2018

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Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring 10 (2018) 413-420

Diagnostic Assessment & Prognosis

Amyloid positron emission tomography candidates may focus more on benefits than risks of results disclosure

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Abstract

Introduction: Given mounting calls to disclose biomarker test results to research participants, we explored factors underlying decisions by patients with mild cognitive impairment to receive amyloid imaging results.

Methods: Prospective, qualitative interviews were conducted with 59 participants (30 = mild cognitive impairment patients, 29 = care partners) from the scan arm of a randomized controlled trial on the effects of amyloid PET results disclosure in an Alzheimer Disease Research Center setting.

Results: Sixty-three percent of the participants were female, with an average age of 72.9 years, and most had greater than a high school level of education (80%). Primary motivations included: (1) better understanding one's mild cognitive impairment etiology and prognosis to plan ahead, and (2) learning one's brain amyloid status for knowledge's sake, regardless of whether the information is actionable. Most participants demonstrated an adequate understanding of the scan's limitations, yet instances of characterizing amyloid PET as a definitive test for Alzheimer's disease occurred. Mention of potential drawbacks, such as negative psychological outcomes, was minimal, even among care partners.

Discussion: Findings demonstrate a risk of disproportionate focus on possible benefits of testing among amyloid scan candidates and suggest a need to clearly emphasize the limitations of amyloid PET when counseling cognitively impaired patients and their families before testing. Future research should examine whether minimizing drawbacks at the pre-imaging stage has adverse consequences on results disclosure.

Keywords: Ethics; Mild cognitive impairment; Alzheimer's disease; Amyloid PET; Decision-making

1. Introduction

Despite the rapid proliferation of imaging-based and other biomarkers for Alzheimer's disease (AD) in research and practice, investigations into how patients and families view undergoing predictive or diagnostic testing for AD are limited. Understanding the motivations for, and perceived drawbacks of, pursuing such testing will be critical to developing best practices for providing information and support to candidates for AD biomarker testing. The need for such data is underscored, on the one hand, by advocates for early detection of AD who are working to minimize barriers to diagnostic testing [1], and on the other hand, by commentators who caution against indiscriminately screening for AD pathology in the absence of a

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https://doi.org/10.1016/j.dadm.2018.05.003

preventative or curative intervention for those who test positive [2,3].

Regarding positron emission tomography (PET) amyloid imaging, there is growing consensus that patients and research participants who will receive their scan results should be adequately counseled before imaging [4–7]. Efforts to develop such pretest counseling (PTC) protocols have focused on considerations unique to cognitively healthy individuals [8] and those with mild cognitive impairment (MCI) [7]. Early evaluations of protocols to inform MCI patients of the benefits, risks, and limitations of amyloid PET have shown PTC to be well received and comprehensible to patients [7]. Yet, prospective studies of factors influencing real-time decisions to pursue amyloid imaging are limited. One recent study documented that the ability to better understand one's brain heath and make future decisions to be the main reasons MCI research participants seek amyloid PET results [9]. Extending this line of inquiry, we examined factors influencing decisions to pursue amyloid PET among both scan candidates with MCI and their family members, focusing on a critical 2-week window following PTC, but before scheduling a scan.

2. Methods

2.1. Study design, sample, and setting

We conducted a prospective, interview-based qualitative study as part of a larger, ongoing investigation of how amyloid PET disclosure impacts the understanding of and ability to cope with a diagnosis of MCI. Patients with MCI and their care partners (typically family members) were recruited into the ongoing parent study from the University of Pittsburgh Alzheimer Disease Research Center (ADRC; NIA grant P50 AG005133) beginning in October of 2015. Of the 113 ADRC participants invited by the ADRC staff, 75 (66%) agreed to be referred to the parent study; to date, 72 of those have enrolled. Primary reasons for declining to participate in the parent study included health problems on the part of either the patient or the care partner and concerns that the study was very time consuming. Inclusion criteria for the parent study were as follows: (1) a current ADRC consensus diagnosis of MCI (isolated impairment in memory, isolated deficit in non-memory domain, or mild deficits in multiple cognitive domains) [10]; (2) the capacity to provide informed consent as verified by the University of San Diego Brief Assessment of Capacity to Consent [11,12]; (3) residence within 100 miles from the university (to facilitate home study visits); and (4) having a care partner who also consented to participate. Exclusion criteria were as follows: (1) familial AD genetic mutation carriers (this group already has biomarker-based AD risk information); and (2) active, untreated mood, or anxiety disorders defined as a Hamilton Depression Rating Scale [13] score of >17 or a Spielberger State Anxiety [14] score of >40. Care partner participants had to be 18 years of age or older. The sample for the sub study reported herein consists of the first 30 dyads (participant + care partner) to undergo a qualitative interview as described below.

2.2. Procedures

This research was approved by the University of Pittsburgh Institutional Review Board. All patients with MCI and their care partners provided informed consent, but one care partner later declined the qualitative interview. Baseline interviews for the parent study included a 10-point self-rating of interest in pursuing amyloid PET and receiving the scan results. Higher ratings indicated greater interest in obtaining a scan. Participants completed this scale at baseline and following the qualitative interview that is the focus of this report. After baseline data collection, all parent study participants were randomized to a scan group with results disclosure or to a comparison group with an MCI education session. All participants were informed of their group assignment at the completion of the baseline visit. An exception was made for individuals who had previously undergone a research PET amyloid scan under a protocol that precluded results disclosure. The randomization process was overridden in these cases, and these individuals were placed in the scan group, with the opportunity to undergo a new amyloid PET scan and results disclosure.

Scan group participants underwent formal PTC. Based on a protocol described previously, PTC sessions were conducted by master's prepared clinicians and included an overview of MCI and AD, followed by a presentation of the purpose of amyloid imaging and its potential pros, cons, and limitations in the context of MCI [7]. At the end of PTC, dyads were encouraged to carefully consider whether or not they wanted to pursue amyloid imaging. During a 2-week interim between PTC and the scheduling of the scan (if decided upon), a qualitative interview was conducted to capture participants' perspectives on the decision-making process in real time. The interview guide contained five semi-structured questions (e.g., "Tell me about your experience with deciding whether or not to get the scan.") and 15 follow-up probes (e.g., "What kinds of factors did you consider when making your decision?"). Questions were open-ended and neutrally worded (See Table 1). Interviewers were trained in qualitative data collection and instructed to probe for clarification when ambiguous or conflicting statements were made. Interviews were completed in participants' homes by two study staff members, one who interviewed the patient and another who simultaneously interviewed the care partner. Interviews were audio-recorded and transcribed verbatim.

2.3. Data analysis

The current report describes findings from qualitative analysis of the first 30 dyads in the scan group to undergo a qualitative interview after PTC. Descriptive analysis of this subsample was conducted using IBM SPSS Statistics for Windows, version 24.0. Interview data were managed in ATLAS.ti

Table 1
Semi-structured interview guide with probes

Introduction

The purpose of this interview is to learn about your experiences with deciding whether or not to undergo [or have your family member undergo] a special type of brain scan (amyloid scan) with the option of getting the results of that scan afterward. It is important that you express yourself openly. There are no right or wrong answers. We want to know what you think.

1. Tell me about your (or your family member's) decision to participate in an amyloid brain scan research study in the first place.
   Probes: Why did you (or is your family member) participate in the research study? What motivated you (or your family member) to volunteer for a brain scan study?
2. What were your first thoughts when you were asked if you wanted to be in a study where you could receive your (or your family member's) research scan results?
3. Tell me about your experience with deciding whether or not to get the scan and receive its results.
   Probes: What kinds of factors did you consider when making your decision? Did you feel like you had all of the information that you needed in making your decision? If not, what other information would have been helpful?
   Who, if anyone, did you discuss your decision with? What was that discussion like?
   How was your decision influenced by the fact that the scan was part of a research study, as opposed to something that your regular physician ordered?
   How do you think the process of making this decision was different from other medical decisions you've made in the past?
4. At this point, have you (or has your family member) made a final decision or are you still thinking about whether or not to do the next scan and receive your results?
   If a decision has been made: How do you feel about your decision? What, if anything, if your biggest concern about your decision at this point in time?
   Would you say that the information session influenced this decision? If so, how?
   Were you leaning one way or another when you enrolled in the study?
5. How would you describe the type and amount of support that you have received during the decision-making process?

NOTE. Interview conducted within 2 weeks of formal pretest counseling session for amyloid imaging.

7.0 and analyzed using the qualitative method of constant comparison [15]. This method centers the analysis on comparing and contrasting data between and within interview transcripts to determine whether incidents fit or do not fit within emerging categories and the properties that define them. Although each member of the dyad was interviewed separately to ensure adequate opportunity for the expression of individual thoughts and feelings, their data were analyzed together to form a complete representation of factors influencing the decision to be scanned. Line-by-line coding of transcripts was performed by three coders, categories were generated to label codes as similarities emerged, and themes were developed as a result of the constant comparison analysis.

3. Results

3.1. Sample characteristics

As Table 2 indicates, 63% of patient participants were female and 87% Caucasian, with an average age of 73 years. Care partners were also primarily female (83%) and Caucasian (86%), but slightly younger, with an average age of 68 years. Both patients and care partners reported relatively high levels of educational attainment, with 80% of the total sample having more than a high school level of education. Most participants had expressed a high level of interest in undergoing amyloid imaging on enrollment into the parent study (Table 2). At the time of the qualitative interview, 24 of the 30 patients with MCI had made a decision to proceed with the scan; the remaining individuals were either still deciding (n = 4) or had decided against it (n = 2). Analysis of the decision-making interviews revealed rich information concerning participants' motivations for, and perceived drawbacks of, pursuing amyloid imaging. Key features of the decision-making dynamic within this highly motivated group were also identified.

3.2. Motivations

Patient (n = 27) and care partner participants (n = 21) consistently cited the potential for the amyloid PET scan to give them more information about the underlying cause or likely course of their MCI as a major motivation for pursuing the scan. This motivation was often described in conjunction with talk of plans to use the information for planning ahead (see Table 3). While most participants demonstrated an adequate understanding of the scan's limitations on probing, three patients and two care partners made statements that equated amyloid positivity with an AD diagnosis. For example, one patient with MCI stated, "*people… want to know whether they have Alzheimer's or not, which is determined by the scan,*" while another said, "*I want to know the defining thing on Alzheimer's…so far [that] is that PET scan and that's testing amyloid, right?*" In one additional case, a care partner described her husband with MCI as potentially equating a positive scan with an AD diagnosis, *"My only concern is that he's going to, uh—if he, if he would get a result that there was, you know, some plaque, some um, that he is going to be—look at it more as a definitive diagnosis, even though you guys have said all along this is not a diagnosis, it's not, you know."*

There were also nine cases in which the potential to gain information was characterized as a desire to know one's brain amyloid status for knowledge's sake. The following quote exemplifies this sentiment: "*I want to know. [Even though] You might not be able to do anything about it*." In such cases, the emphasis was on the "right" to know the

Table 2
Sample characteristics

Variable	Patient (N = 30)	Family member (N = 29)
Mean age in years (SD)	72.9 (8.94)	68.2 (9.67)
Education, n (%)		
<H.S.	0 (0)	1 (3)
H.S./GED	6 (20)	5 (17)
Technical school or college	10 (33)	13 (45)
Graduate school	14 (47)	10 (35)
Gender, n (%)		
Female	19 (63)	24 (86)
Male	11 (37)	5 (17)
Race/ethnicity, n (%)		
White/Caucasian	26 (87)	25 (86)
Black/African-American	3 (10)	3 (10)
Asian/Pacific Islander	1 (3)	1 (3)
Relationship, n (%)		
Spouse/partner		21 (72)
Adult child		4 (14)
Friend		3 (10)
Sibling		1 (3)
MCI subtype, n (%)		
Amnestic	25 (83)	
Nonamnestic	5 (17)	
Mean rating of interest in PET amyloid imaging on a 10-point scale (SD) (patient n = 28; care partner n = 24)		
Baseline	9.07 (2.12)	8.46 (2.94)
At time of qualitative interview*	9.18 (1.68)	8.96 (2.79)

Abbreviations: GED, general education diploma; H.S., high school; MCI, mild cognitive impairment; PET, positron emission tomography; SD, standard deviation.

*Paired t-tests showed no significant differences in interest between baselines and the time of the qualitative interview.

results of one's scan rather than the potential for the information to clarify one's diagnosis or explain one's symptoms.

Even though it was not described as a primary motivator, the research context emerged as a supporting factor that influenced some in deciding to pursue an amyloid PET scan. Research-related motivation took four distinct forms: (1) the scan being free of charge, (2) scheduling and logistics being handled by study staff, (3) the fact that as a research scan, the results would not become part of the medical record, and (4) a belief that participation in the scan process would "help the researchers."

3.3. Potential drawbacks

Overall, drawbacks of amyloid PET were mentioned less often than potential benefits. Indeed, some interviewees stated that they perceived no risks associated with the scan. This is exemplified by the statement, "*I don't see any reason not to do it.*" made by a 78-year-old woman with MCI. In the few instances where drawbacks were mentioned, such statements revealed a view that scan results would not likely change one's course of treatment. One patient explained that suicide may be a "rational" choice on receiving a positive scan result, but in only two cases was there an acknowledgment of the potential for a negative psychological reaction to learning one's brain amyloid status. For example, one care partner stated that a positive scan result "*would affect him [her husband] badly…he'll say, 'I'm going to wind up like….a vegetable*.'" One patient who decided against the scan stated, "*I thought about knowing that if it [the result] was bad, I'd be depressed.*" and made similar statements throughout the interview.

3.4. Features of the decision-making process

3.4.1. Deliberative speed

When asked to describe the decision-making process, 14 of the 30 dyads characterized the decision as being easy, rapid, or requiring little deliberation, whereas only 4 described any prolonged consideration of whether to proceed with the scan. For example, one patient stated "*I'm on a… fence right now and 75% of me…is saying no to the PET scan and the other 25% of me is saying 'why don't you go ahead?'*" while a care partner described second thoughts stating, "*The only thing I'm thinking of is, you know, we said right off the bat, 'Oh yeah, we want to know.' But I don't know if it's a good idea if both of us know.*"

3.4.2. Feelings about the decision to be scanned or not

When asked how they felt about the decision, many participants responded with descriptions about their feelings regarding the prospect of learning their amyloid status, rather than their feelings about the decision itself. Several participants expressed positive feelings including "happy," "enthusiastic," "good," and "positive." Others (n = 6) described neutral emotions (for example, stating they had "no qualms"), but many (n = 18) used some form of negative phrasing when describing their feelings. Negative feelings often included anxiety, which was sometimes reported as being present despite an overall positive perspective on having the scan. For example, one patient who voiced a "definite" plan to proceed with her scan stated, "*I would be…um… remiss to say I'm not worried about it.*"

3.4.3. Consultation with others

Responses to the question, "Who have you discussed the possibility of getting this scan with?" frequently (n = 22 patients; n = 19 care partners) revealed little to no consultation with individuals outside of the dyad other than the research team. In only four instances was consultation with another health-care provider or family member described.

Care partners typically described their role as supportive in nature, emphasizing that the final decision rested with the patient. Statements such as, *"it's her decision,"* and "*You know, I might give my opinion, but…it's him so he needs to decide what he wants*," typified this sentiment. This stance was present in a range of scenarios, from those who admitted to disagreeing with the patient's decision (n = 3), to those who withheld their own opinion, insisting

Table 3
Features of amyloid PET decision-making

Prominent feature of decision-making	Examples of supportive participant quotes
Motivated by desire to understand etiology or course of MCI	"It sure beats waiting for an autopsy."
	"She's forgetful, and, uh, she just truly wants a definitive answer…that she has the plaque or she doesn't…Not that it actually says she has Alzheimer's, but she just wants to know."
Motivated by desire for knowledge for knowledge's sake	"We were excited about the opportunity because I would prefer to know than not know….and we realize that it might not effect-help me at all."
	"To me, not knowing is worse than…. knowing."
Motivated by desire to plan ahead and/or make informed decisions	"…Then there's folks like me who want all the information so that I can better make an informed decision somewhere along the way."
	"I understand what the test does, what you're looking for and, uhm, it's going to help me determine what I'm going to do with my life in the future."
	"I prefer to make decisions with as much information as I can get and I've always been that way."
	"Because like I said before, it's all about planning."
Easy process	"Okay, well you pose it as an option. I pose it as an opportunity. And so, if it's an opportunity then um, to me it's a no-brainer… No pun intended!"
	"I mean it was pretty cut and dried, um…from the beginning that he, if he was chosen for that group he would want to have the scan, he would want to know the results."
	"Well I really didn't think about it twice. I figured the more understanding there is, the better."
Pre-test counseling helpful but did not impact decision outcome	"It was never any question that we were going to do it…[but] she [the pre-test counselor] did make it much clearer for me what… what they're going to do, what the tests are going to look like."
	"I think I always wanted to scan regardless of that [pre-test counseling]. And that the information just reinforced that."
	"No [counseling didn't influence the decision], but I listened to what she [pre-test counselor] had to say and it was… I mean it was interesting and she had more concrete information about it to share, so it was worth it. It was worth it."
	"You know, it did give her more information, but it was, it didn't influence her, her decision to do it or not."
Decision similar to and different from other medical decisions	*Similarities*
	"I think it was pretty similar [to other medical tests] because both equate to understanding and knowing a little more than if I didn't do it."
	"She's always been like 'know what you're dealing with and then you have more information to deal with it.' Not kind of bury her head in the sand regarding anything. At one point she had a lump on her breast and she went and got the mammogram and the biopsy and she's not somebody [to say], 'Don't tell me what's wrong with me.'"
	Differences
	"Well it is [different] in the sense that it's optional, but it would be hard for me to opt out, because…we really want to know."

Abbreviations: MCI, mild cognitive impairment; PET, positron emission tomography.

that the decision belong to the patient (n = 7) and those who voiced agreement and solidarity with the patient (n = 13). Those who disagreed with a patient's decision voiced concerns that scan results would either be upsetting, or of little value.

3.4.4. Comparison with previous medical decisions

When queried about how this decision compared with other medical decisions, participants noted both similarities and differences. Those viewing the decision as similar to previous medical decisions made statements indicating the decision didn't "*feel any different*." Others interpreted the question as a query regarding the patient's decisional capacity, "*Uh no [this decision is not different], up until now he's been able to make his own decisions quite fine*." Explanations of how the decision differed from other medical decisions were provided by care partners more often than patients and included comments regarding the complexity of the decision and seriousness of the information to be gained. Many contrasted this decision, which was posed as the patient's elective, with prior medical decisions involving firm clinical recommendations. For example, "*…this is a choice. This was, for me, a lot more difficult than whether or not I should have heart surgeries.*"

3.4.5. Impact of PTC

While both patients and family members consistently reported PTC to have been helpful and worthwhile, none indicated that the information presented had lessened their interest in the scan. When directly asked about this, several participants stated that the PTC content had either no impact on the outcome of their decision or served to reinforce a decision that had already been made.

Despite statements that PTC did not influence decision outcomes, analysis of the transcripts revealed that nearly all participants were actively considering how they would respond both emotionally and behaviorally to scan results, an exercise that was introduced and encouraged during counseling sessions. The following statement typifies such anticipation, "*I think we're both interested to know where that [amyloid status] stands…so we can plan for the future*." Several individuals offered specific examples about the

conduct of advance care and estate planning. For some, speculation about behavioral responses extended beyond practical planning. One care partner, for example, expressed significant concern regarding a potentially risky reaction to a positive scan, "*I'm afraid in a way that he will maybe even try moving out or something…because he keeps saying that he doesn't want to be a burden*."

4. Discussion

We report findings from qualitative interviews with 30 MCI care dyads following PTC sessions for amyloid PET that culminated with the instruction to carefully consider the counseling discussion before finalizing a decision to schedule a scan or not. Our analysis showed that, in most cases, decisions about amyloid imaging were being made relatively quickly and were characterized by a disproportionate focus on the potential benefits of learning a patient's brain amyloid status, with little consideration of possible drawbacks or limitations of doing so.

The decision to pursue PET amyloid imaging or not is an example of what decision scientists refer to as a preference sensitive decision, meaning that tradeoffs are involved and those tradeoffs should be weighed in light of an individual patient's values and preferences [16]. Although initially applied to treatment decisions, the concept of preference sensitive decision-making is equally useful in discussions regarding diagnostic testing and has been invoked in analyses of the benefits of mammography and prostate-specific antigen testing under circumstances where the benefits of screening do not clearly outweigh the risks [17–19].

Commentaries on the tradeoffs associated with disclosing amyloid imaging results to nondemented individuals focus on the potential for psychological distress [5], discrimination [20] and, in research settings, interference with scientific objectives [21], as risks to be weighed against the personal benefit that a patient or research participant may derive from learning their brain amyloid status. The lack of effective interventions for secondary prevention of dementia also factors into tradeoff calculations. Our previous study using mock disclosure of hypothetical amyloid PET results revealed a tendency for persons with MCI to perceive inherent value in learning one's brain amyloid status, irrespective of the result or whether the result would yield a change in the treatment plan [7]. A recent study of 20 patient-caregiver dyads, including 5 MCI cases, found that the potential to clarify one's diagnosis was reported, in retrospect, to be a common driver of decisions to pursue amyloid imaging, whereas perceived lack of direct benefit and impact on clinical care were reasons to decline scanning [22]. The present study is the first prospective investigation to describe similar anticipated benefits of testing among patients with MCI and care partners who are actively considering amyloid imaging.

Our analysis clearly demonstrates that amyloid imaging candidates and their care partners appreciate the preference sensitive nature of amyloid imaging decisions but offer no support for the notion that these individuals are routinely wrestling with the aforementioned tradeoffs. Rather, amyloid imaging candidates place a high value on gaining knowledge and understanding and that value is reported to be driving decisions in favor of learning one's brain amyloid status, with minimal regard for potential drawbacks to the testing. The latter finding is concerning in light of recent studies showing that 40%–50% of cognitively intact participants may experience dissatisfaction on realizing the limitations of what can be learned from an amyloid scan following results disclosure [23,24]. In a study of symptomatic individuals, nearly one-third (8 out of 26) reported feeling upset, hopeless, or depressed in the months following a diagnostic evaluation that included amyloid PET results disclosure, even though many others in the sample felt relieved [22]. The extent to which pretest expectations may impact reactions to amyloid PET results disclosure is unknown.

In contrast to the strong pretest interest in amyloid imaging observed in our study and hypothetical interest reported in surveys of cognitively healthy adults [25,26], a recent investigation of 63 cognitively healthy participants found that only 17% were interested in learning the results of their research amyloid PET scans when actually given the option [27]. This discrepancy may in part reflect differences in the perceived personal benefit of learning one's amyloid status in individuals who are symptomatic versus those who are not. For example, a survey of 87 dementia patients and 236 caregivers revealed nearly unanimous interest in amyloid PET with the vast majority perceiving clear personal benefits to learning one's amyloid status [28]. A similar pattern of both high interest and perceived benefit was observed in a recent qualitative study of 38 amnestic MCI research participants [9]. The MCI population is unique in that individuals are experiencing symptoms of cognitive decline but have not received a clinical dementia diagnosis. Prior research has shown that many patients with MCI are actively striving to understand the implications of their symptoms for cognitive health in the foreseeable future [29,30]. In a previous study, more than half of a sample of 60 MCI patients, and 35% of their family care partners, endorsed the view that MCI is "puzzling," and 40% of patients and 20% care partners viewed MCI as "a mystery" [30]. These data provide context for the current findings of high interest in amyloid imaging despite the lack of a secondary prevention strategy for dementia to be implemented based on scan results.

Our finding that a small minority of individuals may equate amyloid PET positivity with AD is consistent with Grill et al. [22] study of reactions to amyloid PET results disclosure in a clinically heterogeneous population in which the most commonly cited reasons for undergoing amyloid imaging were to receive a definitive diagnosis and to learn if one had AD. Both studies observed this phenomenon in care partners as well as patients, suggesting that adopting a view of amyloid PET as a definitive test for AD is not an oversimplification that can only be ascribed to cognitive impairment within patients. Furthermore, the emergence of this phenomenon in the

present study, in which participants were interviewed before the scan was conducted, suggests similar caution in assuming a miscommunication during the results disclosure process. Although amyloid positivity in the context of MCI aligns with the 2018 National Institute on Aging and Alzheimer's Association classification of Alzheimer's pathologic change with MCI [31] and the 2011 National Institute on Aging and Alzheimer's Association classification of MCI due to AD [32], our team did not expect participants to describe amyloid scans as providing definitive information about whether one with MCI presently has AD. Our PTC protocol explicitly refrains from characterizing amyloid PET as a test for AD. Rather, our counselors use meta-analytically derived estimates to provide the risk of developing AD dementia symptoms within a 2-year period based on whether a person with MCI has elevated amyloid levels or not [7]. Pretest counselors also emphasize that amyloid scans measure only one of the two pathologies required for a definitive AD diagnosis. Although only 6 of our 30 (20%) participants characterized amyloid PET as a definitive test for AD, these findings warrant further investigation and underscore the need, in the meantime, to clearly and unequivocally emphasize the limitations of amyloid PET when counseling cognitively impaired patients and their families before testing.

Our results should be interpreted in light of several limitations. First, our ability to characterize decisions about amyloid PET was constrained by the fact that individuals who agreed to our parent study were highly motivated to undergo amyloid PET, limiting our ability to balance our sample with an adequate number of scan decliners. Second, we focused on factors influencing the decision to learn one's brain amyloid status in a research setting. Participants were relatively highly educated, had formally demonstrated capacity to consent to amyloid imaging, undergone PTC, and were well supported by their care partners. Findings from this highly self-selected sample may not generalize to the broader pool of candidates for amyloid imaging. While research settings currently represent the most likely context for an individual to undergo amyloid PET, other factors may influence decisions about amyloid imaging in clinical practice. Such factors may include financial costs or concerns regarding inclusion of test results in the medical record. Clinic patients are also likely to have more medical comorbidities than ADRC participants, which may factor in unknown ways into decisions about amyloid PET. Our sample also lacked racial/ethnic diversity. The extent to which motivations to pursue amyloid imaging may be culturally driven is unknown. Finally, our sample was small and should not be used as a basis for estimating the frequency with which various motivations for pursuing amyloid PET occur.

In summary, this qualitative analysis of motivations for pursuing amyloid PET in MCI revealed two influential factors: (1) the potential to gain a better understanding of MCI etiology and prognosis, and thereby plan ahead, and (2) the potential to learn one's brain amyloid status for knowledge's sake, regardless of whether the information is actionable. Instances of potentially overstating the value of amyloid imaging by characterizing the scan as an AD test were noted while mention of drawbacks were minimal, even among care partners. These findings suggest that having a care partner present may be insufficient to safeguard against the temptation to equate amyloid PET positivity with a definitive AD diagnosis. PTC discussions should not only include the limitations of amyloid PET in MCI but also highlight the same. Additional research should include more representative samples and examine whether minimizing the risks of amyloid imaging before scanning has adverse consequences following results disclosure.

Acknowledgments

The authors gratefully acknowledge the participants who volunteered for this research, our pretest counselors (M.M. and Sarah Goldberg), qualitative interviewers (Lisa Tamres and Melissa Knox), and the undergraduate research assistants who transcribed audio-recordings (Maura Devlin, Olivia Greer, and Mengchi Li). This study was supported by NIH/NIA R01AG046906-01, NIH/NIA, P50 AG005133. Florbetapir F 18 injection doses in this study are supplied at no cost by Avid Radiopharmaceuticals a wholly owned subsidiary of Eli Lily, Inc.

RESEARCH IN CONTEXT

1. Systematic review: Combinations of the keywords "amyloid imaging," "mild cognitive impairment," and "ethics" were searched in PubMed through January 1, 2018. This search yielded four reports of psychological reactions to disclosure of amyloid imaging results, two in cognitively healthy, and two cognitively impaired older adults, including a retrospective qualitative analysis of factors influencing the decision to pursue amyloid positron emission tomography. The search also revealed two reports of comprehension of amyloid imaging results, one in cognitively healthy individuals, and one in mild cognitive impairment. These studies provide evidence of both positive and negative reactions to receiving amyloid positron emission tomography results.
2. Interpretation: The present study adds to this body of research by characterizing the decision-making process mild cognitive impairment patients and their family members while actively contemplating amyloid.
3. Future directions: Our findings of a disproportionate emphasis on potential benefits among amyloid positron emission tomography candidates with mild cognitive impairment should be confirmed in a larger, more representative sample.

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