

Interactive Voice Response Telephone Calls to Enhance Bone Mineral Density Testing

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Objective: Bone mineral density (BMD) testing is a key tool used to diagnose and treat osteoporosis. We assessed the rate of scheduling BMD tests among health plan members at risk for osteoporosis who received interactive voice response (IVR) calls.

Study Design: Cohort study.

Methods: Study patients included persons age ≥ 45 years with either a prior fracture or ≥ 90 days of glucocorticoid use and all women age ≥ 65 years during the 2-year baseline period. The IVR call provided educational content and then offered members an opportunity to transfer to schedule a BMD test. The primary outcome was scheduling a BMD test.

Results: We targeted 1402 health plan members, and 708 (50%) were successfully contacted. Of 54 patients who transferred to schedule a BMD test, only 3 actually did so. Because so few patients scheduled a BMD test, predictors of transfer were examined as a secondary end point. In a multivariate model, only self-reported intention to schedule a BMD test was a significant predictor (odds ratio = 4.4, 95% confidence interval = 2.2, 8.8). Members' age, sex, history of a prior fracture, self-report of a BMD test in the previous 2 years, acknowledgement of barriers to BMD testing, and discussion of BMD testing with one's physician were not related to transferring to schedule a BMD test.

Conclusion: A letter and an IVR call prompted few to schedule a BMD test. More interventions to improve BMD testing should be developed and tested.

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Osteoporosis causes significant morbidity and mortality,¹ yet studies have shown suboptimal diagnosis and treatment in many settings.²⁻⁸ Bone mineral density (BMD) testing is a central component to osteoporosis management. Efforts to improve BMD testing rates have included interventions targeting both patients and physicians,⁹⁻¹⁴ but no large-scale interventions have been proved effective. Development and testing of new methods to increase BMD testing are warranted.

Telephone-based interactive voice response (IVR) technology has been promoted as a novel method to provide health information and promote health behavior change among members of health plans,¹⁵⁻¹⁷ as well as persons of low literacy and those who do not respond to mailings and/or in-person education.^{18,19} IVR scripts can follow a "branch-and-tree" configuration that reacts

to the member's responses with additional individually tailored content.¹⁷ IVR systems have been used among diverse populations to (1) encourage screening tests,²⁰⁻²² (2) remind members of scheduled appointments and medication adherence,²³⁻²⁸ (3) monitor clinical indicators,²⁹⁻³² and (4) educate/counsel patients about chronic disease management.^{18,29,30,33-35}

We are not aware that IVR systems have been tested for the diagnosis or treatment of osteoporosis. As part of a larger intervention trial, we implemented an IVR-based intervention to encourage BMD testing among persons at risk for osteoporosis. We hypothesized that the novel educational approach of IVRs to providing health information would prompt members to undergo BMD testing. This article focuses on the experience of the 1402 patients who received IVR calls.

METHODS

Intervention Population

Eligible members had medical and prescription drug coverage with Horizon Blue Cross Blue Shield of New Jersey (HBCBSNJ) from July 1, 2002, through May 31, 2004. In addition, members met at least 1 of the following criteria: (1) female age ≥ 65 years or (2) male or female age ≥ 45 years with a fracture and/or a history of ≥ 90 days of oral glucocorticoid use during the baseline period. Members were randomly allocated either to receive the IVR educational intervention or not to

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receive it. Because the need for repeat BMD testing is unclear, we excluded members who had a BMD test during the baseline period. Both HBCBSNJ and Brigham and Women's Hospital deemed this quality improvement intervention exempt from institutional review board oversight.

Components of the IVR Intervention

The intervention had 3 components: an advance letter, an IVR telephone call, and the opportunity to schedule a BMD test. The letter described osteoporosis and BMD testing and alerted members that, with their physicians' consent, HBCBSNJ would call to schedule a BMD test. IVR calls were initiated 1 week later. An English-speaking, female voice was used for all calls. If the IVR system did not reach the intended member, a message stated that HBCBSNJ was calling to follow up on a recent letter and invited the member to call a toll-free number. Calls were attempted at different times during the day to enhance success. A successful contact reached the intended member. A failed contact was defined as 1 of

the following: answering machine; live person, but not the intended member; wrong/disconnected number; busy signal; no answer; or hanging up.

When a member was contacted, an interactive script began. The script included risk information, encouraged members to schedule a BMD test, and praised prevention behaviors. Examples from the script include "Osteoporosis is a disease that makes your bones weak and likely to break easily. Because osteoporosis is a painless disease, you can have osteoporosis and not be aware of it" and "The best way to tell if a person is at risk for osteoporosis is to have a bone density test. The test only takes about 5 minutes, you don't have to take off your clothes, and it's painless." The script did not mention any specific medication or treatment for osteoporosis.

Each HBCBSNJ member was offered the opportunity to schedule a BMD test. If a member said yes, he or she was transferred to the radiology scheduling service. If the member said no, he or she was asked questions regarding barriers to testing (eg, cost, other health priorities). Two weeks after the first call, the IVR system initiated a second call. To respect members' privacy, the IVR system called only those members who (1) had not been reached or (2) did not transfer to schedule a BMD test during the first call but otherwise answered questions. This second call again offered the opportunity to schedule a BMD test.

Table 1. Characteristics of the Study Patients During the 2 Years Before the Intervention (n = 1402)

Characteristic	No. (%)
Age, y	68.0 ± 8.2*
Female	1291 (92.1)
Diagnosis of osteoporosis	253 (18.0)
Hip, wrist, or humerus fracture	163 (11.6)
Long-term oral glucocorticoid use	106 (7.6)
Any medication for osteoporosis	277 (19.8)
Alendronate	135 (9.6)
Calcitonin	28 (2.0)
Hormone replacement therapy	30 (2.1)
Raloxifene	51 (3.6)
Risedronate	42 (3.0)
Comorbid illnesses [†]	1.7 ± 2.1*
Any acute-care hospitalization	409 (29.2)
No. of physician visits	26 (32) [‡]
No. of different medications	15.5 ± 10.0*
Type of insurance plan [§]	
Direct Access managed care	63 (4.5)
Health maintenance organization	106 (7.6)
Point of service	1133 (80.8)
Preferred provider organization	100 (7.1)

*Mean ± SD.

[†]Comorbid illness was determined by using the Charlson Index.³⁶

[‡]Median (interquartile range).

[§]Members of all insurance plan types were subject to the same inclusion/exclusion criteria.

RESULTS

Fifty percent (n = 708) of patients were successfully contacted by an IVR call. **Table 1** describes the study population. The mean age was 68 years, and almost all were women. Relatively small percentages of members had had a previous fracture or had used oral glucocorticoids. Successfully contacted members were more likely to be female (*P* < .001) and to have taken alendronate (*P* = .02).

Of the 54 members who transferred to the radiology scheduling line, 3 scheduled a BMD test (**Table 2**). In subgroup analyses in which we excluded those who self-reported a BMD test (n = 214) or could not be reached by telephone (n = 694), the percentage of members who scheduled a BMD test through the IVR call increased to 0.6% (3 of 494).

We considered potential predictors of transfer to the scheduling service (**Table 3**). In both models, the only significant predictor of transfer was a member's self-reported intention to schedule a BMD test in the next 3 months (odds ratio = 4.4, 95% confidence interval = 2.2, 8.8).

Table 4 presents analyses examining members' self-reported knowledge, behaviors, and barriers. When

asked, 41% reported having had a BMD test. However, none had corresponding claims for a BMD test during the baseline period. Members in the nontransfer group were significantly more likely to report a previous BMD test than members of the transfer group. Forty-two members in the nontransfer group reported scheduling a BMD test on their own between the first and second call. HBCBSNJ claims from this period showed a BMD test for only 9 of the 42.

DISCUSSION

In this large health plan, an advance letter followed by an automated interactive call prompted few at-risk members to schedule a BMD test. Only self-reported intention to schedule a BMD test was predictive of transfer to the radiology scheduling service. We experienced substantial difficulty in contacting 50% of our sample via an IVR call. These impediments limited the intervention's educational impact.

There were significant differences between the transfer group and the nontransfer group in self-reported BMD testing during the past 2 years, discussing osteoporosis with one's physician, and scheduling a BMD test on one's own between the 2 IVR calls. It is unclear, how-

Table 2. Description of Members' Responses to Interactive Voice Response (IVR) Call (n = 1402)

Response	No. (%)
Successfully contacted	708 (50.5)
Answered 1 or more questions during IVR call	513 (36.6)
Transferred to schedule a BMD test	54 (3.9)
Scheduled a BMD test through scheduling service	3 (0.2)

BMD indicates bone mineral density.

ever, to what degree these differences are meaningful: a review of claims data showed no corresponding claims for previous BMD testing in those who self-reported it. Similarly, roughly 20% of members who reported scheduling a BMD between the first and second call had a corresponding claim over the next 8 months.

HBCBSNJ has utilized IVR reminders to increase use of preventive screening and reported a small but significant increase in the uptake of influenza immunizations (3.7%), mammogram screenings (3.0%), and Papanicolaou tests (2.8%).²² However, it is uncertain to what

Table 3. Predictors of Transfer to BMD Scheduling Service

Predictor	Univariate		Multivariate*	
	Odds Ratio	CI	Odds Ratio	CI
Member characteristic from baseline period				
Age	1.01	0.97, 1.05	1.02	0.97, 1.06
Female	1.28	0.36, 4.57	—	—
History of a prior fracture	1.24	0.53, 2.90	—	—
History of oral glucocorticoid use	2.20	0.64, 7.60	1.80	0.30, 10.90
Osteoporosis medication use	1.57	0.73, 3.35	1.76	0.64, 4.82
Urban residence	0.76	0.36, 1.62	—	—
Self-report during IVR call				
Physician diagnosed them as having osteoporosis	1.17	0.61, 2.24	—	—
Had BMD test in the past 2 years	1.01	0.54, 1.89	—	—
Intended to schedule BMD test in the next 3 months	4.30	2.15, 8.60	4.38	2.18, 8.82
Discussed need to have BMD test with physician	0.35	0.04, 3.27	—	—
Cited cost concerns as a barrier	9.57	0.54, 170.36	—	—
Reported that physician spoke with them about importance of BMD testing	1.91	0.9, 40.58	—	—
Cited other health priorities as a barrier	2.37	0.32, 18.02	—	—

BMD indicates bone mineral density; CI, confidence interval; IVR, interactive voice response.

*The dashes represent predictors with *P* values of >.02. These predictors were not included in the multivariate model.

Table 4. Members' Knowledge, Behaviors, and Barriers Regarding Osteoporosis and BMD Testing

Response to Question	No. Who Were Asked the Question	No. (%)		P*
		Transfer Group (n = 54)	Nontransfer Group (n = 654)	
Knowledge and behaviors				
Told by a physician that they have osteoporosis	513	12 (22.2)	102 (15.6)	.20
Reported BMD test in the past 2 years	513	6 (11.1)	208 (31.8)	<.001
Reported use of osteoporosis medication	96	4 (7.4)	73 (11.2)	.31
Reported discussing osteoporosis with physician	156	4 (7.4)	121 (18.5)	<.01
Reported scheduling a BMD test on their own between the first and second call	420	0 (0)	42 (6.4)	.02
Barriers to testing				
Cost concerns	102	1 (1.9)	10 (1.5)	.10
Other health priorities	102	2 (3.7)	26 (4.0)	.36

BMD indicates bone mineral density.

*The P value was determined by the chi-square test, comparing the proportion in the transfer group with the proportion in the nontransfer group.

degree other concurrent HBCBSNJ or outside interventions to increase uptake for the chosen screenings may have influenced the results. We are not aware of any concurrent campaigns that might have confounded results in this study. Although the success and usefulness of IVR for appointment reminders and medication adherence are well documented and positive,²³⁻²⁹ IVRs are less effective when used in other health education efforts.^{18,30,33,35-37} Of 3 IVR-based interventions for mammography, 2 have not succeeded^{20,22,38}; in contrast, live telephonic reminders and motivational telephone counseling have resulted in increased mammography uptake.^{39,40} It may be that interaction with a live person is important for behavior change.

Our current report has several limitations. Although this IVR intervention was part of a randomized controlled trial, the control patients were not offered the opportunity to call to schedule a BMD test. Thus, we reported only the experience of the intervention patients receiving the IVR call. Because of the branching nature of the IVR call, not all successfully contacted members were asked the same questions. Because of the small number of members who scheduled BMD tests, we could not analyze predictors of scheduling, but rather examined predictors of transferring to the scheduling service as a proxy. Members were included in the analyses if there was no healthcare claim for a BMD test during the previous 2 years. It is possible that some members did have a BMD test that was not recorded in these claims (eg, if they used a spouse's insurance coverage). It also is possible that members who did not

transfer or schedule a BMD test through the IVR call did subsequently undergo a test. Finally, members could have had testing in another setting, for example, a "free heel scan" at a health fair. Such scans would not appear in HBCBSNJ claims.

Although IVR technology has been widely touted, it is important to assess the proportion of patients willing and able to participate, a program's efficacy, and the adoption, implementation, and maintenance required.⁴¹ We specifically targeted members at risk of osteoporosis, hoping to reach those who could most benefit from the intervention. The very low BMD scheduling rate (0.2%) suggests that alternate methods may be a better use of limited disease management funds to encourage BMD testing.

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