Voice of the Patient

A report on the first externally-led Patient Focused Drug Development meeting on Myeloproliferative Neoplasms (MPNs)

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Title of Resource

The Voice of the Patient Report for Myeloproliferative Neoplasms

Authors

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MPN Research Foundation: Michelle Woehrle and Lindsey Whyte led the planning of the externally-led Patient-Focused Drug Development (EL-PFDD) meeting as well as the post-meeting review. Lindsey Whyte led the coordination of analysis of transcripts, compilation, and writing of this report.

Hyman, Phelps & McNamara, P.C.: Larry Bauer, RN, MS and James Valentine, JD, MHS consulted on the EL-PFDD meeting planning, facilitated the live discussion and provided critical feedback on this report.

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This resource document has not been revised and/or modified in any way after November 18, 2021.

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The Voice of the Patient

A report on the externally-led Patient-Focused Drug Development meeting on

Myeloproliferative Neoplasms (MPNs)

Public Meeting: September 16, 2019

Report Date: November 18, 2021

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Introduction

On September 16, 2019, an externally-led Patient-Focused Drug Development (EL-PFDD) meeting was held to better understand the perspectives of patients with myeloproliferative neoplasms (MPNs) including essential thrombocythemia (ET), polycythemia vera (PV) and myelofibrosis (MF) as well as their caregivers. The objective of the meeting was to hear directly from MPN patients about the symptoms and impacts on daily life they experience as well as their thoughts on current and future treatment options. There were 10 patients on panels and an additional 24 individuals identifying as patients in the audience (15 in person and 9 virtual) who contributed to the discussion. Two additional patients were featured in prerecorded videos which were shared during the afternoon panel for a total of 36 patient voices reflected throughout this report.

The EL-PFDD meeting on MPNs was planned in accordance with the guidelines set out by the FDA and this report will be made available to the FDA and to the public via MPNRF's webpage. More information on FDA's PFDD program can be found at www.fda.gov/industry/prescription-drug-user-fee-amendments/externally-led-patient-focused-drug-development-meetings.

About Myeloproliferative Neoplasms

MPNs are a group of chronic, progressive, rare blood cancers that are characterized by an overproduction of platelets, red blood cells, or white blood cells, or increased fibrosis in the bone marrow.[1] This overproduction can lead to blood flow issues and can result in symptoms and problems with clotting, bleeding, organ enlargement, and bone marrow scarring (fibrosis). [1] MPNs are classified as ET (increased platelets), PV (combination of increased red blood cells, white blood cells, and platelets), and primary MF (marrow fibrosis or scarring). ET and PV can evolve into a secondary form of MF (post ET/PV MF) and all three diagnoses can evolve over time in a minority of patients into an acute leukemia.

In the U.S., the prevalence of MPNs is approximately 135,000 individuals with ET, 148,000 with PV and 18,000 with MF (2012). [2]

Treatment of MPNs relies on previously approved therapies that are used off-label for their cytoreductive activities. These include hydroxyurea, anagrelide, and interferon (i.e. Pegasys®). In 2011 ruxolitinib (Jakafi®) was approved by the FDA for myelofibrosis and in 2014, it was approved to treat PV. Fedratinib (Inrebic®) was approved in August 2019 just prior to the EL-PFDD meeting on MPNs.

The predominant feature of ET is thrombocytosis (increased platelet count). A Janus kinase 2 (JAK2) enzyme mutation, JAK2 V617F, is present in approximately 50 -60% of patients living with ET.[3,4] Additionally, calreticulin (CALR) mutation is present in approximately 20 -25% of ET patients.[4] Common symptoms of ET include bleeding and blood clotting issues, bruising, weakness, headaches, sensations such as paresthesias and erythromelalgia with digital ischemia, and thrombotic events (e.g., stroke).[3] Diagnosis of ET is done generally through blood tests, bone marrow biopsy, and/or gene mutation analysis of blood cells. Patients living with ET have a risk of progressing to MF and commonly experience symptoms and impairments to their quality of life. ET can present in young females, creating potential risk and obstacles for bearing children, or after age 50 in both men and women.[3] The median survival rate is near normal (approximately 20 years).[5] While low-risk ET patients are not prescribed treatment

(observation only), some may be prescribed daily aspirin. Other treatment options for patients living with ET and experiencing symptoms include hydroxyurea, anagrelide, and interferon (i.e. Pegasys®).[4]

Elevated red blood cells, white blood cells, and platelets are the hallmark characteristic of PV, and about 10% to 30% of patients can evolve to develop MF and marrow failure, while acute leukemia occurs spontaneously in 1% to 2.5% of PV patients.[3] JAK2 gene mutations are responsible in nearly all cases of PV, while the CALR mutation is absent in PV.[4] While this variant of MPN can sometimes be asymptomatic, the increased blood volume can cause light-headedness, weakness, headaches, visual disturbances, and fatigue. Additionally, patients can experience intense pruritis (itch), an enlarged spleen, bleeding of the gastrointestinal tract, and/or hypermetabolism. Diagnosis for PV is conducted through blood tests, bone marrow biopsy, gene mutation analysis of blood cells, and/or analysis of the levels of erythropoietin. The median survival rate of PV is 14 years and treatment may include phlebotomy, aspirin, hydroxyurea, interferon, and ruxolitinib.[3,4]

MF is a chronic blood cancer that affects the function of the bone marrow through scarring. Common symptoms of MF include anemia, enlarged liver and spleen, general malaise, night sweats, and weight loss. Mutations of the JAK2 gene are present in a high proportion of cases of MF (50-60%), while the CALR mutation is found in 20-25% of MF patients.[3,4] The MPL mutation is found in approximately 5% of patients. Ten to fifteen percent of patients are "triple-negative" for these driver mutations[4]. Diagnosis for MF is usually conducted through blood tests, bone marrow biopsy, gene mutation analysis of blood cells, and/or imaging tests, particularly to determine if the spleen is enlarged. From diagnosis, the overall median survival rate is five to six years from onset in older patients.[3,5], with low-risk patients having a median survival of 11 years, intermediate-risk patients having a median survival of 4-10 years, and high-risk patients having a median survival of two years. Treatment is focused on addressing symptoms and complications including the use of ruxolitinib (Jakafi®) to control symptoms, with stem cell transplantation reserved for advanced stages of the disease. Additionally, in 2019 the FDA approved fedratinib (Inrebic®) to treat patients with myelofibrosis.

Meeting Overview

The EL-PFDD for myeloproliferative neoplasms took place on September 16, 2019 at the College Park Marriott Hotel and Conference Center in Hyattsville, Maryland. The MPN Research Foundation (MPNRF) planned the meeting together with partners Leukemia & Lymphoma Society (LLS), MPN Advocacy & Education International, MPN Education Foundation and MPN Cancer Connection. Invited speakers included Ruben Mesa, MD, FACP and Robyn Scherber, MD, MPH, both of University of Texas Health, San Antonio MD Anderson Cancer Center, and John Mascarenhas, MD of Icahn School of Medicine at Mount Sinai in New York. As Senior Research Analyst, Patient-Focused Drug Development Program and Rare Disease Cures Accelerator, Meghana Chalasani gave brief remarks on behalf of the FDA. James Valentine of Hyman, Phelps & McNamara, P.C. was the discussion moderator and Dudley Digital Works provided audio/visual and live web streaming support. The full meeting agenda is available in the appendices.

Report Overview and Key Themes

Several themes arose during the event which underscore the need to pursue opportunities of engagement between the patient community, biopharmaceutical industry, and regulators.

1. The **uncertainty of disease progression** and how having an MPN will affect their immediate and long-term future is of utmost concern for patients. **Unpredictability of disease and worsening symptoms** instill a fear of progressing to MF or acute myeloid leukemia (AML).
2. Patients described concerns of fatigue, neurological issues such as "brain fog," gastrointestinal issues, and bleeding. The variety of symptoms **illustrate the heterogeneity in clinical experiences within an indication and across the spectrum of MPNs.**
3. **Patients report symptoms which are not well controlled with current therapies.** Overall, uncontrolled symptoms were described as interfering with work life resulting in people having to retire early or take jobs that are less mentally or physically strenuous. The economic impact across the estimated total combined 300,000 MPN patients in the U.S. is not currently known.
4. **Patients find treatment options to be severely limited and those that have shown efficacy can be difficult to tolerate.** There are currently only two approved therapies for MPNs in the U.S. and individuals reported inconsistent responses to the available therapies. Additionally, usage of off-label therapies is common. Patients worry about what will happen if their current therapy stops working for them with such a limited selection.
5. **MPNs are not adequately understood by health care providers.** As a result, many patients experience delays in receiving a proper diagnosis and adequate access to therapies. Patients also report receiving ill-informed guidance from their health care providers and their health problems not being taken seriously. Patients considered low risk based on criteria established by the National Comprehensive Cancer Network (NCCN) are nevertheless at risk of thrombotic events which can be life threatening.
6. **There is a pervasive assumption that MPNs only impact individuals of middle and advanced ages.** However, the ages of the 36 total participants ranged from 39 to 76**.** Participants articulated that the effects of the diseases impact the vitality of people who potentially have decades of productivity ahead of them.

Participant Characteristics

There were 34 patients participating live, including 10 patients on panels and an additional 24 individuals identifying as patients in the audience (15 in-person and 9 virtual) who contributed to the discussion. Web participants shared comments to the live discussion via email. The different types of MPN diagnosis were distributed across the patient panelists with 40% living with PV (4/10), 40% (4/10) living with MF, and 20% (2/10) living with ET. There were three male and seven female panelists and, on average, panelists had been living with an MPN diagnosis for 12 years (SD=10.5). The mean age of the panelists (based on the seven participants who provided their age in their remarks) was 58.3 with a standard deviation of 8.9. The age range was 49 to 76. The two individuals who submitted pre-recorded video remarks were 39 and 48 years old and were unable to participate in the event live due to family and work commitments.

In addition to the 25 people living with MPN who attended the meeting in-person, several family members/caregivers also attended and 240 people living with MPN or their family members/caregivers accessed the live webinar. Live webinar participants were able to contribute their perspectives to the meeting host via email and nine people who identified as patients submitted at least one comment that was shared during the live event. 135 unique participants responded to at least one live polling

question. Sociodemographic and clinical characteristics of live polling participants (in-person and online) are summarized in Table 1.

Table 1. Live Polling Participants Sociodemographic and Clinical Characteristics (Overall N=135)

	# of Responses	Percentage
Patient/Caregiver Status	**45**	
Patient	38	84%
Caregiver	7	16%
Participant Age	**53**	
Under 18 years old	1	2%
18-20 years old	0	-
21-30 years old	1	2%
31-40 years old	2	4%
41-50 years old	2	4%
50-59 years old	13	25%
60-69 years old	22	42%
70-79 years old	12	23%
80 years old and above	0	-
Current Residence	**49**	
U.S. Northeast and New England	24	49%
U.S. Midwest	8	16%
U.S. South (including Texas)	8	16%
U.S. Pacific (including California)	5	10%
U.S. West and Mountain	2	4%
Canada	1	2%
Mexico	1	2%
Disease Originally Diagnosed	**45**	
Polycythemia vera	20	44%
Essential thrombocythemia	17	38%
Myelofibrosis	8	18%
Current Diagnosis	**43**	
Polycythemia vera	17	40%
Myelofibrosis	17	40%
Essential thrombocythemia	9	21%

First diagnosis with MPN	**52**	
Within the last year	8	15%
In the last 1-5 years	11	21%
Between 5-10 years ago	8	15%
Between 10-20 years ago	15	29%
More than 20 years ago	10	19%

Note: Diagnosis of MPN patients may change over time due to progression of the disease and other factors.

Topic 1. Living with MPN

Symptom Experience

Participants shared personal stories about living with MPN. The section below reports an overview of symptoms which are also summarized in Table 2. The subsections detail each group of symptoms (e.g., fatigue-related, organ and clinical, blood-related, etc.). Relevant participant quotations are presented in the subsections.

Overview of Symptoms

During the meeting, invited patient panelists (n=10), as well as in-person audience (n=15 patients) and web participants (n=9 patients), shared diverse perspectives on the symptoms they experience due to MPN. Overall, 51 symptoms were identified throughout the meeting, including several that patients had not formerly attributed to their MPNs. Once in the room with other patients and talking about issues they faced, there was a collective realization that the MPN diagnosis seemed to be the common thread of shared symptoms. Patient panelists frequently discussed lab tests (10/10, 100%), bone marrow biopsy (6/10, 60%), fatigue (8/10, 80%), pain (6/10, 60%), sensation-related symptoms such as pruritis (5/10, 50%), night sweats (6/10, 60%), migraines (4/10, 40%) and neurological issues such as concentration difficulty (7/10, 70%).

Symptoms were grouped into categories: fatigue-related symptoms, organ and clinical symptoms, blood-related symptoms, pain-related symptoms, sensation-related symptoms, gastrointestinal, migraine-related, breathing-related, neurological and other symptoms.

Table 2. Frequency of Symptoms Reported by Patient Panelists

	N=10	Percentage
Fatigue-Related Symptoms		
Fatigue	8	80%
Night sweats	6	60%
Insomnia	1	10%
Organ and Clinical Symptoms		
Laboratory tests	8	80%
Bone marrow biopsy	6	60%
Organ issues	6	60%
Blood-Related Symptoms		
Anemia	4	40%
Stroke/Transient Ischemic Attack (TIA)	2	20%
Blood clotting	3	30%
Bleeding	4	40%
Pain-Related Symptoms		
Bone pain	3	30%
Joint pain	3	30%
Body pain	2	20%
Muscle pain	2	20%
Hand/feet pain	1	10%
Sensation-Related Symptoms		
Itch/Pruritus	5	50%
Tingling	3	30%
Numbness	1	10%
Burning	2	20%
Throbbing	1	10%
Gastrointestinal Symptoms		
Weight loss	2	20%
Diarrhea	1	10%
Nausea	1	10%
Irritable Bowel Syndrome (IBS)	1	10%
Filling up quickly	1	10%

Migraine-Related Symptoms		
Headaches/migraine	4	40%
Migraine without headache	1	10%
Head pain	1	10%
Silent migraine	1	10%
Breathing-Related Symptoms		
Decrease in exercise capacity or endurance	5	50%
Shortness of breath	2	20%
Cough	1	10%
Chest pain while breathing	1	10%
Neurological Symptoms		
Concentration	6	60%
Memory	3	30%
Dizziness	1	10%
Other Symptoms		
Temperature sensitivity	1	10%
General vision issues	2	20%
Early cataracts	1	10%

Fatigue-Related Symptoms

More than three quarters of the patient panelists (8/10, 80%) and six audience participants (25%) reported experiencing fatigue-related symptoms. Fatigue is a feeling of being tired, weak, or exhausted and, in the case of MPN patients, can be due to a number of factors impacting sleep such as insomnia, night sweats, and itching. Fatigue was described as having an impact on quality of life including patients' ability to maintain a robust work schedule and social life and to be active, as described in a later section.

Night sweats were reported by six patient panelists (60%) and three audience participants (13%). Participants described night sweats as impacting sleep and leading to decreased ability to work and otherwise function the following day.

One patient panelist (10%) and three audience participants (13%) reported insomnia. Insomnia was described by the participants as being overly tired yet not able to sleep. One audience member said her "body has forgotten how to sleep." Many reported the fatigue having significant impact on their ability to be active the following day. The patient panelist attributed her insomnia to the night sweats.

Example patient quotations that highlight fatigue-related symptoms:

> ***Susan, PV Patient (female)****: My sleep is horrible. It's like my body has forgotten how to sleep. The fatigue is horrible but I still can't nap. I'll go 48 hours without sleep sometimes. And then I just feel like I'm at death's door.*
>
> ***Bridget B., ET Patient (female, age 49):*** *Fatigue has affected me so much. I'm unable to get to work early as I like, because I'm physically unable to get out of bed without a lot of exertion. I don't do anything social anymore. I used to be in the Army and was very physically fit. I used to be capable of much more...At the same time, I don't look sick, so people don't understand that you look fine but crazy due to symptoms. I was unable to convey this effectively to the doctors for a long time. It wasn't until I was seen by an MPN specialist that I had this symptom acknowledged.*
>
> ***Diane R., PV Patient (female):*** *What's been driving me crazy lately are the night sweats multiple times over and over all night, which of course then blankets on, blankets off, get up, wipe off the sweat, go back to bed. And so that impacts the fatigue that you have the next day. And so, which then impacts my ability to think when I'm at work and my sharpness at work. So I don't know if the night sweat problem was solved, if the other problems would be solved or if they're not even related...*
>
> ***Keisha, MF Patient (female)****: … itching, crazy, keeps me awake at night, just inflamed.*

Organ and Clinical Symptoms

Patient panelists and audience participants described clinical aspects of their condition including abnormal blood counts and enlarged spleen. All 10 patient panelists reported at least one clinical symptom which confirms the typical clinical profile where abnormal blood counts are often the hallmark of MPNs. Five audience participants (21%) also reported clinical symptoms of MPN. Abnormal platelet counts were mentioned by seven panelists (7/10, 70%) and two audience members (8%). The majority of patient panelists (6/10, 60%) reported needing a bone marrow biopsy and a similar number reported experiencing spleen enlargement related to their MPN (6/10, 60%).

Example patient quotations that highlight organ and clinical symptoms:

> ***David K., PV Patient (male, age 54)****: The exam revealed many out-of-range values in both the CBC and blood chemistry, including high hematocrit and platelet counts. Following some diagnostic imaging and then more blood and bone marrow testing through my hematologist, I was diagnosed with JAK2 positive polycythemia vera in June of this year. I started treatment with frequent phlebotomies and hydroxyurea within weeks. Diagnosis for me was actually welcome as it explained the pernicious symptoms that I had been experiencing for some time.*
>
> ***Ned W., MF Patient (male, age 76):*** *Blood tests indicated anemia. As my hemoglobin dropped further, I started to have symptoms of itching, night sweats and early satiety. I was scheduled to see a hematologist in November 2018. Bone marrow biopsy indicated PMF. It also showed several of the associated mutations including the JAK2 V617F mutation.*

Vivienne W., PV Patient (female): *For the last four years, I have been taking Jakafi®. My counts have come down slowly. And as you see me today, my counts are almost all in the normal range. However, even with medication, my spleen is large but does not cause me discomfort.*

Blood-Related Symptoms

Blood-related symptoms were described by eight patient panelists (73%) and five audience participants (17%). Patient panelists shared that they experienced transient ischemic attack/stroke (2/10, 20%) and anemia (4/10, 40%). One patient wrote in to report that she experienced a heart attack at the age of 31.

Blood clotting was a common experience among participants (3/10 patient panelists, 30%; 1/24 audience participant, 4%). Clots impacted pregnancies for one panelist, one panelist had clots in her lungs and a third reported an abdominal clot. Three patient panelists reported bleeding events in the abdomen and GI tracts and an online participant wrote in to report multiple hospitalizations due to colitis with bleeding.

Example patient quotations that highlight blood-related symptoms:

Bridget B., ET Patient (female, age 49)*: I'd come home from work thinking I just had a cold, and I thought that I had a related cough until I started spitting up blood clots. I went to the emergency room, and because they know that I have ET, they did a chest x-ray and CT scan. My platelets were elevated due to a bacterial infection is what I was told. There was nothing that they can do for me. I am currently being seen by an MPN specialist who is taking my symptoms seriously.*

Vivienne W., PV Patient (female)*: My blood counts were very high. Then I switched to hydroxyurea for six years with phlebotomies. I had some relief from the symptoms noted before, but as time went on, I started to bleed in unpredictable ways that really affected my quality of life. I bled into my knees three times, which physicians found difficult to believe was related to my condition.*

Geri T., MF Patient (female)*: ...I was in Chicago about two, three months ago and had a clot then in my lung. Didn't know it until I got back to my scheduled audience with my doctors. And by accident they found it. I had no symptoms. So I have a complication called Leiden factor five which causes clotting also. So not only does the thick blood cause it, but I have that.*

Pain-Related Symptoms

Six patient panelists (60%) and six audience participants (21%) reported pain-related symptoms. Bone pain was the most frequently reported symptom (3/10 patient panelists, 30%; and 6/24 audience participants, 25%). Other pain-related symptoms described by patient panelists included joint pain (3/10, 30%), body pain (2/10, 20%), muscle pain (2/10, 20%), and pain in hands and feet (1/10, 10%). Patient panelists described their pain as interfering with their quality of life and expressed that doctors did not understand the type of pain they experience.

Example patient quotations that highlight pain-related symptoms:

> ***Morgan C., MF Patient (female, age 52)****: My quality of life has changed due to extreme fatigue and bone pain. I'm not nearly as active as I was. The symptoms I most deal with daily are nausea, extreme fatigue, bone pain, temperature sensitivity and large spleen, tingling of hands and feet and headaches.*
>
> ***Ruth R., MF Patient (female)****: And bone pain, I remember talking to my doctor when my children were little, which means it was 25-30 years ago and trying to explain "No, I don't mean arthritis." They're like, "Well, you probably have a little bursitis, or arthritis runs in your family." "No, I'm not talking about my joints, I'm talking about my bones, my bones ache," and no one ever had any explanation for that.*
>
> ***Jean D., PV Patient (female)****: I had absolutely terrible joint and bone pain.... I had an accident. I was put in physical therapy. My neurologist told me there was nothing wrong with me. They sent me to physical therapy. Physical therapy, my joints would burn and hurt and no one would believe me.*

Sensation-Related Symptoms

Six patient panelists (60%) and three audience participants (13%) reported sensation-related symptoms. Specifically, five patient panelists (50%), and two participants (8%) reported pruritus (itch) which was described as “unreal,” “constant,” “life-stopping,” and “making me crazy.” Patient panelists also reported tingling (3/10, 30%), throbbing (1/10, 10%), numbness (1/10, 10%), and burning (2/10, 20%).

Example patient quotations that highlight sensation-related symptoms:

> ***David A., PV Patient (male, age 64)****: Disease progression for me was exemplified a decade after diagnosis by increasing fatigue, muscle pain, lack of concentration, and especially life-stopping pruritis. Don't let anybody tell you that pruritis is only itching and only after a shower. It was nearly body-wide pain worse than any burn I've ever had and punctuated by stabbing horse fly bites for one to three hours, day or night. It was so bad I was unable to fix a glass of ice water, which I thought helped, or say more than three words. Due to fear, I dared not go out in the rain, workout or even sleep under covers.*
>
> ***Bridget B., ET Patient (female, age 49)****: On a daily basis I struggle the most with tingling, and numbness, and burning sensations. To understand what this feels like, imagine minding your own business and suddenly something is creeping up your arm or your leg. Imagine that feeling when at work or in a meeting, or on a date. It's very disconcerting and hard to be out in the world or at work when this is happening. Like I said, it's happening now on a daily basis. I've also had a burning sensation coming down my leg, also happening on a daily basis.*
>
> ***Keisha, MF Patient (female)****: Well, all over. So if anybody else is dealing with that, I'd love to kind of talk with you privately about it, because somebody mentioned it, itching, crazy, keeps me awake at night, just inflamed. And it's one of the things that doctors say, "Oh that's not really a thing. That's not real." And I'm going, "Oh, but it is for me. It's making me crazy."*

Gastrointestinal (GI) Symptoms

GI symptoms were reported by six patient panelists (60%) and two audience participants (8%). Weight loss was reported by three panelists (30%). Diarrhea, nausea, and irritable bowel syndrome (IBS) were reported by panelists and audience participants. Participants described diarrhea as "debilitating" and occurring daily. Another participant shared that nausea occurs daily. Finally, one panelist noted filling up quickly as a symptom.

Example patient quotations that highlight GI symptoms:

> ***Vivienne W., PV Patient (female)****: Well, I had really severe diarrhea, which was debilitating, which I called it Imodium® two, four or six, depending on how bad it was. And it was unpredictable and it was affecting my quality of life because I just didn't know when it was going to hit.*
>
> ***Morgan C., MF Patient (female, age 52)****: The symptoms I most deal with daily are nausea, extreme fatigue, bone pain, temperature sensitivity and large spleen, tingling of hands and feet and headaches.*
>
> ***Julia, MF Patient (female)****: I have had years of GI distress with daily diarrhea and occasional severe pain that caused me to double over in pain on the floor, unable to talk. I was hospitalized twice for colitis with bleeding.*

Migraine-Related Symptoms

Four patient panelists (40%) and three audience participants (13%) reported migraine-related symptoms. Patient panelists described living with headaches/migraines, head pain, migraine without headaches, and silent migraines. Patient panelists specified that headaches were often unable to be treated and "unexplained."

Example patient quotations that highlight migraine-related symptoms:

> ***Jean D., PV Patient (female)****: I ended up taking four Advil three times a day and on top of that, after I had my monthly allotment of Imitrex®, I would take Excedrin Migraine® daily because I could never get my head off the couch.*
>
> ***David K., PV Patient (male, age 54)****: I had tried before to treat migraines, or the migraines with aura, without any success. I was convinced there was nothing that could be done to eliminate their occurrence.*
>
> ***Ruth R., MF Patient (female)****: For as long as I remember I had "unexplained" bone pain, migraine headaches with neurological symptoms, including a probable small TIA from sticky platelets, and irritable bowel syndrome, which mysteriously went away once my blood counts were normalized decades later.*

Breathing-Related Symptoms

Five patient panelists (50%) and two audience participants (8%) shared experiences of breathing-related or endurance symptoms. Five patient panelists (50%) and one audience member (4%) discussed experiencing decreased endurance, and two patient panelists (20%) and one participant (4%) reported shortness of breath. One panelist (10%) reported cough and another panelist (10%) noted experiencing chest pain while breathing.

Example patient quotations that highlight breathing-related symptoms:

> ***David K., PV Patient (male, age 54)****: Without being able to pinpoint the onset, over the last several years I had been struggling with declining physical and mental health. I was very easily fatigued and unable to maintain significant exercise. More recently, I would develop mild chest pains, dizziness and breathlessness following even mild exertion such as mowing the lawn.*
>
> ***Vivienne W., PV Patient (female)****: As time went on, I had difficulty with shortness of breath, altitude and endurance.*
>
> ***Rosemary, PV patient (female):*** *I used to be able to walk 45 minutes to the library and back without any trouble. I can't do that now. I can park halfway, walk there and take our free circulator most of the way home... I can see my energy levels and acuity slowly declining over time.*

Neurological Symptoms

Neurological symptoms were reported by six panelists (60%) and three audience participants (13%). Concentration, often called "brain fog," was cited as problematic for six panelists (60%) and three audience members (13%). Dizziness was reported by one panelist (10%) and one audience member (4%). One panelist described visual disturbances that occurred daily, an audience member reported "blind spots" when looking for something in front of her, and another panelist described episodes of transient global amnesia.

> ***David K., PV Patient (male, age 54)****: It's a major visual disturbance without headache, but the frequency started increasing several years ago. I also had been feeling generally bad over this time, and I attributed it to aging and stress. In the last year, I lost significant weight and developed daily visual disturbances that led me to see my general practitioner for a physical exam.*
>
> ***David A., PV Patient (male, age 64)****: I now have cognitive issues and have had for these decades that have now been diagnosed as transient global amnesia….They occur periodically and having incapacitated me for important work meetings and resulted in my first ever hospital admission. Transient global amnesia is characterized by inability to form new memory...*
>
> ***Susan, PV Patient (female):*** *I can babysit my grandchildren, but then again, I'm afraid of something happening because I'm just not aware of my surroundings... I am not sure what it is, but it's just like a brain fog that is with me all the time. And I just feel like I am going backwards instead of getting better, I just feel like I'm getting worse. And that's one of my biggest problems is the concentrating…*

Other Symptoms

Other symptoms were reported by four patient panelists (40%) and four audience participants (17%) including vision issues (2/10 panelists, 20%; and 4/24 audience participants, 17%), early cataracts (1/10 panelist, 10%), head/lumbar pressure (1/24 audience participant, 4%), temperature sensitivity (1/10 panelist, 10%) and unexplained bruising (1/24 audience participant, 4%).

Example patient quotations that highlight other symptoms:

> ***Sondra R., Unspecified MPN Patient (female):*** *Currently, my biggest complaint is my vision problems. Since about two years ago I started having fuzzy vision, went to my doctor. I have cataracts now and also have macular degeneration. I had no problem with my eyesight at all.*
>
> ***Morgan C., MF Patient (female, age 52)****: Simple things like washing dishes or filling a cooler with ice are now near impossible due to my sensitivity to temperature.*
>
> ***Linda, ET Patient (female)****: My most severe symptom is not being able to stand or sit up straight after a few minutes from head pressure and lumbar pressure as well as vision issues.*

One panelist (10%) and one audience participant (4%) reported infection-related symptoms and fever. The panelist indicated experiencing elevated platelets due to infection while the audience participant reported fevers on a daily basis.

Disease Impacts

Participants shared personal stories about living with MPN and the effect that living with the disease and its symptoms has had on them. The section below reports an overview of the impacts MPN has had on their lives which are also summarized in Table 3. The following subsections detail each group of impacts (e.g., emotional/psychological, activities of daily living, cognitive, etc.). Participant quotations are also presented.

Overview of Impacts

Overall, during the in-person discussion, the most commonly mentioned impacts on daily life (mentioned by five or more of the 34 live participants) were categorized as emotional/psychological impacts [worry about disease progress (10/34, 29%); general worry about the disease (6/34, 18%); fear of the future/unknown (7/34, 21%)]; cognitive impacts [difficulty concentrating or brain fog (10/34, 29%); memory problems (4/34, 12%)]; impacts on activities of daily living [physical activity and exercise (10/34, 29%); work-related tasks (6/34, 18%); ability to perform household activities (6/34, 18%)] and financial burden (6/34, 18%). Additionally, participants identified unmet treatment needs and barriers with limited knowledge on the disease condition being the most commonly reported unmet treatment need (7/34, 21%). Table 3 provides a detailed summary of the impacts reported by patient panelists during the meeting discussions.

Audience responses to the live polling questions (Tables 4 through 6) provided additional information about the patient perspectives on the overall impacts of living with MPN. The following sections summarize participants' perspectives and experiences about the impacts that MPN has had on their daily lives.

Table 3. Frequency of Impacts Reported by Patient Panelists

	N=10	Percentage
Emotional/Psychological		
Worrying about disease progression	7	70%
General worry about the disease	5	50%
Fear of the future/unknown	6	60%
Lack of positive outlook	3	30%
Self-confidence and self-esteem	2	20%
Feeling anxious	2	20%
Feeling depressed	2	20%
Feeling frustrated	3	30%
Declining mental health	1	10%
Activities of Daily Living		
Physical activity and exercise	9	90%
Work-related tasks	6	60%
Household-related tasks	3	30%
Social activities and hobbies	2	20%
Self-care	1	10%
Cognitive		
Difficulty concentrating or focusing	7	70%
Memory problems	3	30%
Symptom-Related		
Anemic	2	20%
Pain related to surgery	1	10%
GI (diarrhea, nausea and IBS)	3	30%
Thrombosis	2	20%
Financial Burden		
Medical insurance coverage	2	20%
Treatment costs	3	30%
Family Relationships	4	40%
Quality of Life	4	40%
Sleep Impacts	3	30%

Unmet Treatment Needs and Barriers		
Limited disease knowledge of physicians	4	40%
Ability to have children	1	10%

Emotional/Psychological Impacts

Overall, 29% of participants (10/34) indicated that they worried about disease progression, 18% of participants (6/34) indicated that living with MPN causes general worry, and 21% (7/34) were fearful or frightened about living with MPN. The majority of patient panelists (7/10, 70%) indicated that they worried about the impacts of living with a progressive disease, while 50% (5/10) expressed general worry about living with MPN and 60% (6/10) were fearful or frightened about living with MPN.

Example patient quotations that highlight the worry and fear about living with MPN:

> ***Diane R., PV Patient (female):*** *Living as a person with an MPN means worrying about other health conditions developing and then being unable to possibly have a stem cell transplant in the future. This is very real and always in the back of your mind. I'm very worried about having another TIA or stroke. To quote my neurologist, "It's not if but when."*
>
> ***Ruth R., MF Patient (female)****: The one thing that I would add is for me, all the personal stuff you heard, which is hard to talk about, but physically, I think that for me the biggest fear is the unknown. That we all experience the unknown. When will the next episode or crisis come along?*
>
> ***Vicki B., ET Patient (female):*** *I later learned was with my falling platelet counts, a sign that my ET is likely transforming into MF, which frightens me greatly.*
>
> ***Rosemary, PV Patient (female):*** *Well, my worries are, because I'm just at the beginning stage, progression and longevity. I always thought I'd live to be 100 because there are long, aged genes on one or both sides of my family... And I think the biggest worry is having a heart attack or stroke and surviving it, and then how am I going to care for myself?*

Example patient quotations highlighting the less frequently reported emotional and psychological impacts of living with MPN:

> ***David K., PV Patient (male, age 54)****: My mental and physical challenges contributed to having an unsuccessful experience in my last role, which I left last summer. Since then, I struggled to gain focus and energy towards a new professional role as a symptom burden has eroded my confidence that I could regain the trajectory that I was on. I never imagined that I would be away from work for a full year.*

Morgan C., MF Patient (female, age 52)*: Every morning when I wake up, I hope it's going to be a great day, but it's extremely frustrating to have no control over your physical state. I always do try to have a positive outlook and put on a smile though. Having an MPN affects every area of your life and those close to you. People don't know how to react to you having a cancer that is chronic and that can't be seen. Because the symptoms can't be seen, you often encounter ignorance and find yourself having to explain what it is you have exactly. For example, after I was diagnosed a now-former boss asked me, did I really have to go to the doctor as often as I was going. It's just a blood thing. Are these symptoms even real?*

Cognitive Impacts

Overall, several participants expressed that living with MPN has impacted their cognitive function, with 29% (10/34) indicating that the disease impacted their ability to focus and/or that they experienced "brain fog." Several participants also indicated that they experienced memory problems (4/34, 12%). The majority of patient panelists described how MPN impacted their ability to concentrate or think clearly (7/10, 70%), while several patient panelists highlighted difficulties with brain fog (3/10, 30%) and with their memory (3/10, 30%).

Example patient quotations that highlight the cognitive impacts of living with MPN:

David K., PV Patient (male, age 54)*: The neurological impacts for me were even more difficult. I had short term memory lapses and difficulty maintaining concentration. I frequently lost my train of thought. I felt very dull and depressed mentally. My visual disturbances had always created anxiety for me as they would occur during important business meetings and presentations and even sometimes while driving. I always tried to work through the usual 30 minutes duration to avoid looking weak in the workplace. With an increase in frequency though, these episodes had a major impact on my quality of life.*

David A., PV Patient (male, age 64)*: At that time, my cognition was severely affected. I couldn't readily use a map. I'd find the milk in the cupboard, cereal in the fridge, and I'd lose my keys only to find them in my left hand. My day job did not go well.*

Bridget B., ET Patient (female, age 49)*: For the problem of focusing, it's as if I have a haze of some sort preventing me from focusing and concentrating. Almost like I'm intoxicated. Because of this, it's taking me longer to complete tasks at work, which is difficult as I have many responsibilities as a manager.*

Activities of Daily Living

Several participants expressed that living with MPN has impacted their ability to engage in physical activity, with particular concerns around inactivity and the inability to engage in physical exercise (12/34, 35%), work-related activities (8/34, 24%), and completing household chores (6/34, 18%). Nearly all patient panelists expressed a concern about the limitations to their ability to engage in physical exercise (9/10, 90%), and the majority of patient panelists indicated that living with MPN impacted their ability to perform work-related tasks (6/10, 60%). Patient panelists also shared that MPN limited their

ability to complete household chores (3/10, 30%) and participate in social activities (2/10, 20%). One patient panelist shared that MPN impacted the self-care task of bathing.

Example patient quotations that highlight the impacts of living with MPN on daily activities:

> ***David K., PV Patient (male, age 54)****: …over the last several years I had been struggling with declining physical and mental health. I was very easily fatigued and unable to maintain significant exercise. More recently, I would develop mild chest pains, dizziness and breathlessness following even mild exertion such as mowing the lawn.*
>
> ***Bridget B., ET Patient (female, age 49)****: It has been a dream of mine to go back to school to complete my Master's degree. I'm afraid to even start because I would have to drop classes due to my focusing and concentration.*
>
> ***Susan, PV Patient (female)****: One of the biggest things that has changed in my life is I've had to give things up….I had to quit cooking because I made so many mistakes in putting meals together. I have visual problems. I really cut down on my driving. I'll walk into a room looking for something and it can be right in front of me and I can't see it. It's like a blind spot.*

Symptom-Related Impacts

Several participants shared that their physical symptoms impact their daily life, with vision problems being frequently reported (6/34, 18%). As a result of her prescribed MPN therapy, one panelist incurs frequent skin cancer, the treatment of which causes pain and impacts her quality of life. Two panelists (2/10, 20%) mentioned that living with anemia impacts their lives and two additional panelists consider the risk of thrombosis to be impactful. General intestinal problems are also a common issue that impacts the daily lives of MPN patients with panelists and audience participants mentioning diarrhea, nausea and irritable bowel syndrome (2/34, 17% for each of the GI symptoms mentioned).

Example patient quotations highlighting the symptom impacts of living with MPN:

> ***Morgan C., MF Patient (female, age 52)****: Since diagnosis, my symptoms have unfortunately worsened. I've experienced spleen issues and thrombosis. My most recent TIA, or mini-stroke, occurred just a few weeks ago as I was preparing to participate in this meeting. After my doctor cleared me to fly, I felt I had to be here to share my story and to help show the importance of finding a cure.*
>
> ***Bridget B., ET Patient (female, age 49)****: I was always anemic and had been on and off iron pills, and even iron transfusions. To describe how I experienced anemic, imagine you wake up and you have legs made out of elastic. You have to peel yourself out of bed because you feel so low. In 2017, I had an iron transfusion, and currently, my anemia appears under control, but I don't know what the future holds given I have ET.*
>
> ***Sondra R., Unspecified Patient (female):*** *Currently, my biggest complaint is my vision problems. Since about two years ago I started having fuzzy vision, went to my doctor. I have cataracts now and also have macular degeneration. I had no problem with my eyesight at all. I'm on hydroxyurea, have been on it for 10 years. I do believe that... contributed to my problem with my vision.*

Vivienne W., PV Patient (female): *I have attacks of severe diarrhea on an occasional basis. Those would be my worst days. These attacks cannot be predicted and occur when my counts are elevated. I also fear the pain associated with surgeries that have been required for skin cancer. I have had over 40 skin cancers. My first skin procedure was in 2016, a year after I started Jakafi® and it has been suggested that the medicine was a contributing factor. Some of the lesions have been frozen off, but many are basal and squamous cell cancers, which require Mohs surgery, which is a special kind of skin surgery that takes off layers of skin.*

Financial Burden

Several participants shared that living with MPN has resulted in financial burden, with 21% of participants (7/34), overall, indicating that treatment costs and insurance coverage impacts their lives. Forty percent (4/10) of the patient panelists indicated that treatment costs impact their financial security and that they worry about treatment costs and insurance coverage.

Example patient quotations highlighting the financial impacts of living with MPN:

Morgan C., MF Patient (female, age 52)*: I know this meeting isn't about reimbursement issues, but even with insurance coverage, I have racked up almost $20,000 out-of-pocket due to treatments, testing, and doctor appointments since December 2018. I've used up almost all my vacation time from work for appointments.*

David K., PV Patient (male, age 54)*: I've had good health insurance on COBRA, so I have not had any major financial disaster personally, but my COBRA will be expiring at the end of the year. So, my wife and I are concerned about the next step and whether the Affordable Care Act will be around, et cetera to provide us with an option if I'm not employed at that time. I have not considered unemployment or disability claims.*

Vivienne W., PV Patient (female): *The cost of my medication causes me great worry. If I were to lose my coverage for treatment, I wouldn't be able to afford to make up the difference. I faced substantial co-pays and the donut hole and worry that I will not be able to access this lifesaving medicine. I also fear that one day my medication will quit working for me or my bone marrow will stop producing the cells necessary to live, that I will get a more aggressive cancer or an infection that can't be treated, or that I will outlive my money because of huge medical bills.*

Rosemary, PV Patient (female)*: Cost is an issue. I'm on limited income and not a lot of savings. I live alone, so that's an issue. And I think the biggest worry is having a heart attack or stroke and surviving it, and then how am I going to care for myself? I don't have long-term care. I don't have someone around me who can care for me.*

Barriers to Appropriate Treatment

In addition to participants describing a range of impacts of living with MPN, several participants discussed barriers to treatment and care needs that have impacted their lives, including experience with a health care provider's limited knowledge of the disease (6/34, 18%). For example, a few patient panelists (3/10, 30%) highlighted that their doctors were not knowledgeable about the disease which led to delays in diagnosis or misdiagnosis and frustration. One panelist and one pre-recorded patient

cited difficulties having children and one specifically highlighted the lack of awareness of their care provider of appropriate therapeutic interventions for a woman in that situation.

Example patient quotations highlighting barriers to appropriate treatment:

> ***David A., PV Patient (male, age 64)****: My doctor dismissed my concerns, but I knew something was wrong. I sought attention where I could find it. A year before my diagnosis, an NIH tongue researcher insisted that I was iron deficient. She said she could see it from the tongue, but when I iron supplemented with my doctor's permission, my hematocrit rose to 63% in only several months.*
>
> ***Karrie S., PV Patient (female, age 48)****: Soon after I gave birth to my son, my condition progressed from ET, or essential thrombocytosis, to PV (polycythemia vera). With PV, all of my blood counts were elevated, my white counts, my red cell counts, and my platelet counts. My husband and I wanted that second child, but unfortunately, I suffered two miscarriages and my blood counts were skyrocketing. Also, during this time I received more bad advice from a hematologist at one of the Midwest's top hospitals than you might expect, who told me that I could take hydroxyurea to control my counts during pregnancy.*
>
> ***Patty-Jo, PV Patient (female)****: …I wear a bracelet to let everybody know I have issue and medication I'm on. A year ago February, I was taken to the hospital. They put me on three types of medication that sent all my white count sky high, red count sky high, platelets sky high. Worst medication I could have been put on, they put me on it.*
>
> ***Jean D., PV Patient (female)****: …When I was diagnosed in 2009 with PV it was very difficult to find a doctor that understood what I had dealt with for many, many years. I fought for that for approximately four years and that's when I found out that the MPN Research Foundation was there to have a symposium and that when I got to the symposium, Dr. Mesa had a chart, 24 symptoms of a MPN. I had 19. So I think to me it's been very challenging the awareness, not with the MPN specialist world, but all the other hematologists and oncologists because they just don't get it.*
>
> ***Rosemary, PV Patient (female)****: I'm being checked by a hematologist every three months. But initially, my internist ignored my platelet count, which was in the high six hundreds.*

Live Polling Responses on MPN Impacts

A total of 135 in-person and web participants responded to at least one live polling question. More than half of the audience participants responded to the question regarding the overall impacts of MPN on their lives (90/135, 67%) (Table 4). Of those who responded to this question, nearly half (41/90, 46%) indicated that living with MPN has moderately impacted their life overall. Significantly, 38% (34/90) reported that MPN has a severe impact on their lives. Forty-three percent of the audience members (58/135) responded to the question: *"The biggest physical struggle I face attributable to my MPN is:"* (Table 5), with almost half of the respondents (26/58, 45%) indicating that severe symptom burden is the biggest struggle that they face. Only 12% of responders (7/58) indicated that they do not face any struggles. Audience participants were also asked if they had to reduce, stop work, or retire early due to their MPN (Table 6). Forty-one percent of audience members responded to this question (56/135). Of

the respondents, 36% (20/56) indicated that they continue to work while living with MPN while 18% (10/56) indicated that they had to stop working due to their MPN and 13% (7/56) indicated that they retired early.

Table 4. Live Polling: Overall Impact of MPN on Life

	N=90	Percentage
None	1	1%
Mild	14	16%
Moderate	41	46%
Severe	34	38%

Table 5. Live Polling: Biggest Physical Struggle Related to MPN

	N=58	Percentage
Severe symptom burden	26	45%
I do not face any struggles	7	12%
Anemia	5	9%
Recurring bleeding/clotting including thrombotic events	5	9%
Skin lesions	5	9%
Other	5	9%
Transfusion dependence	3	5%
Spleen size	2	3%

Table 6. Live Polling: Impact of MPN on Work

	N=56	Percentage
I continue working at the same pace	20	36%
I have stopped working altogether	10	18%
I wasn't working before my diagnosis	9	16%
I retired early	7	13%
I retired as scheduled	5	9%
I cut back to part-time	5	9%
I am on a temporary work leave of absence	0	-

Topic 2: Current and Future Treatments

Overview of Current Treatments

During the EL-PFDD meeting, panelists and audience members were asked about their experiences with various drugs, phlebotomies, transfusions, and mind-body wellness therapy used to treat their MPN. Table 7 summarizes the treatments used by the patient panelists. In addition to the patient panel and audience discussion, seven live polling questions were posed to in-person and web-based participants that explored the current MPN treatment experiences (as shown in Tables 8 through 11).

Panel and Audience Perspectives on Current Treatments

Overall, the meeting participants reported utilizing a variety of treatments for MPN and their symptoms (e.g., anemia, pain, and itch). They frequently reported using blood cell-reducing medications, including the chemotherapy drugs hydroxyurea (Hydrea®) (9/34, 26%) and anagrelide (Agrylin®) (2/34, 6%), as well as therapeutic phlebotomy (7/34, 21%), low-dose aspirin (8/34, 24%), supportive care options like pegylated interferon alfa-2a (4/34, 12%) and blood transfusion (3/34, 9%), and newer treatments like ruxolitinib (Jakafi®) (9/34, 26%). Two meeting participants (6%) indicated that they use CBD/marijuana to treat their pain. Only one meeting participant indicated that they received a stem cell transplant (haploidentical transplant). The patient panelists described a range of current and former MPN treatments (Table 7), with the most common current treatments being low dose aspirin (3/10, 30%), hydroxyurea (3/10, 30%) and phlebotomy (5/10, 50%). None of the panelists reported currently using pegylated interferon alfa-2a but both of the pre-recorded patients were currently taking it and had done so for many years. One MF patient panelist was currently participating in a clinical trial and a PV patient panelist shared that she engages in healthy lifestyle activities to support her condition, including yoga, mindfulness, diet, and exercise.

Table 7. Treatments Used by Patient Panelists Currently and in the Past

	CURRENT		PREVIOUS	
	N=10[a]	Percentage	N=10[a]	Percentage
Low dose aspirin	3	30%	2	20%
Chemotherapy: hydroxyurea (Hydrea®)	3	30%	2	20%
Phlebotomy	5	50%	2	20%
Ruxolitinib (Jafaki®)	2	20%	2	20%
Pegylated interferon alfa-2a (Pegasys®)	0	0%	2	20%
Blood transfusion	2	20%	0	0%
Chemotherapy: anagrelide (Agrylin®)	1	10%	0	0%
Fedratinib (Inrebic®)	1	10%	0	0%
Clinical trial investigational therapy	1	10%	1	10%
Other: mind/body wellness (diet; exercise)	1	10%	0	0%

[a] not mutually exclusive, patients could report multiple treatments

Meeting participants also shared their perspectives on treatment benefits and side effects. Overall, improved blood count was the most frequently reported treatment benefit (8/34, 24%), with 70% of patient panelists (7/10) describing this treatment benefit. Patient panelists described several other treatment benefits, including improved symptoms overall (4/10, 40%), improved spleen (4/10, 40%), reduction in treatment (3/10, 30%), improved quality of life (2/10, 20%), improved mental clarity (2/10, 20%), increased energy (2/10, 18%), and increased participation in activities of daily living (ADLs) (2/10, 20%). One patient panelist indicated that treatment reduced their pain and another patient panelist indicated that treatment improved their visual disturbances.

Example patient quotations that highlight MPN treatment benefits are as follows:

> ***David K., PV Patient (male, age 54)****: My treatments have been reducing my blood counts, and I'm still in the process of fine-tuning and developing my equilibrium with the medication. Since the beginning of treatment, I have felt a great reduction in the most significant symptoms. I experience much less visual disturbances, which is a tremendous improvement to my quality of life. I still have limited capacity for exertion though as I become dizzy and winded easily, but I do feel my mental clarity is improving. That's really important.*
>
> ***Vivienne W., PV Patient (female)****: For the last four years, I have been taking Jakafi®. My counts have come down slowly. And as you see me today, my counts are almost all in the normal range. However, even with medication, my spleen is large but does not cause me discomfort. In the last year, I have reduced the frequency of phlebotomies to every eight to ten weeks.*
>
> ***Ruth R., MF Patient (female): ...****I've really never thought about am I fortunate enough to not have an enlarged spleen and some of the other things that are, you know, are constitutional symptoms because the hydroxyurea is working.*
>
> ***Karrie S., PV Patient (female, age 48)****: It's 10 years that I've been... on pegylated interferon and it has worked amazingly well for me and allowed me to live a more or less normal life. I've experienced very few side effects from Pegasys®, some aches, dehydration, but all of those are manageable and certainly well worth it. I've had an excellent quality of life with no discernible progression of my disease. Unlike many PV patients, I've experienced no spleen enlargement, no thrombotic events, no progression to leukemia, and no progression to myelofibrosis, like many PV patients experience. Pegasys® has also allowed me to avoid phlebotomies almost entirely and it's been some years since that has been required for me. Also, my blood counts are basically normalized.*

While patients highlighted several benefits of their current treatment, undesired treatment effects were also mentioned. One patient indicated that they had experienced increased fatigue while another indicated that their treatment had increased their risk for infections.

Example patient quotations that highlight undesirable MPN treatment effects are as follows:

> ***Vivienne W., PV Patient (female)****: I can't run or play tennis as endurance has become a problem. Phlebotomy caused me to lose a couple of days as my fatigue level is elevated.*

***David A., PV Patient (male, age 64)**: I was on Jakafi® from 2016 to 2019 when incidental to another study at NIH I was diagnosed with cryptococcus neoformans, a dangerous fungal infection that can be life-threatening as those professionals who are familiar with treating HIV patients know. I don't have HIV. This required stopping the drug due to its immune-suppressing effects. An ideal treatment for me as you've gathered would be to do for me what Jakafi® did for me without causing high-risk infections.*

Live Polling Responses on Current Treatments

Of the 135 in-person and web-based participants who responded to at least one live polling question, 57 participants reported treatments that they are currently receiving (Table 8) and 55 participants reported the current drugs that they are using to treat their MPN (Table 9). Similar to the results from the panel discussion, minimal to no treatment (e.g., low-dose aspirin), cell-reducing drug treatments (e.g., hydroxyurea), supportive care (e.g., pegylated interferon alfa-2a), new treatments (e.g., ruxolitinib), and phlebotomy were the most frequently reported current MPN treatments.

While live-polling participants reported the use of several treatments, nearly all respondents indicated that their fatigue was not well controlled by their current treatment (52/57, 91%), and over half of the live-polling responders indicated that the numbness/tingling/burning sensation in their hands, feet, or limbs, as well as night sweats and/or insomnia, were poorly controlled (30/57, 53%) with their current treatment (Table 10).

Finally, when asked about their confidence in the availability of additional therapies, 40% of the live polling responders indicated that they did not have confidence in the availability of additional drug treatments (Table 11).

Table 8. Live Polling: Treatments Currently Receiving

	N= 57[a]	Percentage
Drug to treat my MPN (such as a JAK2 inhibitor, platelet reducing drug, chemotherapy agent, interferon, etc.)	41	72%
Phlebotomy	25	44%
Drug to treat specific symptoms (such as anti-histamine, anti-inflammatory, pain medication, etc.)	24	42%
Strict diet and/or exercise (including yoga, meditation, etc.)	16	28%
Homeopathic remedy (including CBD, medical mushrooms, vitamins, etc.)	12	21%
Transfusion	2	4%
Recent or planned splenectomy	1	2%
Other	4	7%

Note. Percent calculations are based on the total number of participants who responded to the question (n=57).

Abbreviations: CBD = cannabidiol; JAK2 = janus kinase 2

[a] not mutually exclusive, patients could report multiple treatments

Table 9. Live Polling: Current Drugs Using to Treat MPN

	N=55[a]	Percentage
Anticoagulants (e.g., aspirin and warfarin)	43	78%
Chemotherapy (e.g., hydroxyurea and busulfan)	15	27%
JAK Inhibitor (e.g., ruxolitinib [Jakafi®], fedratinib [Inrebic®], and other)	14	25%
Interferon (including interferon alfa, peginterferon alfa-2a [Pegasys®], and other)	6	11%
Platelet reducing (e.g., anagrelide)	4	7%
Anemia improvement (e.g., erythropoietin and darbepoetin)	0	0%
Other	10	18%

Note. Percent calculations are based on the total number of participants who responded to the question (n=55).
Abbreviation: JAK = janus kinase
[a] not mutually exclusive, patients could report multiple treatments

Table 10. Live Polling: MPN Symptoms Not Adequately Controlled Despite Current Therapy

	N=57 [a]	Percentage
Fatigue	52	91%
Numbness/tingling/burning sensation in hands, feet, or limbs	30	53%
Night sweats or insomnia	30	53%
Bone pain	24	42%
Headache/migraine	23	40%
Vision problems; visual disturbances	21	37%
Progression to MF, AML, or other diagnoses	19	33%
Itching	18	32%
Sexual difficulties	17	30%
Satiety (early feeling of being full)	11	19%
Other	18	32%

Note. Percent calculations are based on the total number of participants who responded to the question (n=57).
[a] not mutually exclusive, patients could report multiple symptoms

Table 11. Live Polling: Confidence in Availability of Other Therapies

	N=55	Percentage
No	22	40%
Not sure	15	27%
Yes	14	25%
Not applicable (not currently on a drug regimen)	4	7%

Note. Percent calculations are based on the total number of participants who responded to the question (n=55).

Patient Perspectives on Future Treatments for MPNs

Panel and Audience Perspectives on Future Treatments

During the EL-PFDD meeting, participants expressed their perspectives on the development of new treatments, specifically their experience and perceptions of participating in clinical trials for MPN drug development. Several meeting participants shared their thoughts during open discussion about participating in a clinical trial (11/34, 32%), and 30% of patient panelists (3/10) and both prerecorded patients discussed participation in clinical trials. Five meeting participants expressed their concerns about receiving the placebo instead of the treatment and ensuring that the placebo group has the option to have the treatment (15%), and one participant indicated that they would participate in a clinical trial if they had no other treatment option available to them. Additionally, a few patient panelists (3/10, 30%) discussed that it is important for drug treatments to improve the quality of life of people living with MPN and that the ideal treatment would address the underlying cause of MPN, not just the symptoms. Finally, two patients shared that the goal of drug treatments should be to reduce the MPN symptom burden without causing additional side effects.

Example patient quotations that highlight perspectives on participating in a clinical trial are as follows:

> ***Nancy D., MF Patient (female, age 52)****: …the first clinical trial I was on, I was on the placebo arm of the fedratinib trial, and I wouldn't wish that on anybody. My life was miserable...I personally don't think once you're being treated for this, you should not go off treatment. That's kind of my lesson on that one. I lost a lot of weight. I mean, actually it was very evident from many people. "What's, what's up with you, what you were looking so good two weeks ago and now or two months ago and now look at you." So I'm glad I stuck it out because it turns out it's the drug that is currently helping me and my spleen. But anyway, I just want to advocate that I don't think placebo arms of a trial are a very good idea.*

> ***Ned W., MF Patient (male, age 76)****: In order to participate in this trial, I make two- to three-day trips to UCLA every three weeks for tests and to get the next two weeks supply of the test drug. Many of these visits are rather routine. I have asked if they could be performed locally and the study drug sent to me, but according to the PI, the FDA rules prohibit that. I'm not sure if it's the FDA or the PI... That is something that I would like to see changed, especially for rare diseases where it's difficult to recruit patients into a study on a timely basis. If the number of travel visits were reduced, perhaps more patients would apply and the studies could be conducted much more rapidly.*

David A., PV Patient (male, age 64)*: I would consider a clinical trial directed at mitigating intractable quality of life problems or extending life, but you will understand that I want to be confident not only that the benefit is real, but also that the ongoing risks are properly assessed. Accordingly, I would be willing to sign up, even travel to a study, as long as it included a placebo arm, and the promoter and FDA committed to conducting and reporting controlled post phase 3 studies. I feel, I and patients, generally are owed that.*

Example patient quotations that highlight thoughts about drug treatments and preserving quality of life are as follows:

Vicki B., ET Patient (female)*: I would be concerned whether the long-term benefits, which we don't know because we haven't taken the drug, would offset the say possible messing up of quality of life, current. So, the idea is we want to beat the disease but we also don't want to have a poor quality of life. So, I guess that would be the balance, the question…I mean I think the ability to work and function socially. Mood, does it have depressive side effects, does it sap people have energy, does it make one nauseated?*

Karrie S., PV Patient (female, age 48)*: Despite this, living with an MPN is living with a blood cancer and there are difficulties. My thought is that now is the time to expand available treatments and access to drugs to improve patient quality of life and longevity, and one of the best ways to do this would be to encourage the development of generic biologic drugs and to bring those to market. Embracing the new longer-lasting version of pegylated interferon that has been approved in Europe would also be a fantastic improvement for patients with PV like me because it would allow shots once every two weeks instead of weekly. If future clinical trials were available for such medications, I would be interested in participating in a clinical trial. My only requirement that I would have is that some form of interferon be available to every patient in the trial.*

Example patient quotations that highlight thoughts about reducing the side effects of drug treatments while reducing MPN symptoms are as follows:

Diane R., PV Patient (female): *In my view, there's simply no good choices when it comes to medication. I feel like I'm faced with choosing the lesser of two or three evils. I'd say my biggest wish other than a cure is that the treatment I ultimately end up with to manage my disease also reduces the symptom burden without the risk of additional side effects.*

David A., PV Patient (male, age 64): *With regards to side effects, I would be concerned more about long term side effects. I would not want to put myself in long term danger of maybe having another cancer as a result of having a trial for the PV. That's what would be important to me.*

Live Polling Responses on Future Treatments

Of the 135 in-person and web-based participants who responded to at least one live polling question, 57 participants shared their experience, if any, with being involved in a clinical trial (Table 12), 57 participants indicated the five factors that are important to deciding to participate in a clinical trial (Table 13), and 56 participants reported what side effects would be tolerable in a treatment that prevented disease progression for five years (Table 14). The majority of live-polling participants indicated that they have not participated in a clinical trial (42/57, 74%), while 9% of the participants are currently participating in a clinical trial, and 11% have participated in a clinical trial (Table 12).

When live-polling participants were asked the top five reasons for choosing to participate in a clinical trial, the majority of participants indicated the potential drug side effects of the new drug (52/57, 91%), whether they would potentially receive a placebo treatment (46/57, 81%), if previous clinical trials showed that the drug was effective in treating symptoms that were meaningful to the participant (38/57, 67%), and the travel distance to the trial site (32/57, 56%) (Table 13). Finally, the majority of live-polling participants reported that they would tolerate mild, chronic side effects for a treatment that prevented disease progression (45/56, 80%), while only 7% indicated that living with a treatment side effect was not worth the outcome (4/56) (Table 14).

Table 12. Live Polling: Experiences and Perceptions of Clinical Trials for MPN Drugs

	N=57	Percentage
I have not participated in a trial, because I didn't know about the opportunity	25	44%
I have not participated in a trial because I was not eligible	10	18%
I have not participated in a trial, although I was aware of the opportunity and eligible	7	12%
I am currently participating in a trial	5	9%
I have participated in a trial and I would do so again	4	7%
I have participated in a trial and I would not do so again	2	3%
Not sure	4	7%
I would never enroll in a clinical trial	0	-

Note. Percent calculations are based on the total number of participants who responded to the question (n=57).

Table 13. Live Polling: Five Factors Most Important in Choosing to Participate in a Clinical Trial

	N=57	Percentage
Potential side effects from a new drug	52	91%
Whether I might get a placebo (sugar pill)	46	81%
In earlier trials, was study drug effective for specific benefits most meaningful to me	38	67%
Distance to trial site	32	56%
Whether I need to stop my current treatment	25	44%
Length of trial	14	25%
Frequency of exams appointments	13	23%
Knowing if I can commit to participating in a clinical trial	13	23%
How the drug is taken (by mouth, IV, injection in muscle)	10	18%
Whether a biopsy is required	8	14%
Other	7	12%
Negative things I have heard about clinical trials	2	4%

Note. Percent calculations are based on the total number of participants who responded to the question (n=57).

Table 14. Live Polling: What Would Be Tolerable for Treatment Preventing Disease Progression for More than Five Years

	N=56	Percentage
Mild, chronic side effects	45	80%
Treatments that require prolonged hospitalizations	7	13%
No side effect or treatment burden is worth that outcome	4	7%

Note. Percent calculations are based on the total number of participants who responded to the question (n=56).

Additional Survey Results - True Reply

To complement the responses captured during the EL-PFDD meeting, a pre-meeting survey was conducted via an audio recording system called True Reply. Invitations were sent out to the MPN community by mail (postcard) as well as by email and social media to dial a toll-free number and respond to two questions:

1. What has been the most difficult part of living with this disease for you?
2. How has your diagnosis impacted the fulfillment of your life goals?

Survey participants' responses were transcribed and indexed using a similar lexicon that was used with the EL-PFDD meeting panelist and audience testimony. No demographic, diagnosis, age or other data was collected from survey respondents. Tables showing the full lists of key words mentioned in the True Reply responses and their frequencies are in Appendix 4.

Conclusion

During the EL-PFDD meeting for MPNs, 10 panelists, 15 audience participants, and 9 web participants, all identifying as MPN patients, shared their personal stories and contributed to an informative discussion on the experience of living with MPN-related symptoms, the impacts of these symptoms, and perspectives on current and future treatments. Tools used prior to and during the forum supported the participation of 135 people in live polling and nearly 300 people responding to each True Reply question.

Among the goals of the meeting and this document are to spotlight the continued unmet medical needs of people living with MPNs and to dispel beliefs that:

1) the needs of MPN patients can be considered under one umbrella when, in fact, the experience of MPN patients is heterogeneous both within and across indications;

2) watching and waiting is a sufficient strategy to monitor for progression because MPNs are chronic conditions;

3) MPNs are exclusively diseases of the elderly.

To the first point, there is very little homogeneity to the patient population. Each person has his/her own journey. The severity of many symptoms is not easily measured but the symptoms are troublesome and may not be apparent to people around the patient experiencing them. During the prepared remarks, panelists reported a diverse range of current treatments that are used for their MPN (cell-reducing drugs, supportive treatments, phlebotomy, new treatments). Subsequent discussion and live polling results indicated that several symptoms were not well managed by current drug therapies (e.g., fatigue, night sweats) and these results were validated by the True Reply responses. Additionally, 40% of the live polling respondents indicated that they do not have confidence in the availability of additional drug treatments if their current treatment stops working for them. Participants were resolute on their desire for therapies that positively impacted progression-free survival with side effect burdens that they could live with long term. To the final point, the mean age of the panelists was 58.3 years with a range of 49 to 76. Two additional patients (females aged 39 and 48) were unable to attend due to family and work commitments but submitted pre-recorded videos. PV, ET and MF affect people in the prime of their lives when they may be working, raising families, and going to school. Many indicated that their MPN impeded their ability to work to what they felt was their highest potential.

Deep insights were shared at the EL-PFDD and in this report from the patient perspective. A very important initial step in patient-focused drug development is to ensure that outcomes that are meaningful to patients are being measured to inform future endpoints in the development of new treatments for MPNs. These patient perspectives can serve as a base in helping to identify appropriate clinical outcome measures that may be used in clinical trials to assess treatment benefits.

Considering the heterogeneity of the MPN patient experience, the need for relief from symptoms not addressed by current approved therapies and the urgency felt by many patients (heightened by the uncertainty of progression), it is suggested herein that regulatory authorities consider a broad review of endpoints in the evaluation of potential new treatments. The MPN community looks forward to future discussions about how to better meet the therapeutic needs of these diverse patient populations.

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Appendix 1. Meeting Agenda

Externally-Led Patient-Focused Drug Development Meeting for Myeloproliferative Neoplasms

September 16, 2019

Hyattsville, MD

8:30-9:30 am	**Registration**
	Opening Remarks
	Michelle Woehrle, Executive Director, MPN Research Foundation
9:40 am	**Clinical Overview of MPNs**
	Robyn Scherber, MD, MPH
9:55 am	**Introduction and Meeting Overview**
	James E. Valentine, JD, MHS, Meeting Moderator
10:05 am	Audience and Remote Demographic Polling
Patient Panels and Audience Discussion	
10:15 am	Topic 1: Living with an MPN Panel Discussions • Living with Polycythemia Vera • Living with Essential Thrombocythemia • Living with Myelofibrosis
10:45 am	Audience and Remote Polling
11:00 am	Moderated Audience Discussion
12:00 pm	Lunch
12:50 pm	Living with MPN Video
1:00 pm	Meghana Chalasani Center for Drug Evaluation and Research, U.S. Food and Drug Administration
1:05 pm	Topic 2: Current and Future Treatments • Panel Discussion • Audience and Remote Polling
1:40 pm	Moderated Audience Discussion
3:00 pm	Recap and Closing Remarks Ruben Mesa, MD, FACP and John Mascarenhas, MD
3:20 pm	Farewell Remarks
3:30 pm	Meeting Concludes

Appendix 2. Patient and Clinical Panelists

Patient Panelists, Topic 1 and Topic 2

- David K. PV Patient
- Vicki B. ET Patient
- Vivienne W. PV Patient
- Bridget B. ET Patient
- Ruth R. MF Patient
- David A. PV Patient
- Diane R. PV Patient
- Nancy D. MF Patient
- Ned W. MF Patient
- Morgan G. MF Patient

Clinical Panelists

- Ruben Mesa, MD, FACP
- Robyn Scherber, MD, MPH
- John Mascarenhas, MD

Appendix 3. Audience and Remote Polling Questions

Demographic Questions

1. I am a:
   a) Patient
   b) Caregiver

2. What one word comes to mind when you think about myeloproliferative neoplasms? (word cloud)

3. The MPN or related disease I was originally diagnosed with was:
   a) Essential thrombocythemia
   b) Polycythemia vera
   c) Myelofibrosis
   d) Acute Myeloid Leukemia, Chronic myelogenous leukemia, other leukemia
   e) Other
   f) Unsure

4. My current diagnosis is:
   a) Polycythemia Vera
   b) Essential Thrombocythemia
   c) Myelofibrosis
   d) Acute Myeloid Leukemia, Chronic myelogenous Leukemia, other leukemia
   e) Other
   f) Unsure

5. Where do you currently reside?
   a) U.S. Pacific (including California)
   b) U.S. West and Mountain
   c) U.S. Midwest
   d) U.S. South (including Texas)
   e) U.S. Northeast and New England
   f) Canada
   g) Mexico
   h) Outside of North America

6. The following best describes my age:
    a) Under 18 years old
    b) 18-20 years old
    c) 21-30 years old
    d) 31-40 years old
    e) 41-50 years old
    f) 50-59 years old
    g) 60-69
    h) 70-79
    i) 80 and above

7. When were you first diagnosed with an MPN?
    a) In the last year
    b) In the last 1-5 years
    c) Between 5-10 years ago
    d) Between 10-20 years ago
    e) More than 20 years ago

8. I have been told I have the following genetic mutations (Select all that apply):
    a) Jak2
    b) MPL
    c) CALR
    d) Triple Negative
    e) ASXL1
    f) TET2
    g) EZH2
    h) IDH1/2
    i) Do not recall/Not tested
    j) Other mutation

Living with MPN Polling Questions

1. Select the three symptoms that impact your daily life the most (limit to 3 selections)
    a) Fatigue
    b) Bone Pain
    c) Pruritis (itching)
    d) Tingling, numbness or burning in hands, feet or limbs
    e) Vision problems or visual disturbances
    f) Night sweats
    g) Abdominal discomfort (enlarged spleen, early satiety, gastrointestinal problems, etc)
    h) Problems with sexual relations, feeling sad or depression
    i) I do not have any symptoms
    j) Other

2. Have you had to reduce, stop work or retire early due to your MPN?
    a) Yes, I stopped working altogether
    b) Yes, I cut back to part time
    c) Yes, I retired early
    d) I am on a temporary work leave of absence
    e) No, I retired as scheduled
    f) No, I continue working at the same pace
    g) I wasn't working prior to my diagnosis

3. The biggest struggle I face attributable to my MPN is:
    a) Anemia
    b) Transfusion dependence
    c) Spleen size
    d) Recurring bleeding/clotting including thrombotic events
    e) Severe symptom burden
    f) I do not face any struggles
    g) Other

4. Overall, the impact of my MPN on my life has been:
    a) None
    b) Mild
    c) Moderate
    d) Severe

5. In the previous six months I have had (select all that apply):
    a) thrombotic event (TIA, blood clot, cardiac event, pulmonary embolism)
    b) bleeding event (GI, respiratory, reproductive area, upper or lower extremity, other)
    c) skin lesion
    d) change in MPN diagnosis

Current and Future Treatments Polling Questions

1. The treatment(s) I am currently using include:
    a) Phlebotomy
    b) Transfusion
    c) Drug to treat my MPN (such as a Jak2 inhibitor, platelet reducing drug, chemotherapy agent, interferon, etc)
    d) Drug to treat specific symptoms (such as anti-histamine, anti-inflammatory, pain medication, etc)
    e) Recent or planned stem cell transplant
    f) Recent or planned splenectomy
    g) Homeopathic remedy (including CBD, medical mushrooms, vitamins, etc)
    h) Strict diet and/or exercise (including yoga, meditation, etc)
    i) Other

2. The drugs I am currently taking include (select any that apply):
    a) Anticoagulants (e.g. aspirin, warfarin)
    b) Platelet reducing (e.g. anagrelide)
    c) Interferon (including interferon alfa, peginterferon alfa-2a aka Pegasys, other)
    d) Anemia improvement (e.g. erythropoietin, darbepoetin)
    e) Jak Inhibitor (e.g. ruxolitinib aka Jakafi®/Jakavi®, fedratinib aka Inrebic®, other)
    f) Chemotherapy (e.g. hydroxyurea, busulfan)
    g) Other

3. Are you confident that, if your current therapy stops working for you, there is another drug that your doctor can potentially prescribe?
    a) Yes
    b) No
    c) Not sure
    d) Not applicable (not currently on a drug regimen)

4. What is the most you would you tolerate in exchange for a treatment that would prevent disease progression for more than 5 years?
    a) No side effect or treatment burden is worth that outcome
    b) Mild, chronic side effects (e.g. headache, nausea, rash) or moderately intensive treatment (e.g. weekly or bi-weekly office visit or infusions that take many hours) are worth that outcome
    c) Treatments that require prolonged hospitalizations (e.g. stem cell transplant) are worth that outcome

5. What MPN symptoms are not adequately controlled despite your current therapy? (select all that apply)
    a) Itching
    b) Bone pain
    c) Fatigue
    d) Numbness/tingling/burning sensation in hands, feet or limbs
    e) Satiety (early feeling of being full)
    f) Night sweats or insomnia
    g) Vision problems; visual disturbances
    h) Headache/migraine
    i) Sexual difficulties
    j) Other

6. What worries you most about the future? (Rank from 1 to 5 with 5 being highest worry, 1 being least worry)
    a) Progression to MF, AML or other diagnosis
    b) Lack of therapeutic options should my current therapy fail or stop working
    c) Cost/availability of healthcare and/or medication
    d) Quality of life
    e) Other

Appendix 4. True Reply Responses

To complement the responses captured during the EL-PFDD meeting, a pre-meeting survey was conducted via an audio recording system called True Reply. The MPN community was encouraged by mail (postcard) and email in addition to social media to dial a toll-free number and respond to two questions:

1. What has been the most difficult part of living with this disease for you?
2. How has your diagnosis impacted the fulfillment of your life goals?

Survey participants' responses were transcribed and indexed using a similar lexicon that was used with the EL-PFDD meeting panelist and audience testimony. No demographic, diagnosis, age or other data was collected from survey respondents.

Of the 296 intelligible answers to the first question, almost one third (95/296, 32%) said that fatigue was the most difficult part of living with their disease. Body pain (39/296, 13%) was cited often as was emotional and psychological burdens (31/296, 10%).

Fatigue was also cited the most often in the second question as impacting fulfillment of life goals (45/273, 16%). Activity-related impacts were also commonly mentioned including work/school (41/273, 15%), social/hobbies (31/273, 11%) and general daily activities (26/273, 10%).

Examples of True Reply responses are as follows

> *"I think the most difficult part has been the uncertainty about how the disease will progress and the lack of information about the disease and how it progresses. I also find that the side effects from hydroxyurea can be challenging and yet I know that there isn't another drug that is as effective. So those are the most difficult things."*
>
> *"In so many ways I can no longer do physically the things I want to do. I can no longer concentrate the way I used to concentrate. I can no longer take hot showers. It's a myriad of symptoms and you never know when the symptoms are going to affect you."*
>
> *"Chronic fatigue and chronic pain that most doctors don't know how to help you; the medications don't really help that much and the doctors will give old answers to your questions that have never been researched and the people don't really think you're sick."*
>
> *"Most difficult part of living with having polycythemia vera is not knowing how I would feel from one day to another. I'm very well controlled now. I've been using Pegasys® interferon for a number of years but, prior to that, I would have dizzy spells, visual disturbances and feel fuzzy mentally plus I was very tired a lot of the time. I was trying to hold down a full-time job. I do presentations. So I had to be in front of people and not knowing how I was going to feel made working rather difficult. Sometimes come home from work and just collapse and not really be able to do much around the house."*

The open, unprompted nature of the True Reply questions resulted in a variety of responses in terms of length, emotion and content. In contrast to the live polling during the EL-PFDD, where participants selected responses from a list, the responses to the recorded phone survey were not limited or guided.

The data collected represents a large sample of MPN patients and corresponds well to the responses and testimony collected during the EL-PFDD meeting. Tables showing the full lists of key words mentioned in the True Reply responses and their frequencies are in Appendix 4.

Patient Responses to True Reply Question 1: Most Difficult Part of Living with MPN

	N=296	Percentage
Fatigue-Related Symptoms		
Fatigue	95	32%
Reduced energy	20	7%
Tiredness	7	2%
Night sweats	4	1%
Insomnia	2	1%
Organ and Clinical Signs		
Laboratory tests (blood work)	6	2%
Phlebotomies	6	2%
Spleen enlargement	3	1%
Bone marrow biopsy	2	1%
Sensation-Related Symptoms		
Burning	11	4%
Itch/pruritus	7	2%
Tingling	1	0%
Numbness	1	0%
Throbbing	1	0%
Pain-Related Symptoms		
Body pain	39	13%
Bone pain	10	3%
Mouth sore	6	2%
Hand/feet pain	5	2%
Joint pain	4	1%
Chronic pain	3	1%
Head pain	1	0%
Muscle pain	1	0%
Pain surgery discomfort	1	0%
Blood-Related Symptoms		
Anemia	11	4%

Bleeding	1	0%
Migraine-Related Symptoms		
Headaches/migraine	5	2%
Migraine without headache	1	0%
Head pain	1	0%
GI-Related Symptoms		
Autoimmune disease comorbidity	2	1%
Nausea	1	0%
Filling up quickly	1	0%
Weight loss	1	0%
Breathing-Related Symptoms		
Shortness of breath	7	2%
Decrease in endurance	7	2%
Neurological Symptoms		
Dizziness	3	1%
Lightheadedness	1	0%
Activity-Related Issues		
Activities of daily living (general)	16	5%
Work/School	9	3%
Development	9	3%
Social/ hobbies	8	3%
Chronic impacts	4	1%
Inactivity/exercise	2	1%
Treatment-Related Issues		
Ideal treatment	27	9%
Lack of information	23	8%
Treatment side effects	8	3%
Side effects from medications	8	3%
Lack of knowledge of MPN	7	2%
Access to care	6	2%
Lack of supportive care	4	1%
Treatment inconveniences	3	1%

Emotional /Psychological		
Emotional/psychological	31	10%
Worry about unpredictable future (disease progression)	23	8%
Worry/fear about unpredictable symptom(s)	12	4%
Depression	4	1%
Anxiety	4	1%
Frustration	2	1%
Fear	2	1%
Embarrassment	1	0%
Decline in mental health	1	0%
Cognitive		
Cognitive impairment	7	2%
Brain fogginess	6	2%
Financial		
Travel stipend and housing	12	4%
Cost of treatment	12	4%
Financial impact	1	0%
Other Symptoms		
Decline in physical health	4	1%
Spots in vision/vision issues	4	1%
Skin problems	2	1%
Reduced sexual function and desire	1	0%
Infections	1	0%
Other		
No difficulty	8	3%
Quality of life	4	1%
Other cancer morbidity	2	1%

Note: Of the 425 participants who responded to question 1, 78 responses were unavailable to code, leaving 347 participants responses available for coding. Of these participants, 51 responses were unintelligible. Therefore, a sample size of 296 was used for the True Reply question 1 analysis.

Patient Responses to True Reply Question 2: Impact of MPN on Life Goals

	N=273	Percentage
Fatigue-Related Symptoms		
Fatigue	45	16%
Tiredness	24	9%
Reduced energy	21	8%
Insomnia	1	0%
Organ and Clinical Signs		
Laboratory tests (blood work)	4	1%
Reduce blood counts	1	0%
Open wounds	1	0%
Spleen enlargement	1	0%
Sensation-Related Symptoms		
Burning	3	1%
Tingling	1	0%
Throbbing	1	0%
Pain-Related Symptoms		
Body pain	18	7%
Bone pain	8	3%
Mouth sore	6	2%
Joint pain	3	1%
Chronic pain	3	1%
Hand/feet pain	2	1%
Head pain	1	0%
Muscle pain	1	0%
Pain surgery discomfort	1	0%
Blood-Related Symptoms		
Anemia	5	2%
GI-Related Symptoms		
Nausea	5	2%
Weight loss	2	1%
Filling up quickly	1	0%

Breathing-Related Symptoms		
Shortness of breath	10	4%
Neurological Symptoms		
Lightheadedness	1	0%
Activity-Related Issues		
Work/School	41	15%
Social/ hobbies	31	11%
Daily activities (general)	26	10%
Inactivity/exercise	10	4%
Self-development	2	1%
Treatment-Related Issues		
Treatment side effects	6	2%
Ideal treatment	4	1%
Lack of information	2	1%
Side effects from medications	2	1%
Lack of supportive care	1	0%
Emotional/Psychological		
Worry about unpredictable future	18	7%
Worry (general)	13	5%
Anxiety	5	2%
Fear	3	1%
Depression	3	1%
Worry about disease progression	3	1%
Decline in mental health	3	1%
Frustration	2	1%
Cognitive		
Cognitive impairment	12	4%
Brain fogginess	9	3%
Financial		
Travel stipend and housing	3	1%
Cost of clinical trial	3	1%
Financial impact	1	0%

Other Symptoms		
Decline in physical health	5	2%
Impaired sexual function	1	0%
Other		
Quality of life	11	4%
Autoimmune disease comorbidity	1	0%

Note: Of the 425 participants who responded to question 2, 89 responses were unavailable to code, leaving 336 participants responses available for coding. Of these participants, 63 responses were unintelligible. Therefore, a sample size of 273 was used for the True Reply question 2 analysis.