**Supplemental materials for**

Kurlander JE, Helminski D, Kokaly AN, et al. Barriers to guideline-based use of proton pump inhibitors to prevent upper gastrointestinal bleeding. *Ann Fam Med*. 2022;20(1):5-11.

**Supplemental Appendix 1. Final Interview Guide**

Interview guide – PPI gastroprotection – MDs

## Introduction:

Thank you for your willingness to be interviewed today. The purpose of this interview is to help us learn about how clinicians like you think about upper GI bleeding, and the use of PPIs to prevent it. Ultimately, we are interested in developing interventions that will help reduce patients' risk of upper GI bleeding from peptic ulcer disease. In addition to clinicians, we will also be interviewing patients, pharmacists, and other clinical leaders. However, we are particularly interested in **your** knowledge about upper GI bleeding and how you think about your role in preventing it.

The interview should last under an hour.

Before we begin, we would like to get your permission to conduct this interview and record it in order to facilitate transcription. This study has been exempted from IRB review.

-You can ask that the voice recorder be turned off, decline to answer any interview questions, or stop the interview at any time.

-All audio, notes, and transcripts will be kept confidential and will only be accessible to project staff. Any personally identifying information you may reveal during the interview will be removed when the interview is transcribed, and all interview recordings will be destroyed once the study has been completed.

Do you have any questions for me about the study, this interview, or the consent process?

Okay. I'm going to turn the recorder on now and ask for your consent so we have it on record.

***TURN ON RECORDER***

For the record, do we have your permission to conduct and audio-record this interview?

[If yes, continue to interview guide]

[If no, turn recorder off]

**BACKGROUND**

1. To get started, can you please tell us about your medical background?

    Probes:

    a. Specialty?
    b. Clinical focus within specialty?
    c. Years of practice?
    d. Number of ½ days of clinic per week?
    e. Number of patients seen per ½ day?
    f. Any additional responsibilities such as research, teaching or additional clinical roles?

**GI BLEEDING KNOWLEDGE**

Thank you. We are going to switch gears now and ask you some questions related to gastrointestinal bleeding.

2. Can you tell us about any experiences you have had with patients who have had upper GI bleeding?

3. What risk factors do you think about when assessing a patient's risk of bleeding from peptic ulcer disease?

    Probes:

    a. Medications?
    b. Age?
    c. H pylori?
    d. Prior ulcers or upper GI bleeding?

4. How much is GI bleeding something you fear in your patients?

5. What strategies are you aware of to reduce patients' risk of bleeding from peptic ulcer disease?

    Probes:

    a. Proton pump inhibitors?
    b. H2 blockers?
    c. Stopping high risk medications?

**KNOWLEDGE AND USE OF PPIS**

Now we would like to move on to discuss more about PPIs specifically.

6. How do you tend to use proton pump inhibitors in your patients?

    Probes:

    a. How often do you prescribe them for GERD?
    b. How often do you prescribe them for gastroprotection, which is the use of PPIs to prevent GI bleeding?

7. Thinking back to your medical training, how much education did you receive on the topic of appropriate use of PPI gastroprotection?
    a. Any additional training since then?

8. When you think about the issues that you have to address in a clinic visit, how much of a priority is thinking about whether to prescribe PPI gastroprotection?

    Probes:

    a. Is it something you consider as part of your standard health care maintenance?
    b. How often is PPI gastroprotection something you intend to discuss before you step in the room to see a patient?

9. In what types of visits do you tend to think about a whether a patient would benefit from a PPI for gastroprotection?

    Probes:

    a. Preventive care visit?
    b. New patient visit?
    c. When you see a patient with certain new medications prescribed?

10. How often do patients tend to ask you about their GI bleeding risk?
    Probe:
    a. Or about medications that might reduce their risk?

11. [If ever] In what types of patients do you tend to prescribe a PPI for gastroprotection?

    Probe:

    a. How high does a patient's risk for peptic ulcer disease have to be before you would consider prescribing a PPI?
    b. [If they identify NSAIDs as a risk factor], under what circumstances would you decide to start a patient on NSAIDs on a PPI to prevent upper GI bleeding?
    c. Under what circumstances would you start a patient on aspirin on a PPI?

d. [for cardiologists: aspirin alone? DAPT? ASA + anticoagulation? Certain high risk patients?

12. How effective do you believe PPIs are at preventing ulcers?
    a. How about on a scale from 1-10, where 1 is not at all and 10 is perfectly effective?

13. Are there any certain medical sources you look to when considering whether to prescribe PPI gastroprotection to a patient?

    Probes:
    a. Up-to-date?
    b. Colleagues?
    c. Any professional guidelines, and if so which ones?

14. From your understanding of professional guidelines, which patients should be prescribed a PPI for gastroprotection?

15. What is your impression of the quality of the evidence supporting the use of PPIs for gastroprotection?

16. What have you heard about any risks associated with PPIs?

17. Have recent publications on PPI adverse effects caused you to change how you prescribe PPIs?

    Probes:
    a. How?
    b. How much do you tend to worry about PPI adverse effects when prescribing PPIs?
    c. Which adverse effects do you worry most about?

18. How often do you tend to take patients off of PPIs?
    a. What the main considerations you consider when deciding to stop a patient's PPI?

19. In the end, how do you decide when to prescribe PPI gastroprotection for a patient?

## BARRIERS AND FACILITATORS TO GASTROPROTECTION

We would now like to think about factors that might make you more or less likely to prescribe PPI gastroprotection to your patients who are high risk.

20. We would now like you to think about a common scenario. Say a patient you're seeing in clinic is on dual-antiplatelet therapy after getting a coronary stent. Which clinician involved in the patient's care do you think should be considering whether the patient would benefit from a PPI or not, if anyone?

    Probe:

    a. In your opinion, do you think this patient should be treated with a PPI?
    b. Can you walk me through your thought process?
    c. What do you feel your role is for starting PPI gastroprotection in a patient if another provider prescribes a high risk medication?
    d. How much do you consider thinking about the need for gastroprotection to be something that falls to your specialty?

21. In your practice, how easy or difficult would it be to prescribe PPI gastroprotection to every high risk patient?

    Probes:

    a. What barriers make it difficult to do this?
    b. If you made it a priority, how often do you think you could effectively prescribe PPIs to high risk patients?
    c. If you recommended PPI gastroprotection to a patient at high risk for upper GI bleeding, how likely would they be to follow this advice?
    d. How much of an issue would cost be for patients?

22. How does the clinical environment where you practice affect your ability to prescribe gastroprotection?

    Probes:

    a. How does the electronic medical record affect your ability to prescribe gastroprotection?
    b. What about your clinic staff, like MAs?
    c. Any clinical pharmacists you may work with?
    d. Are there any incentives or rewards that affect your prescribing of gastroprotection?

23. What are some of the barriers that you face in prescribing gastroprotection to patients who are at an increased risk for bleeding peptic ulcer disease?

Probes:

a. Appointment duration?
b. Competing demands?
c. Lack of knowledge about gastroprotection guidelines?

24. What types of interventions do you think might be effective to get more patients who are at high-risk for peptic ulcer disease on PPI gastroprotection?

Probes:

a. A best practice advisory?
b. Better screening tools for identifying high risk patients?
c. Better guidelines or recommendations?
d. Institutional guidelines?
e. Clearer delegation of responsibility?
f. A message from a pharmacist?
g. Patient activation interventions that encourage the patient to talk with their physician?
h. What if your Division decided to make this a priority?

25. How would you feel about a clinical pharmacist initiating a PPI in your patients who are at increased risk for peptic ulcer disease?

Probes:

a. Do you think your patients would be receptive to this?

26. How often do you tend to think about stopping antithrombotic drugs, like aspirin or plavix, that may no longer be needed?

Probes:

a. What barriers do you see to stopping patients' potentially unnecessary antithrombotic drugs?

27. Is there anything else we haven't asked about that you'd like to share with us related to this topic?

28. Are there any questions that we may have missed that you think we should be asking physicians?

Thank you very much for taking the time to participate in this interview. We greatly appreciate you making the effort as we know your time is very valuable.

**Supplemental Appendix 2. Detailed Description of Qualitative Analysis and Coding Process**

A multi-step process was followed in order to analyze transcripts and develop findings. First, two interview transcripts were independently pilot coded by four team members. An additional six transcripts were coded by 2 researchers and discussed over the course of meetings to ensure codes were consistently applied, discuss discrepancies, and resolve difficulty in applying codes. The codebook was revised over the course of 8 meetings until a high level of interrater reliability was achieved. Next, the remaining 7 transcripts were independently coded by one researcher and any areas of ambiguity were discussed with a second researcher to reach a final coding decision. While the TDF was used as a coding framework for this study, additional codes were included to ensure all relevant data was coded and reported in the final analysis. Non-TDF domains identified in the codebook included: current practices related to PPI prescribing and high-risk drug de-prescribing, ideas for potential interventions, patient level barriers, and sentinel experiences, including personal experiences or the perceived prevalence of GI bleeding in their patient population.

**Supplemental Tables 1-3. Supporting Quotes for Knowledge, Decision Processes, and Professional Role**

Supplemental Table 1. Supporting Quotes for Knowledge

| **Primary Care** |
|---|
| [PCP 4]<br><br>I: And when you think about risk factors for upper GI bleeding, which are the ones that come to the top of your mind?<br><br>R: I mean, it's usually NSAID use. I would say less so, daily aspirin use. I would say, obviously, H. pylori although, if we know somebody is H. pylori positive, it usually means somebody has already been successfully treated for it. Those would probably be the main ones. Obviously, anything that predisposes to bleeding, so thrombocytopenia, bleeding diathesis, anticoagulants." |
| [PCP 1]<br><br>"I: And how effective do you think PPIs are at preventing ulcers?<br><br>R: Preventing ulcers… I would say they are probably pretty effective I would think, but I honestly don't know the answer to that question." |
| **Cardiology** |
| [Cardiologist 4] "I don't recall ever seeing guidelines. I feel like maybe I would know that there are a proliferation of guidelines. It's entirely possible that it was published, and I might not be aware of that. I don't remember seeing it –nor have I ever heard anybody discuss it as a guideline." |
| [Cardiologist 2]<br><br>I: Okay. And have publications recently on PPI adverse effects had any impact on how you use PPIs?<br><br>R: No. You know, I have sort of seen that stuff tangentially. I think there's the like higher risk of renal failure, I think. But when I looked at it – which I did only in the briefest way – it seemed like it was a little bit shaky and not entirely a settled… subject. |
| [Cardiologist 3] |

| |
|---|
| I: Has the recent number of publications about risks from PPIs changed your practice at all?<br><br>R: I don't know of any publications about risks from PPIs. |
| [Cardiologist 1]<br><br>I: How effective do you believe that PPIs are at preventing ulcers?<br><br>R: Well, that's a good question! I don't know. I think they must be effective, but I don't know that I have ever seen any data showing that in patients, for example, that would be like on dual antiplatelet therapy or triple therapy. I'm actually not sure what the actual rate of ulcer reduction is. That's a good question. |
| **Gastroenterology** |
| [Gastroenterologist 1]<br><br>I: What risk factors do you think of as the main risk factors for peptic ulcer disease?<br><br>…<br><br>R: I would say… NSAIDs. NSAIDs would be number one on my list. And not just NSAIDs, I think the complexity of medications that are prescribed. I'm amazed, even in 2019, that I see patients who are elderly and are on an NSAID, an aspirin, and sometimes an anticoagulant and they are not on GI protectant therapy. But that's a ticking time bomb….So, I think most – except unidentified H. pylori – I think most ulcers could be prevented if proper consideration were given to the risk in some of the medication [regimen]. |
| [Gastroenterologist 3] "I mean in general, whenever I am starting a PPI for a patient for any reason, really, I mean I always tell them if you look up the medicine there is a long list of potential side effects….. I always start off with for me the biggest concern always is bone density issues in women, especially elderly women who have been on it for a long time. So, that's really what I lead with because in my own mind out of all the potential risk factors and side effects, that's actually the one I worry about most with PPI use. Then, I do bring up sort of the more recent bad press about the PPIs in terms of kidney issues and dementia concerns. I will address that because a lot of patients I feel have heard about that." |
| [Gastroenterologist 2] |

| |
|---|
| I: Are there any professional guidelines you look to when you decide somebody needs a PPI for prevention?<br><br>R: Well, the AGA [American Gastroenterological Association] and the American College of Cardiology came out with some joint guidelines and those are a bit dated now, and I think they are in the process of possibly reviewing them. But they do have a fairly simple chart that talks about the person with cardiac disease, the person who doesn't have cardiac disease, and how many risk factors they could have out of the ones I listed, how many risk factors they can have. And you can basically use that treatment algorithm to determine what you use to treat them with, if you are going to use something – obviously something for NSAIDs. So, there is a guideline out there. |
| **Vascular Surgery** |
| [Vascular Surgeon 2] "I know there is, obviously, a higher risk of GI bleed with dual antiplatelet therapy, but I wasn't sure if using a PPI really moved the needle that much on that." |
| [Vascular Surgeon 3]<br><br>I: What risk factors do you think about when you are assessing a patient's risk of bleeding from peptic ulcer disease?<br><br>R: To be honest, probably just if they have a history of previous GI bleeding. It makes us think about risks of aspirin, but some of our patients are on dual antiplatelet therapy and/or anticoagulation and so sometimes, we are negotiating or navigating that set of balanced risk with the patient's primary team. |
| [Vascular Surgeon 3]<br><br>I: From your understanding of professional guidelines which patients would be prescribed PPIs for gastroprotection?<br><br>R: I have no idea what the guidelines are so I couldn't answer that question. |

Supplemental Table 2. Supporting Quotes for Decision Processes

| |
|---|
| **Primary Care** |

| |
|---|
| [PCP 4]<br><br>I: Do you have kind of like an algorithm in your head where you say this person meets my criteria [for PPI gastroprotection] or this person does not?<br><br>R: Obviously, some of it is multiplicity of risk factors, some of it is prior history of problems, some of it is the dose of medications that are involved. And some of it is how I am feeling at the moment based on recent evidence about PPIs and long-term side effects because that's something that has sort of come and gone a little bit. . . So, you know, a lot of it is if I'm feeling pretty good about PPIs as a safe long-term medication, especially in the setting where, hopefully, cost is not a major concern for patients, my gestalt would leave me to prescribe it more often because I wouldn't see so much of a downside balancing out the risk. |
| [PCP 1] "At least I don't think I am preventing ulcers most of the time when I am starting [a PPI]. I might be continuing it because they have a history of ulcers or a history of GI bleeding from ulcers, but I don't usually start it with the thought of preventing ulcers you know. I guess if I am doing it preventively for an NSAID that's sort of what I am thinking but that's not what my brain is saying. Usually when I am thinking about my patient, honestly, I am thinking more about preventing symptoms from taking that chronic NSAID than I am directly thinking about the ulcer or the upper GI bleeding." |
| **Cardiology** |
| [Cardiologist 3] "I don't think that having something in the guidelines per se is going to change practice at our level. At our level, things that change practice are our own anecdotal experiences or if you have some good actual data behind it. And, you know, if [a colleague] comes to me and says I have been doing this for many years, this is what I have seen in practice, I will value that more than a line in a guideline document. It's almost like, you know, so the real world experiences of people and then, or some real data and not just guidelines because more than 50% of the guidelines are just based on expert opinion and I don't even know who that expert is! Especially with my peers, I know who that person is. I know if this person is reasonable or not." |
| [Cardiologist 2] "My impression is that the risk of PPIs is pretty low. So, I would think that, you know, if the potential benefit was even, you know, it wouldn't have to be that high for the net benefit to be positive." |
| [Cardiologist 3] "Bleeding – and this is across the board – bleeding also increases the risk of thrombosis, you know, so we aren't just doing the PPI to prevent bleeding, we are also doing the PPI to keep them on that [anti-thrombotic drug] because, you know, so any bleeding episode, they come off everything. And that increases the risk of thrombosis" |
| [Cardiologist 4] "I do find that understanding which person is going to bleed specifically in the GI tract is not something I felt that I could predict with confidence, except people who have bled in the GI tract before, or have some other known anomaly of gastrointestinal anatomy." |

| **Gastroenterology** |
| --- |
| [Gastroenterologist 2] “I think there is definitely some merit there with these agents in terms of their long-term risks but I take the same stance that I think GI professional societies have recommended, which is if an individual needs to be on a PPI to prevent something bad or to treat something bad, then the benefit outweighs the risk.” |
| [Gastroenterologist 3] “I do sort of counsel patients that, for the most part, I do think they [PPIs] are overall safe, as long as the benefits that we are getting out of the medicine sort of outweighs the risks.” |
| **Vascular Surgery** |
| [Vascular Surgeon 2] “If we don’t have to use it, we should never have triple therapy but there’s extreme risk of every bleeding complication, but GI bleeds for sure. Yeah. The aspirin, Plavix, heparin, and Coumadin is a bad combination, in my opinion.” |
| [Vascular Surgeon 3]<br><br>I: How much is GI bleeding something you fear in your patients?<br><br>R: It is not something I fear with any regularity, it’s usually not on the top list of concerns for side effects or risk of treatment. To be fair, I don’t talk a whole lot about it with my patients either. |

Supplemental Table 3. Supporting Quotes for Professional Role

| **Primary Care** |
| --- |
| [PCP 1]<br><br>I: So, thinking about a patient of yours who is on dual antiplatelet therapy after the cardiologist placed a coronary stent. Which clinician involved in the patient's care do you think should be considering whether the patient would benefit from a PPI or not?<br><br>R: Theoretically, the person who put them on dual antiplatelet therapy. But in reality, me. I probably don't think about that enough. . . Frankly, everything is my job. |
| [PCP 4] "I always think that if there is a medicine that you – if there is a way that you need to mitigate risk for a medication that you are prescribing, it should be the prescribing doctor because how do you even know the patient is going to follow up with the PCP. I mean, on that day that you prescribe it, that's when it should be undertaken, otherwise, it's too big a risk to fall through the cracks. " |
| **Cardiology** |
| [Cardiologist 4]<br><br>I: So, thinking about like if you had a . . . patient on dual antiplatelet therapy. If someone thought that patient was high-risk . . . who should be thinking about whether they need a PPI?<br><br>R: I think that's the responsibility of all the people who see the person. I can't sort of pin it on any one person. |
| [Cardiologist 1]<br><br>I: When you think about the issues that you have to address in a clinic visit, how much of a priority is it to think about whether to prescribe a PPI for gastroprotection?<br><br>R: I mean it's a priority. . . It's part of the whole package, I would say. But it's not like we are using it routinely, necessarily, like preventively unless a patient's on therapy that could cause bleeding. |

| **Gastroenterology** |
| --- |
| [Gastroenterologist 2] “I think the other barrier is just thinking about it. When somebody comes in with fecal incontinence and diarrhea, I am probably missing the fact that they’ve got three risk factors for a peptic ulcer. I see they are on an aspirin, I didn’t even ask them if they are taking Motrin, which they happen to be taking three times a day for their arthritis. So, if it’s not on your mind and it’s not a part of every evaluation, it’s going to get missed for that reason too.” |
| [Gastroenterologist 3] “I can say maybe only a handful of times, maybe, I have ever been sort of referred a patient specifically to have this discussion [about gastroprotection] … they are coming for some other GI symptom or they have had a bleed, which is different than what we are talking about. So, I don’t think GI necessarily will be seeing the majority of these patients.” |
| **Vascular Surgery** |
| [Vascular Surgeon 2] “I think it would kind of be dealer’s choice about who thinks about that [gastroprotection].” |
| [Vascular Surgeon 3]<br><br>I: If you had a patient of yours who you put a peripheral stent in and is on dual antiplatelet therapy, who do you think should be considering the patient’s risk of upper GI bleeding?<br><br>R: Well, it sounds like it should be me. I will say that the dual antiplatelet therapy is usually for six weeks so to be fair, I am not doing it, so I guess in my mind, I am thinking it’s the PCP – but probably it needs to be us as the proceduralist. |
| [Vascular Surgeon 3] “I would say that as a surgeon and a proceduralist, we have competing draws for our time. So, while in practice I can absolutely say I can write a prescription, I feel like it’s going to be one more thing that we have to negotiate with our patients, and we are also trying to get them to buy in to standards of care for cardiovascular disease.” |