



Published in final edited form as:

J Am Geriatr Soc. 2010 September ; 58(9): 1758–1763. doi:10.1111/j.1532-5415.2010.03030.x.

Challenges and Opportunities for Developing and Implementing Incentives to Improve Health-Related Behaviors in Older Adults

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Abstract

There is growing interest in using patient-directed incentives to change health-related behaviors. Advocates of incentive programs have proposed an ambitious research agenda for moving patient incentive programs forward. Older adults may pose a challenge to such a research agenda. The cognitive and psychological features of this population, in particular, age-related changes in emotional regulation, executive function and cognitive capacities, and a preference for collaborative decision-making raise questions about the suitability of these programs, particularly the structure of current financial incentives, to older adults. Differences in decision-making in older adults need to be accounted for in the design and implementation of financial incentive programs. Financial incentive programs tailored to characteristics of older adult populations may be more likely to improve the lives of older persons and the economic success of programs that serve them.

INTRODUCTION

Financial incentive programs, such as paying patients at risk of thromboembolism to adhere to blood thinning medications,(1) lose weight,(2) or quit smoking,(3) can change patient behavior and thereby improve health outcomes. Although much of the data showing the benefits of these programs are from research studies testing the program, as opposed to practice, employers, insurers, and governments are implementing such programs in the hope that they will significantly reduce the rate of increase in health care costs.(4,5) Soon, these programs will have a national mandate as the recently passed national health care reform bill includes provisions for Medicare and Medicaid to provide beneficiaries incentives to complete behavior modification programs. (6)

Unfortunately, as promising as financial incentive programs are, remarkably little data exists about whether these programs are suitable for older adults (persons over 65 years of age). Older adults, like other adult patients, exhibit many of the behaviors and adverse health outcomes that financial incentive programs address, but they do so against a backdrop of age-relative psychological and cognitive characteristics. Although these characteristics exhibit heterogeneity among older adults, important differences between older and younger

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Author Contributions: All authors contributed equally to the preparation of this manuscript.

Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper.

adults are evident. In particular, this essay examines how, beyond the 6th decade of life, individuals are more likely to experience changes in how they integrate time into their decisions (known as “future time perspective”), in their tolerance for risk, in a variety of cognitive abilities, and in their preference for collaborative decision-making. These characteristics may affect the likelihood that older adults will participate in financial incentive programs and, even if they do participate, that they will benefit from them.

By the middle of this century, the population of persons over 65 in the United States will double from 39 million today to 89 million.(7) As a result, the impact of this population’s healthy behaviors on overall health costs will become increasingly significant. But realizing the potential of incentive programs to help older adults engage in healthy behaviors and reduce costs, if they do, will only happen if such programs address the characteristics of older adults. Below, we review each of the characteristics, the challenges they present to health incentive programs, and explore how research and policy can address them.

THE LOGIC AND THE VALUE OF FINANCIAL INCENTIVES FOR CHANGING HEALTH BEHAVIOR

Patients often engage in behaviors that are not in their long-term best interest and the burden to patients and society of not changing these behaviors is significant. Current estimates are that approximately 40% of premature deaths are due to modifiable behavior.(8) Medication non-adherence is an example of a health-related behavior associated with adverse outcomes and increased cost. Non-adherence is responsible for 33 to 69 percent of medication-related hospital admissions, costs \$100 billion a year, and leads to substantially worse health outcomes.(9) Adherence is particularly important for older adults: more than 50% of older adults take 5 or more medications on a regular basis.(10) Clearly, finding ways to change health-related behaviors is a major challenge for health policy.(11)

Conventional thinking on health policy takes the restoration of the rational decision-maker as the *sine qua non* of changing health-related behavior. Under such a view, a smoker with a clear understanding of the risks and benefits of smoking is choosing to continue to smoke because the benefits to the smoker outweigh the risks. However, work from behavioral economics suggests that such thinking is over-simplified and that people are incompletely rational, having trouble with decision errors such as overweighing the present compared to the future, misjudging probabilities, being swayed by emotions, being affected by framing, and having assessments of probabilities distorted by recent events or by observations of close and trusted people, such as family members.(12-15)

However, while humans are at times irrational, the circumstances in which they make decisions can be configured to facilitate better choices. For instance, individuals are motivated by certain external goods (e.g., money), especially if they receive them relatively immediately. By attaching these external, short-term goods to health-related choices (e.g., paying smokers to quit), patients can be motivated to make healthy decisions that favor their own long-term best interests. Such incentive programs may not be the only way to affect health choices, but they are emerging as another option for achieving better health outcomes.

Financial incentives for behavior change can be structured in different ways. Based on our review of the literature, incentive programs can be structured along 7 core attributes (see Table 1). Money is the most obvious incentive instrument, but monetary equivalents, such as vouchers for goods, can be used as well. The amount of the reward can be set or it can vary by performance or at random. The timing of the reward can be tied to achievement of the program goal (e.g., target weight) or rewards can be distributed on an on-going basis as intermediate sub-goals are met (e.g., 1 pound lost weekly). Rewards can be structured to put

participants own resources at risk, thereby taking advantage of the fact that individuals tend to be loss averse.

To date, research suggests that incentive programs have the potential to dramatically improve medical care and public health. More research is needed to design and implement these programs. Specifically, research is needed to understand the relative costs and benefits of different incentive designs; the effect of differing types, magnitudes, and frequencies of incentives; how to target populations; the optimum duration of programs; and the value of combining programs with other methods of encouraging behavior change.(16) Well-designed incentive programs must also be matched up with appropriate target health behaviors. Changing complex health behaviors (e.g., coumadin monitoring and dose adjustment) may respond better to certain kinds of incentive programs than others. As progress in these areas is made, financial incentive programs look to become an increasingly attractive method for changing health-related behavior.

DECISION-MAKING IN OLDER ADULTS

Research into optimum design of financial incentive programs needs to include older adults, given the higher prevalence of disease in this group and the significant potential for benefit from higher rates of healthy behavior. Careful monitoring and treatment of diabetes affects both cognitive(17) and non-cognitive outcomes.(18) In older patients with arrhythmias, a narrowly maintained International Normalized Ratio (INR) is an important predictor of subsequent stroke.(19) Heart disease and cerebrovascular disease are leading causes of morbidity and mortality in patients over 65. Older patients commonly take medications, like lipid-lowering drugs and antihypertensives to lower the risk of vascular events, and 10% of those over 65 years-old continue to smoke, a leading contributor to vascular morbidity.(20) With few exceptions,(21) the design of incentive programs has favored enrollment of younger populations, whether by explicit exclusion of older adults(22) or by restriction to population features typically associated with younger age (e.g., pregnancy,(23) methadone use,(24) employment status(3)).

This focus is potentially problematic. Although older adults largely have been excluded from research into the design of incentive programs, no one has proposed that this population be excluded from the future implementation of these programs. In fact, recent health care legislation proposes to provide incentives to Medicare beneficiaries to complete behavior modification programs. (6) The inclusion of older adults in the implementation but not the design of incentive programs is likely to lead to non-optimum outcomes.

For older adults to enroll and succeed in financial incentive programs, these programs need to accommodate the psychological and cognitive characteristics that have been shown to affect their decision-making. Four important characteristics have particular relevance to decisions about financial incentive programs in older adults: (1) emotion and emotional regulation, (2) changes in executive function, particularly with respect to risk and reward assessment, (3) age-related cognitive declines that may mark the signs of common neurodegenerative diseases, such as Alzheimers disease, and (4) a preference for collaborative health care decision-making.

Below, we review each of these characteristics and then discuss how they might affect willingness of older adults to participate in financial incentive programs and the likelihood of successful participation in these programs. We conclude with an agenda for necessary research.

1. *Emotion and emotional regulation*: Recent work suggests that the emotional or affective experience of older adults tends to differ from that of younger adults.

Older adults, for instance, experience less negative affect than the young, as measured by sampling of self-reported emotional states (e.g., anger, pride, joy) at random intervals. (25) Older adults remember events associated with positive emotions better than events associated with negative emotions (whereas younger adults remember both equally) (26) and give a positive valence to what they remember.(27) Older adults are more likely than younger adults to use cognitive strategies to ensure an experience of more positive than negative affect.(28) The socioemotional selectivity theory posits that those who perceive their time as limited tend to make emotionally safer decisions.(29,30) They invest in already emotionally meaningful relationships and activities rather than in more abstract and less certain ones.(31,32) Clearly, this tendency for tighter regulation of emotional life affects how older adults make decisions.

2. *Changes in executive function, particularly with respect to risk and reward assessment:* Executive function is noted to change with increasing age. Broadly understood as the capacity to monitor and regulate cognitive and emotional states, executive function plays a central role in decision-making. In older adults, this has been examined experimentally with a gambling exercise called the Iowa Gambling Task (IGT). The IGT is a computerized card choice game in which normal decision-makers gradually shift from decks yielding high reward but even higher cost cards to decks with moderate reward and low cost cards.(33) Some otherwise cognitively normal older adults fail to shift to safer, more consistent decks, preferring the riskier decks with higher occasional rewards.(34) This group shares this behavior in common with subjects with frontal lobe lesions and clear executive dysfunction.(35) This tendency is not uniform in older adults nor is it entirely separable from age-related changes in emotional regulation .(36). Work still needs to be done elucidating the relation between emotional regulation and explicit decision-making. Nonetheless, contrary to the common stereotype of older adults as risk avoidant, advancing age may portend a decline in executive function and a tendency to endorse riskier decisions.(37) For example, older adults with impaired executive function have been shown to be more likely to express a willingness to purchase goods that are fraudulently advertised. (38)
3. *Age-related cognitive declines that may mark the signs of common neurodegenerative diseases:* Common age-related declines in cognitive abilities include speed of information processing, working memory capacity, and long-term memory (39). While certain cognitive declines are likely a normal accompaniment of aging in so far as they are not linked to pathology or disability, some declines, such as memory and executive function, are often early signs and symptoms of neurodegenerative diseases such as Alzheimers disease, which in persons over 80 has an annual incidence of at least 10%.(40) Studies of persons with Alzheimers disease and precursor states such as mild cognitive impairment show that characteristic cognitive changes have a substantial impact on decision making. (41,42) This includes impairments in the ability to understand and reason through information, recognize functional deficits, and perform basic financial decisions.
4. *A preference for collaborative health care decision-making:* Older adults are more likely than younger adults to prefer collaborative decision-making. Older adults are more likely to put off making health care decisions(43) or to make decisions with or defer decisions to others (e.g., family (44), health care providers(45-47)). Such tendencies have been shown to extend beyond individual treatment decisions to more general life course decisions such as choosing a Medicare health plan, for instance.(48)

Structuring Incentives to Fit the Decision-Making Needs of Older Adults

The design of an optimum incentive for older adults, one that motivates behavior change at the lowest cost, is a priority. Three questions can guide this design: (1) What kinds of incentives interest older adults? (2) What kinds of incentives motivate older adults to make a *commitment* to change? (3) What kinds of incentives result in sustained participation by older adults? Understanding how this population will respond to different incentives based on the decision-making characteristics discussed above is essential to designing and implementing successful programs that include older adults.

Getting older adults interested in financial incentive programs—The first step for a successful financial incentive program is getting individuals interested in the program. Incentives must draw individuals to want to learn more about a program. Whether these programs are presented to individuals by sponsors (e.g. Medicare) or by others (e.g., physicians), the initial appeal of these programs - and the subsequent likelihood of enrollment - will depend in large part on the attractiveness of the incentive offered. This is particularly important for older adults who are less likely to ask for information in medical contexts.(49)

Incentives designed to advance emotionally important goals may be particularly effective in older adults. For instance, a weekly voucher for a meal and a night of entertainment for a patient and close family member may generate more interest than an open-ended monetary reward. Programs need not require that rewards be spent to forward emotionally important goals, but presenting these kinds of goals as the default may be a particularly effective way to draw in older adults.

Certain methods to allocate incentives may be more attractive to older adults than to younger adults. Although older adults have no greater incidence of pathological gambling than other age groups,(50) evidence suggests that they enjoy and are drawn to gambling.(51) Hence, programs that use lottery systems to allocate rewards may be especially attractive to older adults. The reward for changing an unhealthy behavior, for instance, can be the opportunity for a big payout (e.g., drawing for a one in five chance of a \$200 reward). The chance of winning a large award may be particularly appealing to older adults, as evidence from performance on the IGT suggests. In summary, research is needed to better understand how the kinds of rewards and how they are allocated appeal to older adults.

Getting older adults to enroll in a financial incentive program—Behavior change programs require substantial first-person commitment. But securing a long-term commitment to a financial incentive program may be a significant challenge for older adults. The decision to participate in a financial incentive program shares much in common with a medical treatment decision.(52) Sufficient information needs to be disclosed to and understood by potential participants who should then weight the costs and benefits of participation and apply them to their individual circumstances. For older adults who prefer collaborative decision-making, this process of disclosure and understanding needs to include all relevant decision-making participants.

Because older adults tend toward decisions that yield positive emotional states, programs that harness regret may not be as useful in older adults as they are in younger adults. *Regret* has been used in financial incentive programs as a way to add extra value to monetary incentives.(1) Informing individuals of the reward they *lost* by failing to achieve a program goal is thought to produce regret. The disutility of regret provides extra motivation to adhere to a target behavior. The use of a negative emotion - regret - may prove an effective strategy for motivating older adults enrolled in programs to maintain a target behavior, but those deciding *whether or not* to enroll in the program may be put off by it. Older adults,

particularly those unsure of their likelihood of success, may find the risk of experiencing the emotional cost of regret outweighs the benefits of the program and choose not to enroll. Research will need to examine how emotional states affect the willingness to enroll and adhere to financial incentive programs.

Cognitive impairments may also affect the ability of older adults to make decisions to enroll in programs. Even persons with mild cognitive impairment compared to cognitively normal older adults show impairment in their decisional abilities and capacity to solve financial problems.(53) Hence, older adults may be impaired in their ability to make a decision about whether to enroll in a financial incentive program. Clearly, studies are needed to examine the impact of MCI on the ability of an older adult to decide whether to enroll in a financial incentive program. If research shows that capacity is commonly impaired, then incentive programs will need to examine the value of screening for impaired capacity and investigate the role that concerned others (e.g., family) can and should play in the decision to enroll.

Getting older adults to stick to financial incentive programs—Incentives must not only attract individuals to change behavior and make a commitment to doing so but they must be designed to sustain behavior change over time. Sustaining behavior change is recognized as one of the central challenges facing those designing incentive programs.(16) An incentive that fails to hold interest in behavior change is costly to both participants and sponsors. In older adults, the challenge of selecting an incentive that motivates continued interest in a behavior change is particularly important.

Incentive programs that incorporate frequent, small rewards have shown promise in sustaining interest in behavior change.(2,54) Individuals commonly overestimate the value of small, but frequent costs of changing behavior (e.g., cravings for a cigarette or high fat snack) and underestimate benefits of future health improvements (or promised future monetary rewards).(55) Programs that offer frequent, small monetary rewards (e.g., \$3 per day) for achieving interim goals (e.g., adherence to a medication schedule) may serve to counter this availability bias.

The effectiveness of frequent awards on older adults is difficult to predict. Older adults place greater value on the anticipation of a reward than young adults, showing a greater willingness to defer the experience of a reward to the future, perhaps attaching more value to its anticipation.(55) This suggests that high frequency rewards may be less effective in this population. Some cognitive characteristics of older adults, however, point in the other direction. Though the ability to remember conceptual information clearly declines in older age, the ability to remember positively emotionally-laden information, as discussed above, does not show such clear age-related declines. (56) Frequent rewards, therefore, may help older adults lay down memories important to behavior change. If sustaining behavior change relies on remembering successful thought patterns or mental strategies for avoiding or adopting target behaviors, the positive emotion tied to enjoying frequent incentives may be particularly helpful to older adults. Research is needed to examine how the frequency and size of reward affect adherence of older adults.

CONCLUSION

Financial incentive programs may offer promise to change health-related behavior. The benefits of enrolling older adults in financial incentive programs may be substantial. But these benefits are unlikely to be fully realized unless the characteristics of older adults are incorporated into the design and implementation of financial incentive programs. Key characteristics are changes in emotional regulation, executive function, and cognitive abilities, and a preference for collaborative decision-making. What is already known about

decision-making in older adults can help guide the development of these programs, particularly the choice of incentives. However, we have argued that further research is needed if the full potential of financial incentive programs is to be realized for older adults.

Studies will need to examine particular groups of older adults, rather than simply studying them as a uniform group. Key characteristics to define these groups include those with normal cognition versus those with mild degrees of well-characterized cognitive impairment. Other characteristics include studying how decision-making styles, risk-reward processing, and future time perspective act as potential modifiers of the willingness to participate, and the decision to enroll in and sustain participation in these programs.

Acknowledgments

Eran Klein was funded by The Greenwall Foundation, and Jason Karlawish by the National Institute on Aging P30-AG036592 and P30-AG10124, The Robert Wood Johnson Foundation Investigator Award in Health Policy Research, and the Marian S. Ware Alzheimer Program.

Sponsor's Role: No sponsors were involved in the design, methods, subject recruitment, data collections, analysis and preparation of paper.

References

1. Volpp KG, Loewenstein G, Troxel AB, et al. A test of financial incentives to improve warfarin adherence. *BMC Health Serv Res*. 2008; 8:272. [PubMed: 19102784]
2. Volpp KG, John LK, Troxel AB, et al. Financial incentive-based approaches for weight loss: A randomized trial. *JAMA*. 2008; 300:2631–2637. [PubMed: 19066383]
3. Volpp KG, Troxel AB, Pauly MV, et al. A randomized, controlled trial of financial incentives for smoking cessation. *N Engl J Med*. 2009; 360:699–709. [PubMed: 19213683]
4. Appleby J. Firms offer bigger incentives for healthy living. *USA Today*. 2009 Jan 20.
5. Bishop G, Brodkey AC. Personal responsibility and physician responsibility--West Virginia's Medicaid plan. *N Engl J Med*. 2006; 355:756–758. [PubMed: 16928992]
6. Pub. L. no. 111-148, Sec 3143. 2010. Patient Protection and Affordable Care Act of 2010 (PPACA).
7. U.S. Census Bureau. Census bureau reports World's older population projected to triple by 2050. 2009.
8. Cohen JT, Neumann PJ, Weinstein MC. Does preventive care save money? Health economics and the presidential candidates. *N Engl J Med*. 2008; 358:661–663. [PubMed: 18272889]
9. Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005; 353:487–497. [PubMed: 16079372]
10. Hajjar ER, Cafiero AC, Hanlon JT. Polypharmacy in elderly patients. *Am J Geriatr Pharmacother*. 2007; 5:345–351. [PubMed: 18179993]
11. Schroeder SA. Shattuck lecture: We can do better--improving the health of the american people. *N Engl J Med*. 2007; 357:1221–1228. [PubMed: 17881753]
12. Bickel, WK.; Vuchinich, RE. Reframing health behavior change with behavioral economics. Mahwah, N.J.: Lawrence Erlbaum; 2000.
13. Thaler, RH.; Sunstein, CR. *Nudge: Improving decisions about health, wealth, and happiness*. New Haven: Yale University Press; 2008.
14. Camerer, C. Behavioral economics: Past, present, future. In: Camerer, Colin F.; Loewenstein, George; Rabin, Matthew, editors. *Advances in behavioral economics*. New York; Princeton, N.J.: Russell Sage Foundation; Princeton University Press; 2004. p. 3-51.
15. Loewenstein G, Brennan T, Volpp KG. Asymmetric paternalism to improve health behaviors. *JAMA*. 2007; 298:2415–2417. [PubMed: 18042920]
16. Volpp KG, Pauly MV, Loewenstein G, et al. P4P4P: An agenda for research on pay-for-performance for patients. *Health Aff (Millwood)*. 2009; 28:206–214. [PubMed: 19124872]

17. Ryan CM, Freed MI, Rood JA, et al. Improving metabolic control leads to better working memory in adults with type 2 diabetes. *Diabetes Care*. 2006; 29:345–351. [PubMed: 16443885]
18. Ray KK, Seshasai SR, Wijesuriya S, et al. Effect of intensive control of glucose on cardiovascular outcomes and death in patients with diabetes mellitus: A meta-analysis of randomised controlled trials. *Lancet*. 2009; 373:1765–1772. [PubMed: 19465231]
19. Morgan CL, McEwan P, Tukiendorf A, et al. Warfarin treatment in patients with atrial fibrillation: Observing outcomes associated with varying levels of INR control. *Thromb Res*. 2009; 124:37–41. [PubMed: 19062079]
20. Current smoking. Available from: http://www.cdc.gov/nchs/data/nhis/earlyrelease/200909_06.pdf
21. Finkelstein EA, Brown DS, Brown DR, et al. A randomized study of financial incentives to increase physical activity among sedentary older adults. *Prev Med*. 2008; 47:182–187. [PubMed: 18571226]
22. Jeffery RW, Gerber WM, Rosenthal BS, et al. Monetary contracts in weight control: Effectiveness of group and individual contracts of varying size. *J Consult Clin Psychol*. 1983; 51:242–248. [PubMed: 6841768]
23. Heil SH, Higgins ST, Bernstein IM, et al. Effects of voucher-based incentives on abstinence from cigarette smoking and fetal growth among pregnant women. *Addiction*. 2008; 103:1009–1018. [PubMed: 18482424]
24. Dunn KE, Sigmon SC, Thomas CS, et al. Voucher-based contingent reinforcement of smoking abstinence among methadone-maintained patients: A pilot study. *J Appl Behav Anal*. 2008; 41:527–538. [PubMed: 19192857]
25. Carstensen LL, Pasupathi M, Mayr U, et al. Emotional experience in everyday life across the adult life span. *J Pers Soc Psychol*. 2000; 79:644–655. [PubMed: 11045744]
26. Charles ST, Mather M, Carstensen LL. Aging and emotional memory: The forgettable nature of negative images for older adults. *J Exp Psychol Gen*. 2003; 132:310–324. 324. [PubMed: 12825643]
27. Kennedy Q, Mather M, Carstensen LL. The role of motivation in the age-related positivity effect in autobiographical memory. *Psychol Sci*. 2004; 15:208–214. [PubMed: 15016294]
28. Gross JJ, Carstensen LL, Pasupathi M, et al. Emotion and aging: Experience, expression, and control. *Psychol Aging*. 1997; 12:590–599. [PubMed: 9416628]
29. Carstensen LL, Isaacowitz DM, Charles ST. Taking time seriously. A theory of socioemotional selectivity. *Am Psychol*. 1999; 54:165–181. [PubMed: 10199217]
30. Carstensen LL. The influence of a sense of time on human development. *Science*. 2006; 312:1913–1915. [PubMed: 16809530]
31. Fung HH, Carstensen LL, Lutz AM. Influence of time on social preferences: Implications for life-span development. *Psychol Aging*. 1999; 14:595–604. [PubMed: 10632147]
32. Fredrickson BL, Carstensen LL. Choosing social partners: How old age and anticipated endings make people more selective. *Psychol Aging*. 1990; 5:335–347. [PubMed: 2242238]
33. Bechara A, Damasio AR, Damasio H, et al. Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*. 1994; 50:7–15. [PubMed: 8039375]
34. Denburg NL, Tranel D, Bechara A. The ability to decide advantageously declines prematurely in some normal older persons. *Neuropsychologia*. 2005; 43:1099–1106. [PubMed: 15769495]
35. Bechara A, Tranel D, Damasio H, et al. Failure to respond autonomically to anticipated future outcomes following damage to prefrontal cortex. *Cereb Cortex*. 1996; 6:215–225. [PubMed: 8670652]
36. Denburg NL, Weller JA, Yamada TH, et al. Poor decision making among older adults is related to elevated levels of neuroticism. *Ann Behav Med*. 2009; 37:164–172. [PubMed: 19350336]
37. Okun MA. Adult age and cautiousness in decision: A review of the literature. *Hum Dev*. 1976; 19:220–233. [PubMed: 1002134]
38. Denburg NL, Cole CA, Hernandez M, et al. The orbitofrontal cortex, real-world decision making, and normal aging. *Ann N Y Acad Sci*. 2007; 1121:480–498. [PubMed: 17872394]
39. Park DC, Lautenschlager G, Hedden T, et al. Models of visuospatial and verbal memory across the adult life span. *Psychol Aging*. 2002; 17:299–320. [PubMed: 12061414]

40. Hebert LE, Scherr PA, Beckett LA, et al. Age-specific incidence of alzheimer's disease in a community population. *JAMA*. 1995; 273:1354–1359. [PubMed: 7715060]
41. Karlawish JH, Casarett DJ, James BD, et al. The ability of persons with alzheimer disease (AD) to make a decision about taking an AD treatment. *Neurology*. 2005; 64:1514–1519. [PubMed: 15883310]
42. Griffith HR, Belue K, Sicola A, et al. Impaired financial abilities in mild cognitive impairment: A direct assessment approach. *Neurology*. 2003; 60:449–457. [PubMed: 12578926]
43. Hudak PL, Clark JP, Hawker GA, et al. “You’re perfect for the procedure! why don’t you want it?” Elderly arthritis patients’ unwillingness to consider total joint arthroplasty surgery: A qualitative study. *Med Decis Making*. 2002; 22:272–278. [PubMed: 12058784]
44. Feinberg LF, Whitlatch CJ. Decision-making for persons with cognitive impairment and their family caregivers. *Am J Alzheimers Dis Other Demen*. 2002; 17:237–244. [PubMed: 12184513]
45. Cassileth BR, Zupkis RV, Sutton-Smith K, et al. Information and participation preferences among cancer patients. *Ann Intern Med*. 1980; 92:832–836. [PubMed: 7387025]
46. Ende J, Kazis L, Ash A, et al. Measuring patients’ desire for autonomy: Decision making and information-seeking preferences among medical patients. *J Gen Intern Med*. 1989; 4:23–30. [PubMed: 2644407]
47. Schrag D, Cramer LD, Bach PB, et al. Age and adjuvant chemotherapy use after surgery for stage III colon cancer. *J Natl Cancer Inst*. 2001; 93:850–857. [PubMed: 11390534]
48. Hibbard JH, Slovic P, Peters E, et al. Is the informed-choice policy approach appropriate for medicare beneficiaries? *Health Aff (Millwood)*. 2001; 20:199–203. [PubMed: 11585167]
49. Reed AE, Mikels JA, Simon KI. Older adults prefer less choice than young adults. *Psychol Aging*. 2008; 23:671–675. [PubMed: 18808256]
50. Welte J, Barnes G, Wiczorek W, et al. Alcohol and gambling pathology among U.S adults: Prevalence, demographic patterns and comorbidity. *J Stud Alcohol*. 2001; 62:706–712. [PubMed: 11702810]
51. McNeilly DP, Burke WJ. Gambling as a social activity of older adults. *Int J Aging Hum Dev*. 2001; 52:19–28. [PubMed: 11310572]
52. Faden, RR.; Beauchamp, TL.; King, NMP. A history and theory of informed consent. New York: Oxford University Press; 1986.
53. Marson DC, Martin RC, Wadley V, et al. Clinical interview assessment of financial capacity in older adults with mild cognitive impairment and Alzheimer’s disease. *J Am Geriatr Soc*. 2009; 57:806–814. [PubMed: 19453308]
54. Higgins, ST.; Roll, JM.; Wong, CJ., et al. Clinic and laboratory studies on the use of incentives to decrease cocaine and other substance use. In: Higgins, ST.; Silverman, K., editors. *Motivating behavior change among illicit drug abusers: Research on contingency management interventions*. Washington: American Psychological Association; 1999. p. 35-56.
55. Loewenstein, G.; Prelec, D. *Choice over time*. New York: Russell Sage Foundation; 1992. Anomalies in interpersonal choice: Evidence and interpretation; p. 119-145.
56. May CP, Rahhal T, Berry EM, Leighton EA. Aging, source memory, and emotion. *Psychol Aging*. 2005; 20:571–578. [PubMed: 16420132]

Table 1

The following table depicts the seven features of incentive structures and, for each feature, the range of attributes. Examples of each attribute are in italics.

Feature	Attributes
1. Benefit type	Direct (<i>money</i>) Indirect (<i>goods voucher</i>)
2. Quantity of benefit	Uniform (<i>\$50 for meeting weight loss goal</i>) Indexed (<i>\$25/pound of weight lost</i>) Escalating (<i>\$10 for first pound lost, \$15 for second pound lost, etc.</i>) Random (<i>0 to \$50 for each successful milestone</i>)
3. Probability of distribution	Assured (<i>\$50</i>) Chance (<i>1/4 chance of \$250</i>)
4. Timing of assessment	Completion of program (<i>6 month</i>) Set intervals (<i>weekly clinic visit</i>) Random intervals (<i>10 times during 6 months of program</i>) Dependent intervals (<i>Intervals vary based on previous performance</i>)
5. Participant Investment	Opportunity costs (<i>time, effort, discomfort</i>) Escrow (<i>\$200 of own money lost if fail to meet goal</i>) Matching (“Double or nothing”) (<i>\$200 of own money lost if fail, \$200 extra gained if successful</i>)
6. Information disclosure	Factual (<i>information given about meeting or failing to meet goal</i>) Counterfactual (<i>information given about reward lost by failing to meet goal, e.g., regret</i>)
7. Dispensing type	Resetting (<i>discrete reward at time of each target achievement</i>) Aggregative (“passbook savings”) (<i>information on running tally given</i>)