PRECISION MEDICATION SELECTION

MedsEngine® Hypertension

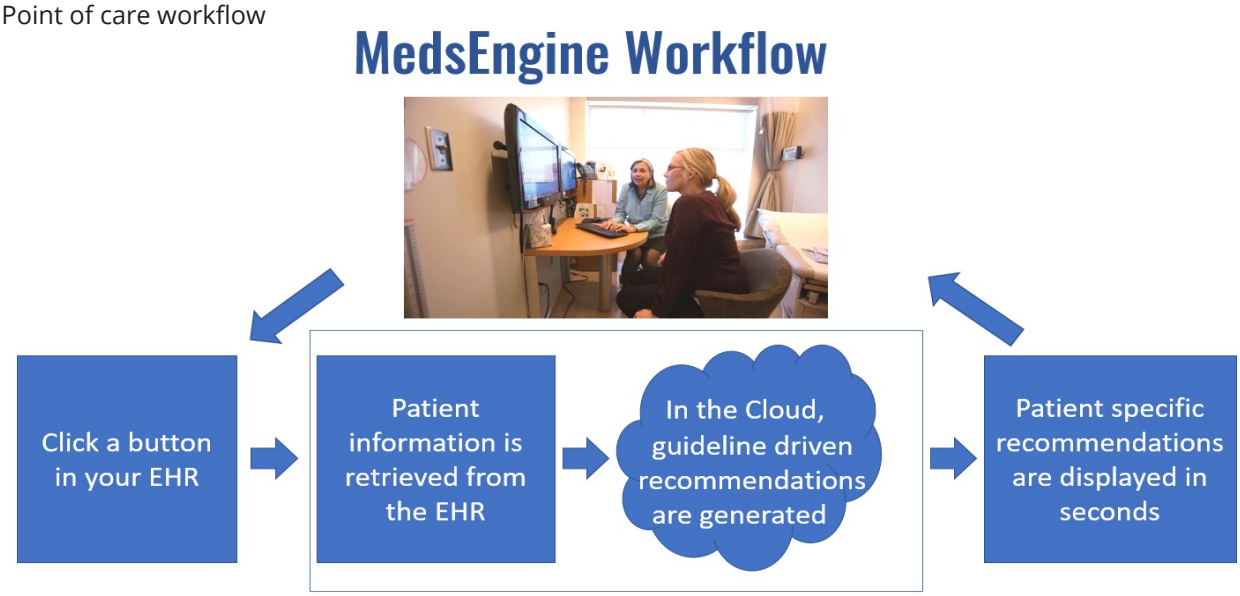
An EHR-integrated Clinical Decision Support Application to Improve the Treatment of Hypertension

Introduction to MedsEngine for Chronic Disease

Clinical decision support (CDS) tools have been around for years, assisting clinicians to appropriately treat specific conditions at the point of care. Most are in the form of alerts, reminders, and drug interactions, but they often induce "alert fatigue" and are disregarded. Other CDS tools are used routinely, such as the CHA_2DS_2-Vasc score for atrial fibrillation stroke risk, Wells score for DVT or PE prediction, and ASCVD risk calculator. They are useful but often require phone apps, data input, and extra time. What is needed are CDS tools that quickly and effectively treat chronic diseases.

MedsEngine is an EHR-integrated clinical decision support application for chronic diseases that harnesses the power of cloud-based software. It uses industry standard FHIR integration to connect to any EHR and absorbs the huge amounts of data stored in EHRs to provide evidence-based therapeutic recommendations at the point of care (Figure 1). MedsEngine codified complex clinical guidelines and uses the EHR data to recommend guideline-directed medical therapy (GDMT), so patients receive consistent, personalized care regardless of the provider's level of training. Physicians and advanced practice providers (APPs) can provide high quality patient care without affecting patient throughput when utilizing MedsEngine. Practices using MedsEngine for hypertension, type-2 diabetes, cholesterol management, and HFrEF have reported increased patient engagement, better chronic disease control, higher HEDIS scores, and lower medical loss ratios (MLRs).

Figure 1. Point of care workflow



Hypertension Background

In October of 2020, NHANES reported that as of 2018, the average blood pressure (BP) control rate in the US dropped to 43.7%. [1] This was followed by *The Surgeon General's Call to Action to Control Hypertension.* The Secretary of the US Department of Health and Human Services' response was, "we must focus on better using the interventions that we already know work, and we must focus on conducting science that supports the creation of new, innovative interventions".[2] By recommending thiazide, ACE/ARB, and CCB-D drug classes as initial treatment, the current guidelines imply that the primary cause of HTN is vasoconstriction. Associated factors and conditions like age, race, diabetes, CKD, etc. influence the order in which these drugs are prescribed. The other antihypertensive drug classes are only advised in specific clinical situations.

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With sustained US BP control rates being so low, causes of high BP other than vasoconstriction must be considered.

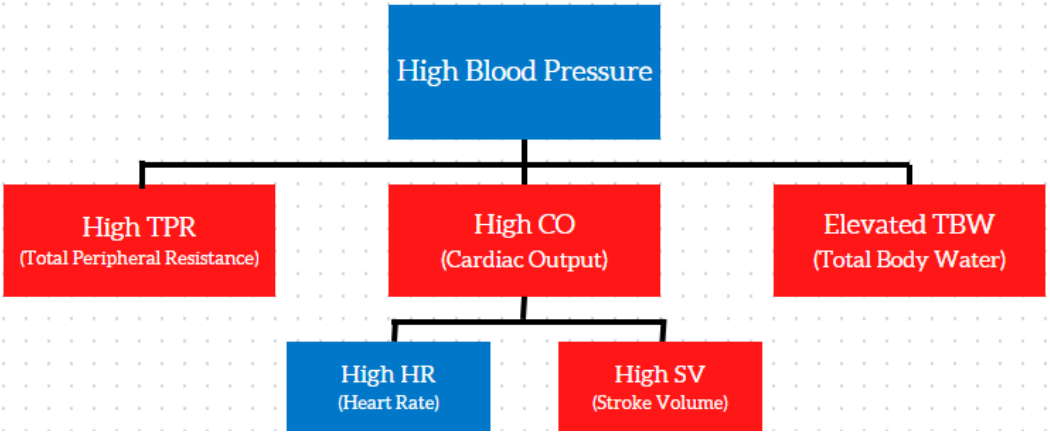
High BP can result from any of the following:

1) High Total Peripheral Resistance (TPR) – vasoconstriction
2) High Cardiac Output (CO) from either high Heart Rate (HR) or high Stroke Volume (SV)
3) Elevated Total Body Water (TBW)

Currently, when managing patients with HTN, only **BP** and **HR** are measured, and HR accuracy is variable. Based on BP alone, the US continues to treat only the implied cause of high BP, vasoconstriction.

NI Medical (Israel) developed the Non-Invasive Cardiac System (NICaS), that uses Impedance Cardiography (ICG) to accurately measure **TPR, CO, HR, SV, and TBW**. [3, 4, 5] **Four critical hemodynamic values are now known** (Figure 2).

Figure 2. Hypertension hemodynamics.



PriMED Physicians (Dayton, Ohio) has performed 12,721 ICGs from 2015-2022. Results show 3 distinct hemodynamic causes of HTN: 42% of patients have high TPR (vasoconstriction), 29% have high CO (hyperdynamic) and 29% are mixed (combination of vasoconstriction and hyperdynamic). Elevated TBW alone is rare. In recent separate studies, obstetricians, nephrologists, and a primary care group have reported markedly improved BP control using ICG technology. [6, 7, 8]

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MedsEngine Hypertension is a patented, EHR-integrated clinical decision support application. At the click of a button, BP, ICG data, and 37 clinical factors are searched for in the EHR and sent to the MedsEngine software in the cloud. A Validation Screen displays the patient's pertinent clinical factors and allows a PCP to amend any erroneous data found in the EHR as well as to include any factors not documented in the EHR. Upon confirmation of the validation screen data, MedsEngine processes millions of combinations and permutations and produces a recommendation screen.

The *Recommendation Screen* clearly informs the PCP and patient about the cause of their high BP. Patients can "see their BP" for the first time and have a much better understanding of why and how their BP will be treated (Figure 3). BP History, BP Type, and Facts influencing the drugs to be recommended are easily seen and understood. Up to 5 classes of antihypertensive drugs are recommended in order of efficacy (Figure 4). Changing between similar drugs within a class is simple. For example, a drop-down box lets you choose your preferred ACE/ARB (18 drugs in all). Drug Effect, Schedule, Pill Size, Max Therapeutic Daily Dose, Key Information, Follow-Up, Notes on Use, and Benefits of each drug are displayed. Contraindications and drug allergies are also displayed.

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Patient Engagement and Shared Decision Making

A Patient Summary report can be printed and provides a detailed explanation of all the information on the recommendation screen in addition to providing general information about hypertension. This personalized summary promotes improved understanding and medication adherence.

Figure 3. Recommendation Screen

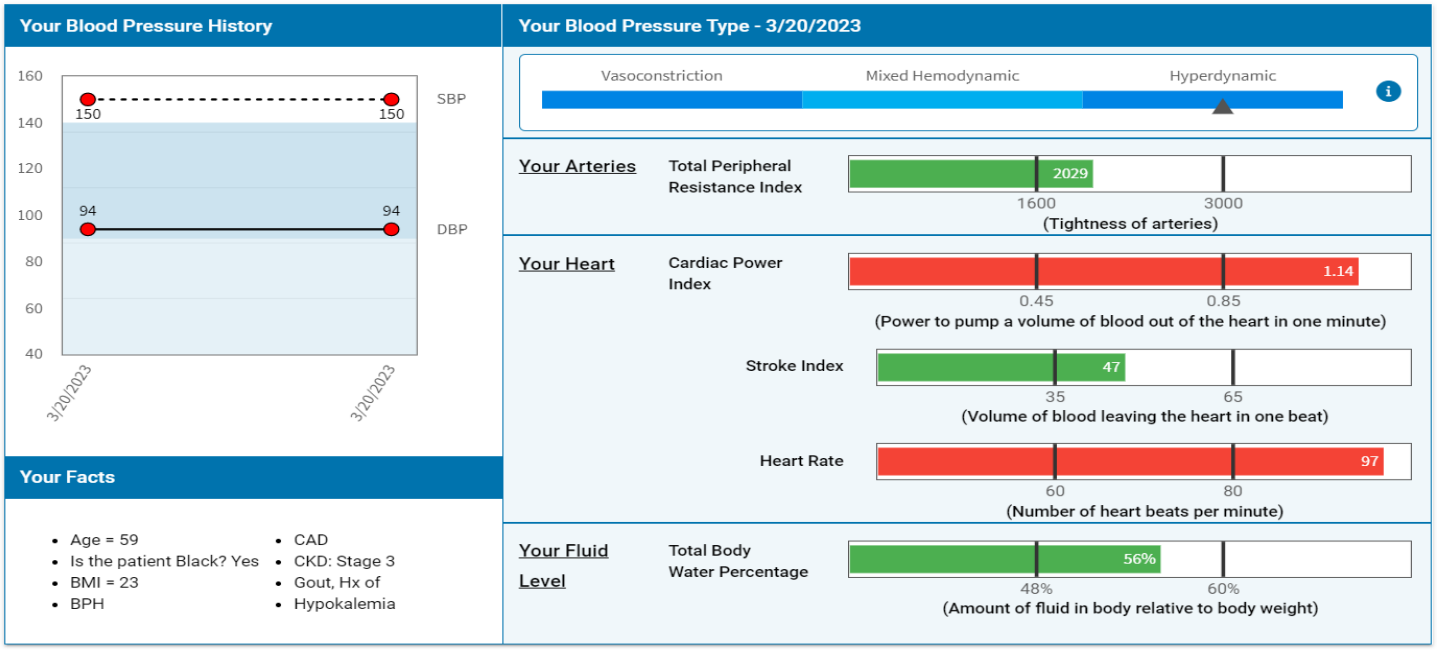
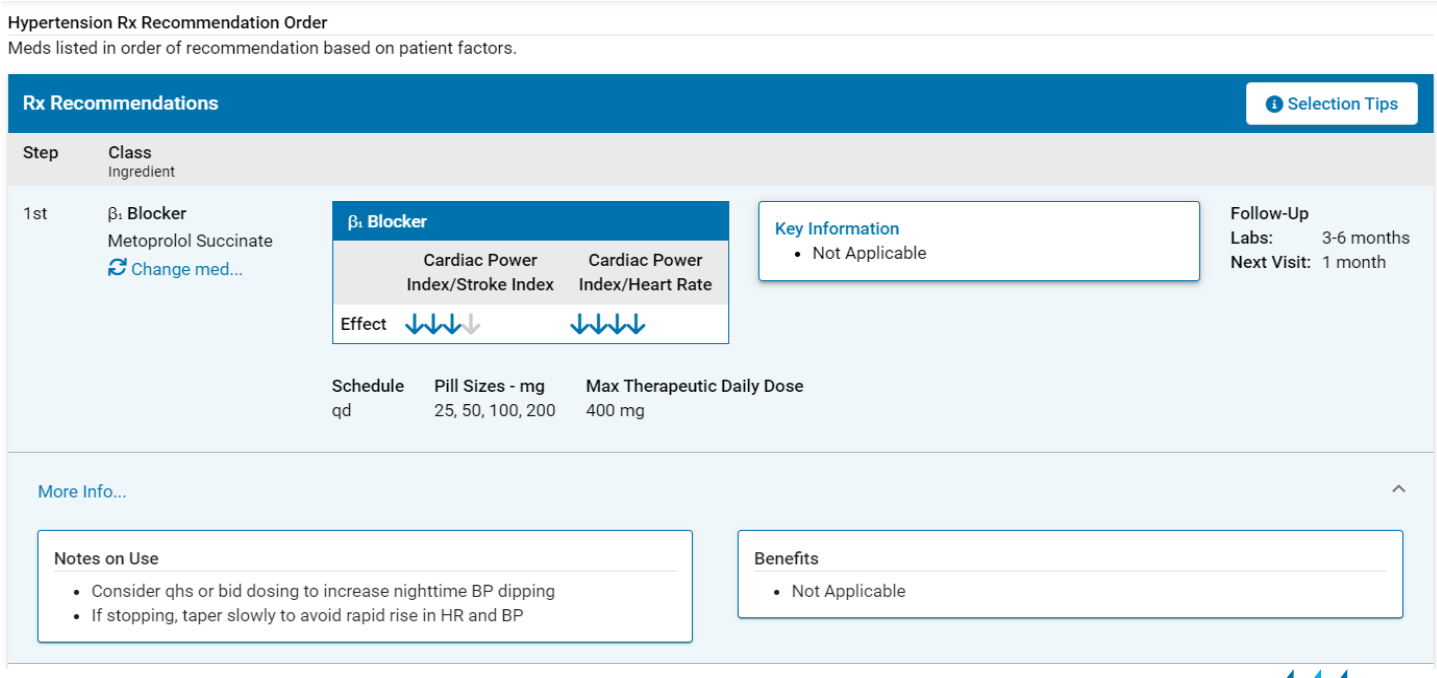


Figure 4. Medication recommendation (first of 5 drugs in order of efficacy).



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Results

PriMED Physicians have BP control rates of >90% for several years. They have been recognized as CDC "Million Hearts Champions"[9] and were #1 in the nation in the American Medical Group Association "Measure Up Pressure Down"[10] initiative. Their total cost of care, as measured by Medical Loss Ratio (MLR), is the lowest in the region.

Premier Medical Associates (Pittsburgh, PA) recently began using MedsEngine Hypertension and attained a BP to goal rate of >90%. Analysis of 40 months of data showed the correlation between the use of MedsEngine and getting patients to goal had an R^2 of 0.95.

Conclusions

MedsEngine considers each patient's unique hemodynamic profile and patient-specific factors to recommend precise medical treatment. Additionally, MedsEngine's presentation engages each patient to understand their therapy, thus increasing medication adherence. PriMED and Premier Medical Associates achieved and maintained BP control in over 90% of two large outpatient populations. This clearly demonstrates that optimal medical control of patients with high blood pressure is achievable.

Citations

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5 Amram. J. Cohen, et al Accurate, Noninvasive Continuous Monitoring of Cardiac Output by Whole-Body Electrical. Bio-impedance Chest 2004; 1431-1440

6 Cottrell, Jesse, et al. "The effect of impedance cardiography directed antihypertensive therapy on fetal growth restriction rates and perinatal mortality in women with chronic hypertension." *Pregnancy Hypertension* 28 (2022): 123-127.

7 Greco B, Chait Y, Nathanson BH, Germain MJ. A Novel Hypertension Management Algorithm Guided by Hemodynamic Data. Kidney Int Rep. 2021 Nov 27;7(2):330-333. doi: 10.1016/j.ekir.2021.11.029. PMID: 35155873; PMCID: PMC8820980.

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9 Million Hearts. Hypertension Control Champions website. 2020; https://millionhearts.hhs.gov/partners-progress/champions/index.html. Accessed January 27, 2020.

10 American Medical Group Foundation (AMGF), Measure Up Pressure Down Collaborative, www.measureuppressuredown.com