4	Tobacco	Aspirin or Blood Thinner Use
Your Weight : 183  Recommendations: For support with weight management contact: HP Nutrition Services (952-967-5120), or visit www.healthpartners.com/public/health , or call your clinic.		Tobacco user    Recommendations: For help stopping tobacco use, consider calling HealthPartners at 1-800-311-1052, or the smoking hotline at 1-800-784-8669 (1-800-QUIT NOW). Or visit www.quitplan.com .	

* The estimated likelihood of having a heart attack or stroke in the next 10 years or 30 years (lifetime risk)

Talk to your provider about anything with one or more  symbols. Take notes here about what you can do to improve your heart health:




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Later iteration of CV Wizard patient interface


TALK TO YOUR DOCTOR ABOUT HOW YOU CAN IMPROVE YOUR HEALTH


Start the conversation! Use the priorities below as a guide to take action to better your health.















 **Most potential to improve your health**

 **More potential to improve your health**

 **Potential to improve your health**

 **Needs Attention**

 **Doing Well**


 TOBACCO	 Current Tobacco User	For help stopping tobacco use, ask your provider about local options, call 1-800-QUIT-NOW (1-800-784-8669), or go to the website smokefree.gov .
 CHOLESTEROL	 Your LDL: 94	Your Goal: Talk to your doctor about your statin dose.
 BLOOD PRESSURE	 Your Blood Pressure: (135/86)	Experts recommend BP goals ranging from less than 130/80 to less than 140/90 Talk to your provider about how to lower your blood pressure and schedule a BP recheck in 2-4 weeks.
 BLOOD SUGAR	 Your A1C: 5.8	Your Goal: A1C less than 5.7 Participating in lifestyle programs can lower your risk of developing diabetes. Talk to your primary care team about lifestyle programs they recommend.
 WEIGHT	 Your Weight: 160	Ask your provider about local weight loss options.
 ASPIRIN OR BLOOD THINNER		Aspirin is not recommended.
 KIDNEY HEALTH		Good work!


Low
literacy,
visual


Print
button


Conditions: Hypertension, Kidney Disease, Atrial Fibrillation

Cardiovascular Risk: Risk of having a heart attack or stroke over the next 10 years is 23.0% . Risk over your lifetime is Calculated only for ages 20-59 .

BLOOD PRESSURE  Potential CV Risk Reduction: 7.5 % **	Labs <table border="1"> <tr> <td>BP (mm Hg)</td><td>165/82</td><td>2/11/19</td></tr> <tr> <td>Last BP (mm Hg)</td><td>154/88</td><td>1/9/19</td></tr> <tr> <td>eGFR(ml/min)</td><td>56</td><td>11/14/18</td></tr> <tr> <td>eGFR(ml/min)</td><td>51</td><td>8/1/18</td></tr> <tr> <td>eGFR(ml/min)</td><td>53</td><td>8/5/16</td></tr> <tr> <td>K (mmol/L)</td><td>4.3</td><td>11/14/18</td></tr> </table> Medications Metoprolol Succinate Tab SR 24HR 200 MG	BP (mm Hg)	165/82	2/11/19	Last BP (mm Hg)	154/88	1/9/19	eGFR(ml/min)	56	11/14/18	eGFR(ml/min)	51	8/1/18	eGFR(ml/min)	53	8/5/16	K (mmol/L)	4.3	11/14/18	Goal: Ideal BP <120/80 Treatment Considerations <ul style="list-style-type: none"> No blood pressure was documented today. The blood pressure meets Stage 2 HTN criteria ($\geq 140/90$). Consider adjusting BP medication if BP has been consistently elevated, and reassess in 1 month. Consider home BP monitoring Consider ACEI/ARB medications based on kidney function tests. Check a potassium and creatinine test 1-2 weeks after starting ACEI/ARB, and continue them unless the creatinine rises more than 30%. Consider starting: <ul style="list-style-type: none"> ACEI/ARB Thiazide Diuretic CCB
BP (mm Hg)	165/82	2/11/19																		
Last BP (mm Hg)	154/88	1/9/19																		
eGFR(ml/min)	56	11/14/18																		
eGFR(ml/min)	51	8/1/18																		
eGFR(ml/min)	53	8/5/16																		
K (mmol/L)	4.3	11/14/18																		

BMI  Potential CV Risk Reduction: 1.4 % **	Labs <table border="1"> <tr> <td>Weight(lbs)</td><td>273</td><td>2/11/19</td></tr> <tr> <td>BMI</td><td>41.51</td><td>2/11/19</td></tr> </table>	Weight(lbs)	273	2/11/19	BMI	41.51	2/11/19	Treatment Considerations <ul style="list-style-type: none"> Discuss advantages of reducing weight by 10-20 lbs. Potential actions are listed on patient interface. Based on BMI and/or other comorbid conditions, consider discussing bariatric surgery.
Weight(lbs)	273	2/11/19						
BMI	41.51	2/11/19						

ASPIRIN  Potential CV Risk Reduction: 2.6 % **	Labs Medications Aspirin Tab 325 MG	Treatment Considerations <ul style="list-style-type: none"> CHADS2VASC score is ≥ 2 indicating a moderate to high risk of stroke. Anticoagulation is strongly recommended.
--	---	--

CKD  Potential CV Risk Reduction: 0.0 % **	Labs <table border="1"> <tr> <td>eGFR(ml/min)</td><td>56</td><td>11/14/18</td></tr> <tr> <td>eGFR(ml/min)</td><td>51</td><td>8/1/18</td></tr> <tr> <td>eGFR(ml/min)</td><td>53</td><td>8/5/16</td></tr> </table>	eGFR(ml/min)	56	11/14/18	eGFR(ml/min)	51	8/1/18	eGFR(ml/min)	53	8/5/16	Treatment Considerations <ul style="list-style-type: none"> Consider updating albumin to creatinine ratio results To prevent progression of Kidney disease pay attention to: <ul style="list-style-type: none"> Lowering blood pressure Starting an ace inhibitor or angiotensin receptor blocker medication <ul style="list-style-type: none"> Avoiding NSAIDs
eGFR(ml/min)	56	11/14/18									
eGFR(ml/min)	51	8/1/18									
eGFR(ml/min)	53	8/5/16									

RELEVANT INFORMATION AND RECOMMENDATIONS

Labs		
Random Plasma Glucose	139	8/1/18
Serum Creatinine	1.33	11/14/18
eGFR(ml/min)	56	11/14/18
LDL (mg/dl)	47	8/1/18
HDL (mg/dl)	30	8/1/18
TRIG (mg/dl)	434	8/1/18
TC (mg/dl)	122	8/1/18
ALT (mg/dl)	28	6/1/15
Smoking Status/Review Date	NEVER	2/11/19
Smokeless Tobacco	NEVER	2/11/19

GLYCEMIC CONTROL

- A glucose reading ≥ 100 mg/dL was identified (fasting status unknown). Consider screening for prediabetes with A1c or FPG and/or add prediabetes to the problem list if indicated.

LIPID

- Patient unlikely to benefit from statin use based on the ACC/AHA lipid guidelines.

TOBACCO

- Smoking is not identified.

Suggestion tab -
to type feedback

More detailed
information and
treatment
considerations

CKD
and
OUD
content
added

Study Design Issues

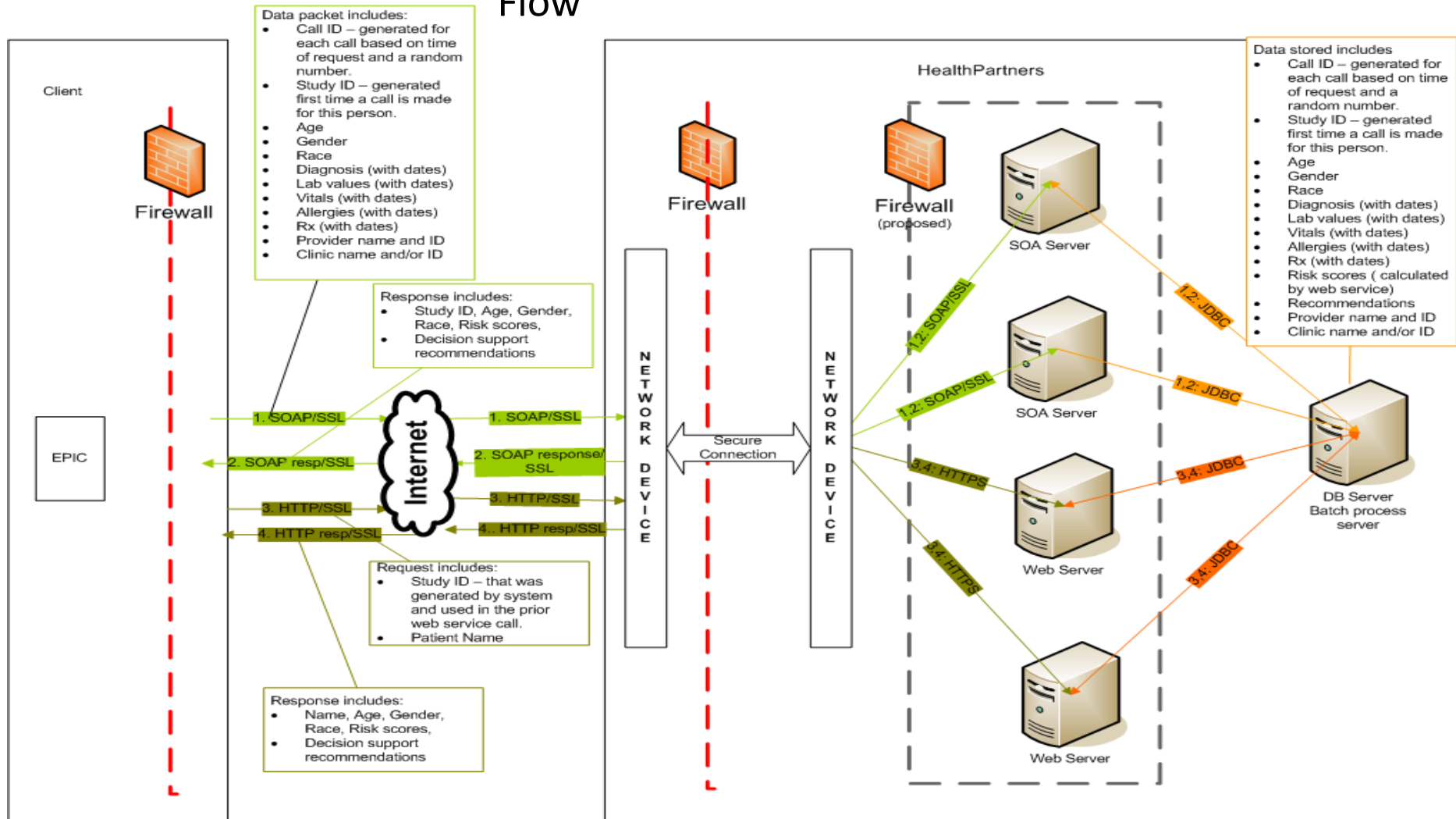
- Clinic-Randomized Trials (vs. Stepped Wedge)
- Waive written consent for clinicians
- Waive written consent for patients
- DSMB to monitor adverse over-treatment
- CDS-Linked Data Repository for analysis
- Data security
- Maintain and Update clinical algorithms

Additional Key Features

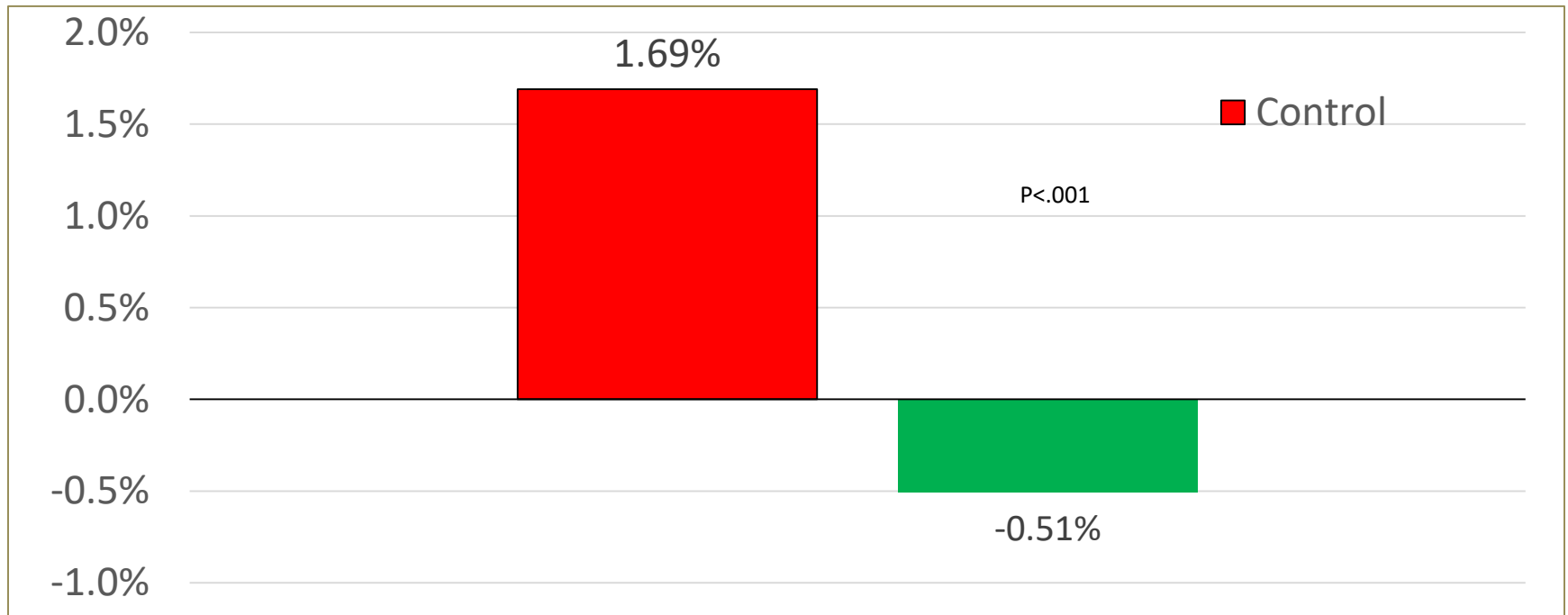
- Real Time: EMR → Web → EMR in < 1 second
- Data Security (need to send names)
- Feedback of CDS Use rates to maintain high rates
- Methods to Prioritize CDS suggestions
- Collect and use real-time user feedback for CDS improvement
- Support analysis through the CDS platform



CV Wizard Data Flow



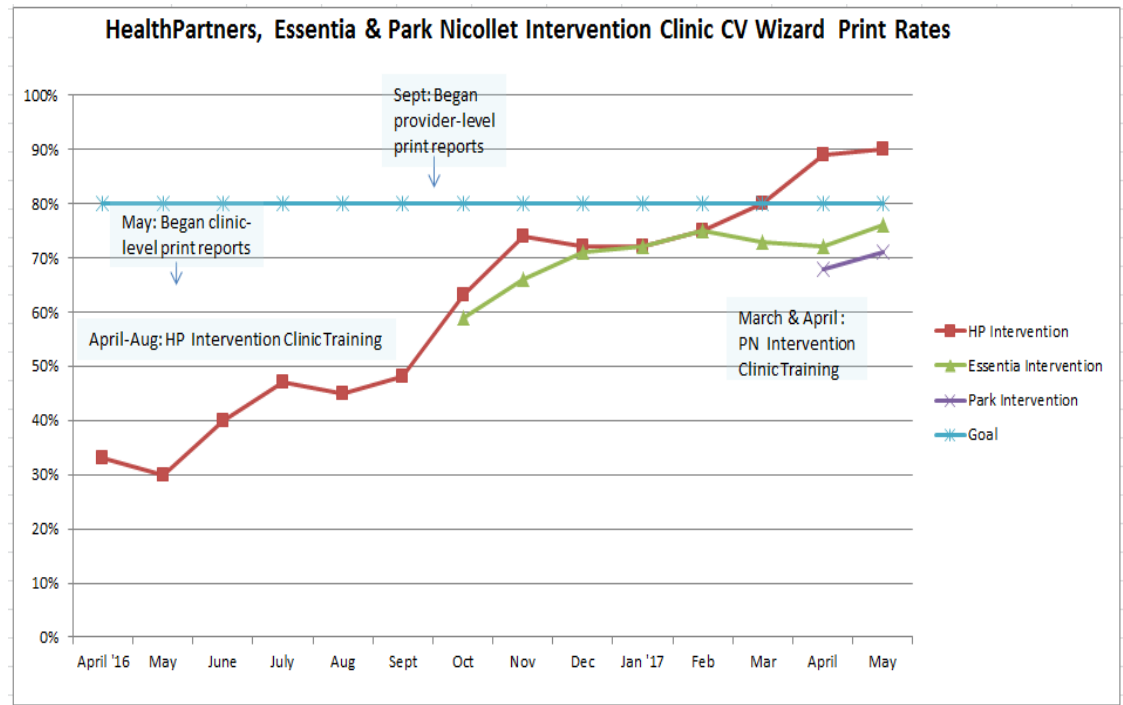
CV Wizard Significantly Reduced 10-year Cardiovascular Risk Over the 14 Month Observation Period



CV Wizard Use Rates

Wizard is used at more than 70% of targeted patient visits

- **Training** (very important) – in person or remote
- **Feedback** on measured use rates (very important)
 - Compare clinics to each other by name
 - Compare clinicians within each clinic to each other by name
- **Financial Incentives** for achieving and maintaining high use (may not be needed)



CV Wizard Impact on Clinician Communication with Patients

Clinician Survey Results	User	Non-user	P-value
Use calculated CV risk while seeing patients	73%	28%	0.006
Feel well prepared to discuss CV risk reduction priorities with patients	98%	78%	0.03
Able to provide accurate advice on aspirin for primary prevention	75%	48%	0.02
Often discuss CV risk reduction with patients	60%	30%	0.06



Clinician Satisfaction with CV Wizard

Wizard User Comments (N=47)	% Agree/Strongly Agree
Improved CV risk factor control	98%
Saved time when talking to patients about CV risk reduction	93%
Efficiently elicited patient treatment preferences	90%
Useful for shared decision-making	95%
Influenced treatment recommendations	89%
Helped initiate CV risk discussions	94%
My patients liked the Wizard	85%

Debates & Decisions

- What is optimal CDS “surveillance” rate? (100%)
- What is optimal CDS firing rate? (20%, 60%)
- What is ideal CDS use rate? (80%)
- Who should trigger the CDS? (Dietrich)
- Print versus electronic CDS?
- How to use between visits....
- How to use patient reported data....
- How to support ordering and documentation....



Future Directions

- New clinical domains (opioid use disorder, CKD, dementia, depression/suicide risk, asthma/COPD)
- Incorporate new data into existing domain algorithms
 - Medication adherence
 - Patient self- reported data
 - Device data (BP telemonitoring and CGM)
 - Better risk assessment models (AI)
 - Medication costs
- Improve workflow efficiency (Active Guideline Features)
 - Facilitate easy ordering of what CDS suggests (meds, labs, referrals)
 - Note builders for efficient documentation
 - Shared decision making tools and personalized educational materials
 - Interactive assessments and tools (e.g. for OUD, easy access to PDMP, screening tools)
- Improve current interfaces
 - Design Features
- Direct to patient applications
 - Patient portal access
 - Patient messaging (e.g. batch messages from the DM registry with Wizard link)
- Expand scalability, dissemination, interoperability
 - Greater use of FHIR
 - API capability – Plug and Play
 - Communicate the business case for CDS adoption



Addition of Adherence and CKD CDS

WIZARD® Data refreshed on: 05-Aug-2020 15:53:58:71 PM [Suggestions](#) [FAQ](#)

Clinical Priorities Mayo Statin Tool **Medication Adherence**

PRIORITY WIZARD [Provider](#) **Patient** [Print](#)

Relevant Conditions: Hypertension

Priority Wizard SmartSet is Available (Patient personalized): Quickly order medications, labs, and referrals and add patient instructions for clinical priorities below. Use the SmartSet link above.

Medication Adherence: A medication adherence or reconciliation issue was identified. More details in the [Wizard Adherence tab](#).

10-year Cardiovascular Risk: 14.5% (Risk of stroke or heart attack over the next 10 years)

#1 BLOOD PRESSURE Potential CV Risk Reduction: 4.2%

Experts recommend BP goals ranging from less than 130/80 to less than 140/90

Treatment Considerations

- The blood pressure meets Stage 2 HTN criteria ($\geq 140/90$). Consider adjusting BP medication if BP has been consistently elevated, and reassess in 1 month.
- Consider home BP monitoring.
- Consider starting:
 - *Thiazide Diuretic
 - *CCB

Results	Medications
BP (mm Hg) 155/100 8/5/20	Losartan Potassium Tab 100 MG
Last BP (mm Hg) 188/86 3/18/20	
eGFR (ml/min) >60 9/26/19	
K (mmol/L) 3.6 9/26/19	

Recommended quick orders for : ☒ Diuretic ☒ Calcium Channel Blocker ☒ Referral [SHOW ALL](#)

#2 LIPID Potential CV Risk Reduction: 1.9%

Goal: Consider intensifying statin therapy.

Treatment Considerations

- Statin initiation or intensification is recommended due to LDL ≥ 190 mg/dl. Many experts recommend high intensity statin therapy in this situation.

Results	Medications
LDL (mg/dl) 255 7/26/20	Atorvastatin Calcium Tab 10 MG
HDL (mg/dl) 80 7/10/19	
TRIG (mg/dl) 64 7/10/19	
TC (mg/dl) 253 7/10/19	
ALT (mg/dl) 20 8/21/19	

Recommended quick orders for : ☒ Statin [SHOW ALL](#)

#3 CHRONIC KIDNEY DISEASE

Treatment Considerations

- To prevent progression of kidney disease, pay attention to:
 - *Lowering blood pressure
 - *Starting an ACE or ARB
 - *Avoiding NSAIDs

Results	Medications
eGFR(ml/min) 45 5/30/19	No Medications
eGFR(ml/min) 20 10/17/17	
eGFR(ml/min) >60 6/17/17	

Adherence Information

CKD Information

Examples of Shared Decision Making Tools

Mayo statin tool is auto-populated with patient data

Wizard Tools

Update Wizard

WIZARD®

Suggestions FAQ

Clinical Priorities Mayo Statin Tool Medication Adherence

Hypertension

Current BP : 158/77, Date : 7/31/19 Previous BP : 150/68, Date : 7/16/19

Dispense History

PDC*	Description	Medication(s)	Medication Instructions
40%	Potential medication reconciliation or adherence issue	Metoprolol Succinate Tab SR 24HR 100 MG	Take 1 Tablet by mouth two times a day.
26%	Potential medication reconciliation or adherence issue	Amlodipine Besylate Tab 10 MG	Take 0.5 Tablets by mouth daily.
34%	Potential medication reconciliation or adherence issue	Hydrochlorothiazide Tab 25 MG	Take 1 Tablet by mouth daily.

Glycemic Control

A1C : 6.2, Date : 5/30/19

Dispense History

PDC*	Description	Medication(s)	Medication Instructions
58%	Potential medication reconciliation or adherence issue	Glipizide Tab SR 24HR 5 MG	Take 1 Tablet by mouth daily.

Lipid Management

LDL (mg/dl) : 106, Date : 10/2/18

Dispense History

PDC*	Description	Medication(s)	Medication Instructions
61%	Potential medication reconciliation or adherence issue	Atorvastatin Calcium Tab 80 MG	Take 1 Tablet by mouth daily.

Pharmacist Outreach: Click [Patient Declines](#) or [Provider Declines](#) to prevent a phone call to the patient from the pharmacist working with your clinic on improving medication adherence.

*Medication adherence issue is defined as the proportion of days covered (PDC) of less than 80%. PDC is determined by comparing how a patient is supposed to be taking medication based on the active medication list in EPIC with the amount of medication that has been dispensed. For example, if a patient was supposed to be taking metformin twice a day for the last 6 months (360 pills), but dispense history shows they only received enough for 90 days (180 pills), the PDC is 50%.

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Medication Adherence Tab



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Personalized CKD educational tool



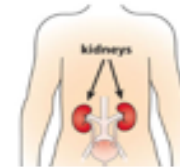
Patient: Name, Age, Date

Provider: Name

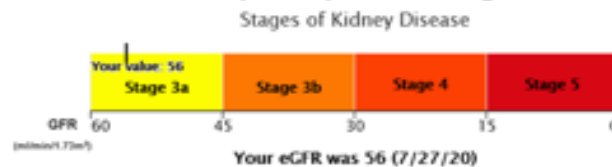
Your Kidney Health

What you should know and what you can do

When you have chronic kidney disease (CKD), your kidneys are not able to filter your blood and get rid of waste the way they should. Over time, your kidney function can worsen. However, there are steps you can take to help keep your kidneys working as well as they can. Use this handout to learn about your kidney disease and what you can do to keep your kidneys as healthy as they can be.



How do I know how well my kidneys are working?



How to interpret the stages of kidney disease

eGFR 30-60: Moderately low kidney function
eGFR 15-29: Very low kidney function
eGFR 15-14: Kidney failure

We use blood tests to find out how well your kidneys are working. A lab result called eGFR stands for estimated glomerular filtration rate. The eGFR is used to "stage" kidney disease. There are 5 stages. Stage 1 is mild kidney disease, and stage 5 is complete kidney failure. We may also check your urine for protein using a test called the urinary microalbumin creatinine ratio (UMACR) test.

What can I do about my kidney function?

From a review of your health record, you may be able to slow or stop kidney damage by:



- Working to keep your blood pressure at a healthy level. It's best for blood pressure to be below 130/80 mmHg. Your last blood pressure was **136/84 mmHg**. High blood pressure can hurt the tiny blood vessels in the kidneys. This can make your kidney disease worse. Ask your doctor about how to lower your blood pressure.




- Talking with your doctor about all the medicines you take now, even the ones you buy at the store without a prescription. A medicine named **IBUPROFEN** was found in your health record. This is a pain medicine called an NSAID (nonsteroidal anti-inflammatory drug). Using NSAIDs for prolonged periods can hurt your kidneys. People with CKD need to stop using NSAIDs if possible. Your doctor can also talk with you how to manage your pain if you stop taking **IBUPROFEN**.

What else can I do for kidney health?

Here are other steps you can take:

- Don't take any medicines, vitamins, minerals, or supplements unless your doctor says it's okay, and only take them exactly the way your doctor tells you to. Some of these can be harmful to your kidneys.
- Eat healthy. Eating less processed and pre-packaged foods can help lower the salt and phosphorous in your diet. This helps with kidney health.


Quick Orders are shown at the bottom of domain card in Active Guideline




Data refreshed on: 11-Feb-2020 12:00:39:819 PM


SuggestionsFAQ


Clinical PrioritiesMayo Statin Tool



ProviderPatientPrint

 **Relevant Conditions:** Hypertension, Diabetes

 **Priority Wizard SmartSet is Available (Patient personalized)** : Quickly order medications, labs, and referrals and add patient instructions for clinical priorities below. Use the SmartSet link above.

 **Cardiovascular Risk** : Unable to calculate risk score due to patient's age outside of range 20-75.

#1 BLOOD PRESSURE **Potential CV Risk Reduction: 11.7%**

Experts recommend BP goals ranging from less than 130/80 to less than 140/90

Treatment Considerations

- The blood pressure meets Stage 2 HTN criteria ($\geq 140/90$). Consider adjusting BP medication if BP has been consistently elevated, and reassess in 1 month.
- Consider home BP monitoring.
- Consider increasing dose of:
 - *ACE/ARB
- Consider starting:
 - *Thiazide Diuretic
 - *CCB

Results

BP (mm Hg)	155/76	2/11/20
Last BP (mm Hg)	143/93	1/7/20
eGFR(ml/min)	57	12/10/19
K (mmol/L)	4.8	1/7/20

Allergies
LISINOPRIL

Medications
Losartan Potassium Tab 50 MG

Recommended quick orders for : ☐ Diuretic ☐ ARB ☐ Ace Inhibitors ☐ Referral ☐ Calcium Channel Blocker

Quick Orders

Diuretic	ARB	Ace Inhibitors	Referral	Calcium Channel Blocker
<input type="checkbox"/> HYDROCHLOROTHIAZIDE 25 MG OR TABS	<input type="checkbox"/> LOSARTAN POTASSIUM 100MG OR TABS <input type="checkbox"/> LOSARTAN POTASSIUM 50 MG OR TABS	<input type="checkbox"/> LISINOPRIL 20 MG OR TABS <input type="checkbox"/> LISINOPRIL 40 MG OR TABS <input type="checkbox"/> LISINOPRIL 10 MG OR TABS	<input type="checkbox"/> PHARMACY-MEDICATION THERAPY MANAGEMENT	<input type="checkbox"/> AMLODIPINE BESYLATE 2.5 MG OR TABS <input type="checkbox"/> AMLODIPINE BESYLATE 5 MG OR TABS



Priority Wizard integrated into Telehealth Encounters

At phone and video encounters, clinician can access Wizard three ways:

- ❖ Click on Wizard Tools tab located on the navigation bar within encounters
- ❖ Use the .cvrisk dot phrase in a documentation note and click on the Wizard link
- ❖ Click on the Wizard link in the BPA section



Messaging through the Patient Portal

Your Cardiovascular Health-Personalized Recommendations

You have personalized information available that you can use to help make decisions on how to improve your health and lower your risk of heart attack or stroke.

Please click the link below to view the information.

[MyHealthSnapshot](#)

The information provided is based on recent information in your medical records. **Please consider scheduling a visit with your clinician to discuss any questions or concerns and develop a plan to improve your health.** You now have the option to schedule either a video or office visit.



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Publications

- **Clinical Effectiveness**

- Sperl-Hillen JM, Crain AL, Margolis KL, Ekstrom HL, Appana DX, Amundson G, Sharma R, Desai JR, O'Connor PJ. Clinical Decision Support Directed to Primary Care Patients and Providers Reduces Cardiovascular Risk: A Randomized Trial. *J Am Med Inform Assoc*. 2018 Sep;25(9):1137-46.
- O'Connor PJ, Sperl-Hillen JM, Rush WA, Johnson PE, Amundson GH, Asche SE, Ekstrom HL, Gilmer TP. Impact of Electronic Health Record Clinical Decision Support on Diabetes Care: A Randomized Trial. *Ann Fam Med*; 2011; 9(1) 12-21. PMID: PMC3022040.

- **Cost Effectiveness**

- Gilmer TG, O'Connor PJ, Sperl-Hillen JM, Rush WA, Johnson PE, Amundson GH, Asche SE, Ekstrom HL. Cost Effectiveness of an Electronic Medical Record Based Clinical Decision Support System. *Health Serv Res*. 2012 Dec;47(6):2137-58. PMID: PMC3459233.

- **CDS Design and Implementation**

- Kharbanda EO, Nordin JD, Sinaiko AR, Ekstrom HL, Stultz JM, Sherwood NE, Fontaine PL, Asche SE, Dehmer SP, Amundson GH, Appana DX, Bergdall AR, Hayes MG, O'Connor PJ. TeenBP: Development and Piloting of an EHR-Linked Clinical Decision Support System to Improve Recognition of Hypertension in Adolescents. *EGEMS (Wash DC)*. 2015 Jul 9;3(2):1142. PMID: PMC4537153
- Desai JR, Sperl-Hillen JM, O'Connor PJ. Patient preferences in diabetes care: overcoming barriers using new strategies. *J Comp Eff Res*. 2013 Jul;2(4):351-4
- Sperl-Hillen JM, Averbeck B, Palattao K, Amundson G, Ekstrom HL, Rush WA, O'Connor PJ. Outpatient EHR-Based Diabetes Clinical Decision Support that Works: Lessons Learned from Implementing Diabetes Wizard. *Diabetes Spectr*. 2010;23(3):149
- O'Connor PJ. Opportunities to increase the effectiveness of EHR-Based Diabetes Clinical Decision Support. *Appl Clin Inform*. 2011 Aug 31; 2(3):350-4. PMID: PMC3631926
- O'Connor PJ, Desai JR, Butler JC, Kharbanda EO, Sperl-Hillen JM. Current status and future prospects for electronic point-of-care clinical decision support in diabetes care. *Curr Diab Rep*. 2013 Apr;13(2):172-6. PMID: PMC3595375



Thank you!

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