

SUPPLEMENT

Rationale and design of the Novel Uses of adaptive Designs to Guide provider Engagement
in Electronic Health Records (NUDGE-EHR) pragmatic adaptive randomized trial: A Trial
Protocol

APPENDIX TABLES

eTable 1. Behavioral principles in electronic health record tools tested in regression model

Study Arm	FACTORS OF INTERVENTIONS TO TEST (1=yes, 0=no)							
	Choice architecture (timing of information)	Follow-up boosting	Cold-state priming	Simplification	Sign-off approval timing	Pre-commitment/consistency	Framing: Guideline risks	Receipt of any EHR tool
1: Order entry alert	0	0	0	0	0	0	0	1
2: Encounter opening alert	1	0	0	0	0	0	0	1
3: Order entry alert + follow-up booster message	0	1	0	0	0	0	0	1
4: Encounter opening alert + follow-up booster message	1	1	0	0	0	0	0	1
5: Order entry alert + pre-visit priming message	0	0	1	0	0	0	0	1
6: Encounter opening alert + pre-visit priming message	1	0	1	0	0	0	0	1
7: Simplified order entry alert	0	0	0	1	0	0	0	1
8: Simplified Encounter opening alert	1	0	0	1	0	0	0	1
9: Order entry alert + sign-off approval alert	0	0	0	0	1	0	0	1
10: Encounter opening alert + sign-off approval alert	1	0	0	0	1	0	0	1
11: Pre-commitment alert + Order entry alert	0	0	0	0	0	1	0	1
12: Pre-commitment alert + Encounter opening alert	1	0	0	0	0	1	0	1
13: Order entry alert with different risk framing	0	0	0	0	0	0	1	1
14: Encounter opening alert with different risk framing	1	0	0	0	0	0	1	1
15: Non-enhanced standard alert	0	0	0	0	0	0	0	1
16: Usual care	0	0	0	0	0	0	0	0

APPENDIX FIGURES

eFigure 1. Provider tapering information and talking points embedded in enhanced alerts (2 pages)

Tapering information and patient talking points: Benzodiazepine and sedative hypnotic ("Z-drug") de-prescribing

1) What are the risks of benzodiazepines and sedative hypnotic ("Z-drugs")?

- All guidelines consider these high-risk medications for older adults, including chronic use at low doses.
- Risks include a 30% higher risk of falls, reduced cognition, and impaired driving similar to driving drunk.

2) How many patients can actually be tapered off benzodiazepines and Z-drugs?

- Studies show that >80% of patients can discontinue these drugs – even in those using them for >10 years.
 - Minor side effects are expected within the first few days but will improve.
 - With appropriate tapering, serious side events can be completely avoided.
- In order to taper, some patients with severe anxiety or other behavioral health conditions may benefit from a consultation with a specialist.

3) How are benzodiazepines and Z-drugs tapered?

- Most patients can complete a full taper in approximately 12 weeks.
 - Guidelines suggest decreasing patients' dose by ~25% every 2 weeks, and then slowly at the end.
 - Some patients may need to be stabilized on half their original dose for several weeks before completely tapering.
- Follow-up is recommended during the tapering process.

4) What preset tapers/instructions are in the benzodiazepine and Z-drug SmartSet?

- "Recommended" tapers section:
 - Once and twice daily taper orders for the drug/strength (e.g., diazepam 10mg) that is currently on the patient's medication list or is being ordered now
 - Separate tapers for reducing from full dose to half dose (1st half) and half dose to no dose (2nd half)
- "Alternative" tapers:
 - Three times daily taper orders for the drug/strength on the medication list or is being ordered now
 - Other taper orders for that drug (e.g., other diazepam strengths)
- Patient instructions for the after-visit summary:
 - Tapering directions for each type of taper that includes a dose-reducing calendar (example below)
 - Managing insomnia
 - Managing anxiety
- Orders for alternative medications or referrals
- Notes about tapers:
 - All tapering orders have directions for pharmacy dispensing in the "Note to Pharmacy" box and a SIG for patients.
 - You may need to modify orders, such as pill quantity if patients are taking >1 pill per dose. If you modify the order, please modify the patient instructions.

Dose-reducing calendar

Week	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Week 2
1	100%	75%	50%	25%	10%	5%	2%	1%
2	100%	75%	50%	25%	10%	5%	2%	1%
3	100%	75%	50%	25%	10%	5%	2%	1%
4	100%	75%	50%	25%	10%	5%	2%	1%
5	100%	75%	50%	25%	10%	5%	2%	1%
6	100%	75%	50%	25%	10%	5%	2%	1%
7	100%	75%	50%	25%	10%	5%	2%	1%
8	100%	75%	50%	25%	10%	5%	2%	1%
9	100%	75%	50%	25%	10%	5%	2%	1%
10	100%	75%	50%	25%	10%	5%	2%	1%
11	100%	75%	50%	25%	10%	5%	2%	1%
12	100%	75%	50%	25%	10%	5%	2%	1%

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- Some formulations (e.g., capsules) cannot be split, so the SmartSet defaults to equivalent strengths of lorazepam for benzodiazepines and zolpidem for Z-drugs. You can also order manual tapers if needed.

5) What are the side effects that should be monitored?

- Monitor particularly for withdrawal symptoms, which may be a sign that the medication is being tapered too quickly.
 - Minor, short-term symptoms: rebound insomnia/anxiety, irritability, GI symptoms, dizziness
 - Severe symptoms: Confusion, delirium, seizures
- If symptoms are bothersome, maintain at the current dose for 1-2 weeks more before reducing further, as any reduction in use can be beneficial.

6) What are some patient talking points for de-prescribing these drugs?

Talking points: Risks of benzodiazepines/Z-drugs

- **Highlight risks**
 - "Although these drugs can offer small short-term benefits, they can stop working and become dangerous. Serious side effects also remain over the long term, such as risk of falling or impairing your memory."
- **Emphasize reasons to stop**
 - "To maintain your independence, we should remove any medications that increase the risks of serious side effects."

Talking points: Safe discontinuation/tapering

- **Highlight tapering benefits**
 - "Many patients have successfully stopped taking this medication – the vast majority of people can stop taking them by safely reducing the dose slowly."
- **Mention alternatives**
 - "There are other effective treatments than these medications for your [insomnia/anxiety]."

Talking points: Managing the tapering process

- **Provide anticipatory guidance**
 - "You may experience a couple of nights of worse sleep."
 - "To reduce your risk of serious side effects, you might need to get through a few days of mild symptoms."
- **Emphasize non-abrupt discontinuation**
 - "These medications should not be stopped immediately (unless directed by me or another provider)."

eFigure 2. SmartSet order set embedded within enhanced alerts

A. SmartSet as presented to providers

CHARTING

Visit Info

Review

Allergies

Vitals

History

Problem List

Care Everywhere

Medications

Nursing Notes

Progress Notes

Annotated Images

MyHealth Sign-up

ORDERS

BestPractice

SmartSets

Med Reconciliation

Meds & Orders

Visit Diagnoses

DISCHARGE

Pt. Instructions

LOS

Follow-up

CC Guidelines

Comm Mgt

▼ RECOMMENDED Benzodiazepine Tapering Algorithms

PLEASE MAKE SURE TO SELECT THE PATIENT INSTRUCTIONS THAT CORRESPOND TO THE TAPER YOU ORDERED

▼ DIAZEPAM 5 MG TAB - Recommended Tapering Algorithms

☐ ONCE PER DAY dosing: 1st Rx to taper to half of current dose
Disp-35 tablet, R-0, Taper (based on pts original dose; may differ if changed): Week1=take 0.5 tab PO QD; W1Days2-7=1tab QD | W2D1,5=0.5QD;W2D2-4,6,7=1QD | W3D1,5,7=0.5QD;W3D2-4,6=1QD | W4D1,3,5,7=0.5QD;W4D2,4,6=1QD | W5D1-3,5,7=0.5QD;W5D4,6=1QD | W6D1-3,5-7=0.5QD;W6D4=1QD | W7=0.5QD

☐ ONCE PER DAY dosing: 2nd Rx to finish taper
Disp-15 tablet, R-0, Taper (based on pts original dose; may differ if changed): Week1=take 0.5 tab PO QD | W2Days1,4,7=0.25 tab QD; Days2,3,5,6=0.5 QD | W3=0.25 QD | W4=0.25 QD | W5D2,3,5,6=0.25 QD; Days1,4,7=no dose | W6=no dose

☐ TWICE PER DAY dosing: 1st Rx to taper to half of current dose
Disp-70 tablet, R-0, Week1Day1,5=0.5tabQAM&1tabQPM;D2-4,6,7=1BID | W2D1,3,5,7=0.5AM&1PM;D2,4,6=1BID | W3=0.5AM&1PM | W4D1,5=0.5BID;D2-4,6,7=0.5AM&1PM | W5D1,3,5,7=0.5BID;D2,4,6=0.5AM&1PM | W6D1-3,5-7=0.5BID;D4=0.5AM&1PM | W7=0.5BID

☐ TWICE PER DAY dosing: 2nd Rx to finish taper
Disp-20 tablet, R-0, Taper (based on pts original dose): Week1=take 0.5 tab PO BID | WK2=take 0.25 tab QAM & 0.5 tab QPM | WK3=0.25 tab BID | WK4=0.25 tab QPM | WK5 Days2,3,5&6=0.25 tab QPM; WK5 Days1,4,7=no dose | W6=no dose

▼ Patient Instructions for RECOMMENDED Tapering Algorithms

SELECT THE PATIENT INSTRUCTIONS THAT CORRESPOND TO THE TAPER ORDERED ABOVE

▼ Add patient instructions to after-visit summary

☐ ONCE PER DAY dosing: 1st Rx to taper to half of current dose

☐ ONCE PER DAY dosing: 2nd Rx to finish taper

☐ TWICE PER DAY dosing: 1st Rx to taper to half of current dose

☐ TWICE PER DAY dosing: 2nd Rx to finish taper

▶ ALTERNATIVE Benzodiazepine Tapering Algorithms

▶ Patient Instructions for ALTERNATIVE Benzodiazepine Tapering Algorithms

▶ Patient Instructions for managing insomnia or anxiety

▶ Alternative medications to manage insomnia

▶ Alternative medications to manage anxiety

▶ Referrals

▼ Ad-Hoc Orders

Search

You can search for an order by typing in the header of this section.

Click here to select a pharmacy

Associate Edit Multiple Providers

Remove End Send Order

eFigure 3. Enhanced encounter opening alert used in Arms 2, 6, and 10

A. Part 1: Upon opening a face-to-face (in-person) encounter in a patient's chart

Your patient has been prescribed at least 90 pills of a benzodiazepine in the past 6 months.

Benzodiazepines **increase a patient's risk of falling in the next year by 30%**. Patients who have fallen are 75% less able to perform all their activities of daily living.

ⓘ **A taper is indicated for your patient.** Almost all older adults can be safely tapered off these medications.

The Best Practice section contains a SmartSet that will generate a benzodiazepine taper and provide other useful information.

[Click here for tapering information and patient talking points.](#)

➤ Medication Activity

B. Part 2: Required to close the opened encounter in a patient's chart

Your patient has been prescribed at least 90 pills of a benzodiazepine in the past 6 months.

Benzodiazepines **increase a patient's risk of falling in the next year by 30%**. Patients who have fallen are 75% less able to perform all their activities of daily living. Collapse X ⌵

ⓘ **A taper is indicated for your patient.** Almost all older adults can be safely tapered off these medications.

[Click here for tapering information and patient talking points.](#)

Preset benzodiazepine taper / Alternative options / Pt instructions [Preview](#)

Medication Activity ➤

Acknowledge Reason _____

eFigure 4. Arm 3: Enhanced order entry alert + follow-up message

A. Order entry alert

Boostering
option

Your patient has been prescribed at least 90 pills of a benzodiazepine in the past 6 months.

Benzodiazepines **increase a patient's risk of falling in the next year by 30%**. Patients who have fallen are 75% less able to perform all their activities of daily living.

A taper is indicated for your patient. Almost all older adults can be safely tapered off these medications.

[Click here for tapering information and patient talking points.](#)

Remove the following orders?

Remove

Keep

diazepam 5 mg tablet
Take by mouth, Disp-, R-0

Apply the following?

Open SmartSet

Do Not Open

Preset benzodiazepine taper / Alternative options / Pt instructions
[Preview](#)

The following actions have been applied:

✓ Scheduled: If "Remind me in 4 weeks" is selected as acknowledgement reason, a follow up alert will be sent via in-basket.

Acknowledge Reason

Remind me in 4 weeks

I'll accept the drug's risks

Other (leave comment)

B. Follow-up message (4 weeks later) if "Remind me in 4 Weeks" was chosen

In Basket New Msg Patient Msg Refresh Edit Pools Preferences Search Manage QuickActions Attach Out Properties

My Messages

Open Charts (24)

BestPractice

My Unsigned Orders (1)

Status	Subject	Msg Date	Msg Time
Read	Benzodiazepine taper remin...	04/06/2020	10:48 AM
Read	Benzodiazepine taper remin...	03/05/2020	10:14 AM
Read	Sedative Hypnotics taper re...	03/05/2020	10:46 AM
Pend	Benzodiazepine taper remin...	03/05/2020	10:24 AM

Next appt with me: None

Message More Info Message Status Info Help

BX

ACP: (no ACP docs)
Care Gaps: 1

Weight: None

Benzodiazepine taper reminder from BPA Received: Today

Four weeks ago, you asked for a reminder about discontinuing this patient's benzodiazepine. Please discuss the serious health consequences of benzodiazepines with your patient. If this patient does not have an upcoming appointment, please forward this message to your scheduler. There is a SmartSet that will generate a benzodiazepine taper and provide patient talking points and other information.

Four weeks ago, you asked for a reminder about discontinuing this patient's benzodiazepine. Please discuss the serious health consequences of benzodiazepines with your patient. If this patient does not have an upcoming appointment, please forward this message to your scheduler. There is a SmartSet that will generate a benzodiazepine taper and provide patient talking points and other information.

Accepting this form will complete this advisory and retract related In Basket messages.

✓ Accept

Cancel

eFigure 5. Arm 7: Simplified enhanced order entry alert

ⓘ **Benzodiazepines increase a patient's risk of falling in the next year by 30%. A taper is indicated.**

[Click here for tapering information and patient talking points.](#)

Remove the following orders? _____

Remove

Keep

🏠 diazepam 5 mg tablet

Take by mouth, Disp- , R-0

Apply the following? _____

Open SmartSet

Do Not Open

Preset benzodiazepine taper / Alternative options / Pt instructions

[Preview](#)

Acknowledge Reason _____

I'll accept the drug's risks

Other (leave comment)

Simplification

9

eFigure 6. Arms 9 and 10: Sign-off approval alert that triggers to providers when electronically signing off on refill medications ordered by support staff

Your patient has been prescribed at least 90 pills of a benzodiazepine in the past 6 months.
Benzodiazepines increase a patient's risk of falling in the next year by 30%. Patients who have fallen are 75% less able to perform all their activities of daily living.

ⓘ **A taper is indicated for your patient.** Almost all older adults can be safely tapered off these medications. **Would you like to schedule this patient for a medication review?** Your patient's next appointment is below. If patient has no upcoming appointment, click on the acknowledge reason below to have your staff schedule one.

No future Internal Medicine visits on file.

[Click here for tapering information and patient talking points.](#)

Consider taking these recommended actions after addressing this advisory: _____

Consider opening SmartSet: Preset benzodiazepine taper / Alternative options / Pt instructions [Preview](#)

The following actions have been applied: _____

✓ Scheduled: If you click on "Schedule patient appointment" below, a staff message will be sent to your designated pool for scheduling.

Acknowledge Reason _____

[Schedule patient appointment](#)

eFigure 7. Arm 11: Pre-commitment/consistency alert + enhanced order entry alert

A. Pre-commitment alert

Your patient has been prescribed at least 90 pills of a benzodiazepine in the past 6 months. Benzodiazepines **increase a patient's risk of falling in the next year by 30%.** Patients who have fallen are 75% less able to perform all their activities of daily living.

ⓘ Almost all older adults can be safely tapered off these medications. **Will you start by sharing the handout below with your patient and then discussing a taper at your next appointment?**

If your patient is ready to taper now, use the SmartSet below to generate a benzodiazepine taper.

[Click here to view or print patient handout on how to taper off benzodiazepines – use .benzoinfo to add handout to patient instructions in the after-visit summary](#)

Remove the following orders? _____

Remove

Keep

 diazepam 5 mg tablet
Take by mouth, Disp-, R-0

Apply the following? _____

Open SmartSet

Do Not Open

Preset benzodiazepine taper / Alternative options / Pt instructions
[Preview](#)

Acknowledge Reason _____

I shared patient handout

I'll accept the drug's risks

Other (leave comment)

Pre-commitment

B. Enhanced order entry alert if “I shared patient handout” acknowledge reason chosen in pre-commitment alert

Your patient has been prescribed at least 90 pills of a benzodiazepine in the past 6 months. A taper is indicated for your patient.

ⓘ **You may have recently shared information with your patient about how to taper off benzodiazepines.**

If your patient is ready to taper now, use the SmartSet below to generate a benzodiazepine taper.

[Click here for tapering information and patient talking points.](#)

Remove the following orders? _____

Remove

Keep

 diazepam 5 mg tablet
Take by mouth, Disp-, R-0

Apply the following? _____

Open SmartSet

Do Not Open

Preset benzodiazepine taper / Alternative options / Pt instructions
[Preview](#)

Acknowledge Reason _____

I'll accept the drug's risks

Other (leave comment)

Note: If other acknowledge reasons are chosen, then the enhanced order entry alert shown in Figure 1 fires

eFigure 8. Arm 13: Enhanced order entry alert with different risk framing

Your patient has been prescribed at least 90 pills of a benzodiazepine in the past 6 months.

More than 25 studies have demonstrated that benzodiazepines **increase a patient's risk of falling in the next year by at least 30%**. Patients who have fallen are 75% less able to perform all their activities of daily living.

Numerous clinical guidelines recommend a taper for your patient. Almost all older adults can be safely tapered off these medications.

[Click here for tapering information and patient talking points.](#)

Remove the following orders? _____

 **diazepam 5 mg tablet**
Take by mouth, Disp-, R-0

Apply the following? _____

Preset benzodiazepine taper / Alternative options / Pt instructions
[Preview](#)

Acknowledge Reason _____

Framing of
risks

eFigure 9. Arm 15: Non-enhanced order entry alert

 **Patients age 65 and older should not be prescribed benzodiazepines for more than 90 days.**

Remove the following orders? _____

Remove

Keep

 **diazepam 5 mg tablet**
Take by mouth, Disp- , R-0