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Virtual Reality Videos for Symptom Management in Hospice and Palliative Care

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Abstract

Objective: To learn more about the effect of virtual reality videos on patients' symptoms near the end of life, including which are most effective, how long the effect lasts, and which patients benefit the most.

Patients and Methods: We conducted a prospective study of 30 patients in a regional hospice and palliative care program from March 11, 2022, through July 14, 2023. Using a head-mounted display virtual reality, all participants viewed a 15-minute video of serene nature scenes with ambient sounds. Fifteen patients also participated in a second session of viewing bucket-list video clips they selected. Symptoms were measured with the revised Edmonton Symptom Assessment Scale before, immediately after, and 2 days after each experience. Participants rated their bucket-list selections by level of previous experience, strength of connection, and overall video quality. Functional status was also recorded.

Results: Nature scenes significantly improved total symptom scores (30% decrease, *P*<.001), as well as scores for drowsiness, tiredness, depression, anxiety, well-being, and dyspnea. The improved scores were not sustained 2 days later. Overall, bucket-list videos did not

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POTENTIAL COMPETING INTERESTS

The authors report no competing interests.

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significantly improve symptoms. Neither previous experience with an activity nor a strong connection correlated with significant improvement; however, when patients rated video quality as outstanding, scores improved (31% decrease, *P*=.03). Patients with lower functional status tended to have more symptoms beforehand and improve the most.

Conclusion: Serene nature head-mounted display virtual reality scenes safely reduce symptoms at the end of life. Bucket-list experiences may be effective if they are high-quality. More infirm patients may benefit the most.

Virtual reality (VR) has been defined as "a high-end user-computer interface that involves real-time simulation and interactions through multiple sensorial channels."¹ In health care, VR has been used as an analgesic,² especially for acute pain,³ such as from burn wounds⁴ and dental procedures,⁵ and as an anesthesia adjunct.⁶ Chronic pain is also amenable to VR, where it has been used for back pain, neuropathic pain, complex regional pain syndrome, and phantom limb pain.^{2,7–9} In addition, VR has shown value in mental health treatment, such as for depression, anxiety, social phobias, agoraphobia, posttraumatic stress disorder, autism, obsessive-compulsive disorders, addiction, and schizophrenia.^{10,11}

Use of VR has been studied in hospice or palliative care settings,^{12–21} including for patients with dementia.²² Persons nearing the end of life often lose their sense of autonomy and dignity;²³ by offering some control over their environment, VR may help them regain some of their lost identity.²⁴ Virtual reality can simulate being in nature,²⁵ with results similar to physically being outdoors.^{26,27} Immersion in nature or "forest bathing" has multiple health benefits, including lowering blood pressure, slowing heart rate, increasing heart rate variability, decreasing cortisol levels, increasing immune activity, and improving mood.^{28–30} Virtual reality has also been used for bucket-list goals, allowing patients to "visit" places or experience activities virtually that are no longer physically accessible to them.^{31,32} Some hospitals have created customized VR videos for patients,³³ although generic experiences may be as effective.¹⁷ Virtual reality experiences appear more effective when patients visit and recall places they have been before,¹⁴ although sometimes patients report feeling sad when they are reminded of the past.¹² Several recent systematic or scoping reviews have described VR use in hospice or palliative care settings and concluded that VR is a potentially helpful intervention with few adverse effects, but more and larger studies of its effectiveness and outcomes are needed.^{34–37} Little has been published on the duration of the VR effect. One report noted that the beneficial effect was still present 1 hour later.¹² Another study of cancer patients undergoing chemotherapy reported that the effect of VR on anxiety lasted 2 days.³⁸

In this study, we sought to learn more about the effects and duration of head-mounted display VR (HMDVR) by showing nature and bucket-list videos to patients nearing the end of life. We hypothesized that both types of videos would decrease symptoms and that patients would find the most effective bucket-list videos to be those for which they had more experience or a stronger connection. We tracked functional status to learn which patients benefited the most.

PATIENTS AND METHODS

This study was approved by Mayo Clinic Institutional Review Board. We recruited a convenience sample of 30 adult patients enrolled in hospice or palliative care from March 11, 2022, through July 14, 2023. Inclusion criteria included capacity to consent to the study and physical ability to tolerate the VR experience. Those with open sores on the head or a history of induced seizures were excluded. Eligible patients received a brief description of the project, and those who were interested were scheduled for a visit with a research team member. At that visit, the team member gave a more complete description of the VR experience in a neutral manner, obtained informed consent, and conducted the first video session.

Symptoms were recorded using a printed form of the revised Edmonton Symptom Assessment Scale–revised,^{39,40} which rates the severity of 9 symptoms on a scale from 0 to 10. Patients were asked to complete the form before, immediately after, and 2 days after each VR experience. The patient's Palliative Performance Scale (PPS)^{41,42} score was recorded to track functional status.

Intervention

Once the baseline symptom survey was completed, patients were encouraged to sit in a swivel chair with adequate space for turning full circle. Interpupillary distance was measured, the headset adjusted and placed, and the video started. Participant comments were noted. Every 5 minutes during the video until 10 minutes afterward, the researcher asked patients about adverse effects such as nausea or motion sickness. Project team members were coached to avoid making statements of encouragement or enthusiasm. For their VR experiences, participants wore a cordless Meta Quest 2 headset with a comfort head strap and vinyl cushion face mask. Appropriate infection control protocols were maintained throughout the study.

All participants viewed the first video, a 15-minute, 360-degree video of 19 serene nature scenes with ambient sounds (Table 1 and Figure). Our research team worked with Blend Media in United Kingdom to compile the video; scenes were selected to maximize variety over all 4 seasons. For the second experience, participants selected up to 30 minutes of short (mean, 5.7 minutes; range, 1–23 minutes), 360-degree video clips from a list we compiled of 49 possible bucket-list experiences. We attempted to include a wide array of clips (Table 2); all were publicly available and approved by Mayo Clinic Institutional Review Board. Once each video clip was viewed, participants answered the following questions with the corresponding responses:

- Have you visited the place or participated in the experience before? (Response: never, a little, a lot)
- How strong is your connection to the experience? (Response: none, mild, strong)
- What is your overall impression of the video? (Response: not good, just okay, outstanding)

Data Analysis

Edmonton Symptom Assessment Scale–revised scores were analyzed by using a paired t test. The distribution of the within-subject Edmonton Symptom Assessment Scale–revised score differences was approximately normal. Immediate effectiveness of the intervention was determined by comparing the mean symptom scores before and immediately after the experience. The duration of effectiveness was determined by comparing the mean symptom scores before and 2 days after the intervention. The Spearman coefficient was used to measure the association between the number of minutes the bucket-list videos were viewed and symptom improvement and to adjust for the skewness of the viewing time distribution. A paired t test was used to measure the association between improvement in symptom score with subsets created by level of experience, connection, or overall video quality for the bucket-list videos. Analysis of variance was used to compare functional status groups with initial symptom scores and amount of change after the nature video. A 2-tailed P value of <.05 was considered statistically significant. Analyses were done with BlueSky Statistics, version 7.4 software.

RESULTS

Thirty patients participated in the study: 12 women (40%) and 18 men (60%). The mean age was 74.7 years (range, 46–94 years). Primary diagnoses covered a wide variety of illnesses (Table 3). Visits occurred in the patient's home (n=25 [83%]), in a residential facility (n=4 [13%]), and in the hospital (n=1 [3%]). Anthropomorphic measures such as body mass and height were not available because these measures are not closely monitored at the end of life.

Of the 30 patients who participated in the first nature video experience, 27 (90%) completed the full 15 minutes. One patient stopped at 12 minutes due to fatigue, 1 stopped at approximately 12 minutes due to nausea, which cleared in 13 minutes, and a third patient stopped at approximately 7 minutes because of nausea and dyspnea, which cleared in 15 minutes. Participants who completed the video were given the option of seeing it again; 1 person did this. Immediately after the nature video, the mean total symptom score decreased significantly from 24.2 (possible total of 90) to 17.0 (Table 4), a decrease of 30% (P<.001). Individual symptom scores (rated from 0 to 10) improved significantly for drowsiness (feeling sleepy), which decreased 45% (P<.001); tiredness (lack of energy), 35% (P<.001); depression, 36% (P=.046). Lack of appetite decreased 23%, approaching but not meeting statistical significance (P=.07). No significant improvements were found for pain (decreased 15%, P=.34) or nausea (decreased 4%, P=.92).

Fifteen patients (50%) watched the bucket-list videos. Viewing time depended on the clips they selected and adverse effects; the mean viewing time was 21 minutes and 20 seconds (range, 5:00 to 31:52 minutes). Of these patients, 13 (87%) completed their planned program (Table 4). One patient stopped after 5 minutes due to dyspnea, and another stopped at 15 minutes due to fatigue and discomfort from the headset. The bucket-list videos decreased total symptom scores immediately afterward from a mean of 21.6 to 17.8, down 18%, which was not statistically significant (P=.11). The length of time the patient spent viewing the

videos did not correlate with improved symptoms (sample estimate, ρ =-.21; *P*=.45). For the 7 participants who reported a lot of previous experience with at least 1 video clip, scores decreased 7% (*P*=.69), and for the 9 participants who reported feeling a strong connection to at least 1 video clip, scores decreased 4% (*P*=.69). Only for the 12 patients who rated at least 1 video clip as outstanding did symptoms improve significantly (31% decrease, *P*=.03).

We wondered why only half of the enrollees participated in the bucket-list experience. Had they become too ill to participate? That certainly was true for 1 patient who died 2 days after enrollment and the first experience. Another patient who participated in the second experience died 9 days after enrolling, 7 days after the second session. Of those 15 who participated in the second experience, 13 died an average of 210 days after enrollment; 2 are still alive at the time of writing. Of those who declined the second experience, 11 died an average of 190 days after enrollment; 4 are still alive.

The return rate for the 2-day symptom survey was 20 of the 30 (67%) after the nature video and 8 of the 15 (53%) after the bucket-list videos (Table 4). When the symptom scores at 2 days were compared with the before scores, the benefit did not last: mean total scores for the nature video increased 6% over 2 days (P=.65), and those for the bucket-list videos increased 4% (P=.85). Symptom scores for the nature video were correlated to participants' functional status by PPS scores. Eight patients (27%) had a PPS score of 60% (correlating [approximately] with needing occasional assistance), 14 (47%) were at PPS 50% (considerable assistance), 7 (23%) were at PPS 40% (mainly assistance), and 1 (3%) was at PPS 30% (total assistance, grouped with 40% for this analysis). All 3 groups reported significant improvement. Those patients with lower functional status tended to have more symptoms before the intervention (mean total score: PPS 40%, 26.8; PPS 50%, 22.7; and PPS 60%, 24.4), and they tended to improve more (mean total score change: PPS 40%, decreased 42%; PPS 50%, decreased 29%; and PPS 60%, decreased 18%), although the differences were not statistically significant (P=.83 and P=.31, respectively). Patient acceptance and enthusiasm for the experience are reflected in sample comments in Table 5 (Supplemental Videos [short and long versions], available online at https:// www.mcpdigitalhealth.org/).

DISCUSSION

This study supports other findings that HMDVR may be used for temporary symptom relief at the end of life with minimal adverse effects.^{34–37} Symptoms that improved the most after our nature video (drowsiness, tiredness, depression, anxiety, sense of well-being, and dyspnea) were similar to those reported in other studies.³⁴ Our overall dropout rate (5 of 45 experiences or 11.1%) is consistent with a previously reported rate of 15.6% from a meta-analysis.⁴³ The strong therapeutic effect of the nature video is consistent with reported health benefits of forest bathing or spending time in nature.^{28–30} It is true that VR offers a limited experience. Nature's bounty cannot be touched, and nature's scents are absent; however, our study and others support that sights and sounds in VR retain substantial power.^{26,27}

Differing theories have been proposed for nature's powerful effect. One theory is that our attention has limited capacity, and nature provides gentle fascination to distract us from other matters.⁴⁴ A second theory attributes it to genetics; we evolved outdoors, and those who are attracted to more agreeable environments are more likely to survive.⁴⁵ In another theory, the "vis medicatrix naturae," the innate force of healing in the human body, extends to all living things, and we are most at harmony when we are with them.⁴⁶ Finally, the power of nature has also been ascribed to a spiritual sense of positive awe, where nature reminds us of our humble place on earth.⁴⁷

Our investigation contributes 4 new findings to the literature. First, to our knowledge, our study is the first to directly compare a nature video to bucket-list videos. We were surprised by the weakness of the bucket-list videos because they have been commonly featured in news about hospice care in the popular press.^{32,33} To learn whether the 15 patients who completed the bucket-list videos were simply harsher reviewers, we reexamined their nature video scores. Their mean total symptom scores immediately after the nature video decreased from 19.0 to 12.5 (34%, P<.001), an even greater decrease than in the total group (30%), supporting the conclusion that the bucket-list videos were not as powerful as the nature video. Second, we expected the most effective bucket-list videos to be those for which patients had the most experience or felt the most connected. This was not the case. Participants who reported at least 1 video as outstanding improved more, and only this group's improvement scores met statistical significance. Our results suggest that the quality of the video may be more important than matching the video to the person's previous experience or sense of connection. Third, the duration of effectiveness of a single episode of VR has not been well-researched. Our findings support that the time frame is less than 2 days. Finally, our results reported a tendency for patients of lower functional status to have more symptoms and to improve more with VR therapy. Although not reaching statistical significance, this introduces a direction of investigation for the future. Because functional status roughly correlates with severity of illness and prognosis,⁴⁸ it may be that a wide range of patients at the end of life are acceptable for VR therapy, even those, or especially those, with advanced disease.

In addition, we have 2 other observations. Like others,¹⁵ we found that keeping the nasal cannula oxygen tubing in place to be difficult while patients wore the VR headset. This situation warrants more thought and innovation. In addition, although others have successfully offered a virtual roller-coaster ride,¹⁶ we purposely avoided this or other activities that might be too stimulating. Our caution was probably unnecessary; no video was stopped for being too adventurous, and for our video with the most action, a whitewater river raft ride, both patients who viewed it rated it as outstanding and exhibited a high degree of engagement and pleasure while viewing it.

Limitations

As with many other studies, our sample size was small (30 patients), and our only comparison was level of symptoms before and after the intervention. Although we worked to avoid researcher enthusiasm, it is possible that patients tended to give us answers they thought we would like. Location varied (home, residential facility, or hospital), which may

have affected the outcome. Although some patients probably declined to participate in the second VR experience owing to their health issues, many who declined the intervention lived quite a long time afterward; we missed an opportunity to note their reason for dropping out. Our protocol for assessing adverse effects every 5 minutes may have interrupted the VR experience and, in retrospect, probably was not needed. Our study design was limited to no more than 2 VR experiences; other studies have successfully modeled repeated exposures.^{17,21}

Our conclusion that bucket-list experiences were less effective than the nature video may be flawed. As the second activity, the experience may have lost some of its novelty, diminishing its impact. The quality of these optional video experiences was inconsistent. Of the 69 bucket-list video clip viewings, patients rated them outstanding only 32 times (46%). We also acknowledge that rating a video as outstanding is subjective, with a range of interpretations. Our selection of bucket-list experiences was not as personalized as has been reported by others.¹⁴ We were limited by video clips we could find publicly. Like Niki et al,¹⁴ we offered Google Street View; however, the 1 patient who selected it had technical difficulties with home internet access, thus making his experience suboptimal. It is possible the bucket-list video clips would have had a stronger effect if we had been able to offer those that were more personalized, more diverse, or more consistently high-quality.

Implications for Future Research

Recent review articles on VR at the end of life commonly note the need for more studies with standardized protocols, more patients, and controls.^{34–37} Other researchers have integrated gaming into the VR experience,⁴⁹ and some research suggests that increasing interactivity and immersion with the VR environment increases its effectiveness.^{10,19} With this in mind, we suggest that a model future study would include multiple centers with substantially more patients; a control group; a common protocol with multiple measures, including symptoms, fun, happiness, and quality of life; sustained exposure to VR with increased interactivity with the VR environment; and measurement of the physiologic and psychological health benefits, similar to research in forest bathing. On the basis of limitations that we experienced, we submit that the following will be needed to increase the use of HMDVR in hospice and palliative care: more high-quality 360-degree videos; headsets that are more elder friendly; more intuitive, easy-to-use instructions; and widespread high-speed internet access for increased interactivity.

CONCLUSION

Our study supports that HMDVR videos can be effective and safe in temporarily alleviating patient symptoms near the end of life, especially drowsiness, tiredness, depression, anxiety, absence of well-being, and dyspnea. However, the effect wears off before 2 days. Serene nature videos appear to be more effective than bucket-list experiences, and quality of the bucket-list videos may be more important than a person's past experiences or sense of connection. Our study also suggests that more infirm patients with lower functional status may be more likely to benefit from VR, although further research is needed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations and Acronyms:

HMDVR	head-mounted display virtual reality
PPS	palliative performance scale
VR	virtual reality

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FIGURE.

Still images from the nature video (Blend Media; used with permission). See Table 1 for complete contents of the video.

TABLE 1.

Contents of the Nature Video

Contents	State/country
1. Field of blooming canola flowers	Chile
2. Kayakers on a lake	Sweden
3. Stream in forest in fall	Pennsylvania
4. Swans on a lake	Northern Germany
5. Lake Tahoe in winter	California
6. River in winter	Idaho
7. Snow-covered trees during a snowfall	Canada
8. Northern lights	Alaska
9. Early spring in a forest clearing	Russia
10. Mountain hike in spring	Russia
11. Deer feeding	France
12. Peaceful forest in spring	Germany
13. Waterfall	Chile
14. Sheep and goats	Chile
15. Bobbing boats	Maine
16. High waterfall	South Africa
17. Open field in Yosemite	California
18. Sunlight over fallen trees in Muir Woods	California
19. Cathedral Cove Beach	New Zealand

TABLE 2.

Bucket-List Video Experiences (No. of Times Selected)

Volcano (3),^{*a*} lightning storm (2),^{*a*} pandas (1),^{*a*} butterflies (1),^{*a*} campfire (1),^{*a*} collection of nature scenes with music (1),^{*a*} bears (1), baby pandas (1)

Travel Victoria Falls (2)^b

Google Street View: Slovenia (1), Hawaii (1),^{*a*} Antarctica (0), Rome (0), Venice (0), Paris (0), London (0), Angel Falls (0), Hike in the Alps (0), Big Falls, Eau Claire, Wisconsin (0)

US National Parks: Grand Canyon (6), Yellowstone (4),^b Yosemite (3),^b Glacier (2), Bryce Canyon (1)

Adventure

High altitude flyovers: Spring (4),^{*c*} winter (2),^{*b*} summer (1),^{*a*} autumn (1),^{*a*} Alps (1) Flying: Hot air balloon (5), helicopter (3),^{*b*} small airplane (1), International Space Station (1)^{*a*} Sports: Surfing (3),^{*a*} whitewater river rafting (2),^{*b*} kayaking (1), water skiing (1),^{*a*} fly fishing (1), golfing (0), snow skiing (0) Underwater: Reefs (3),^{*a*} turtle, jellyfish, and stingrays (3),^{*b*} dolphins (1)^{*a*} Riding: Motorcycle (1),^{*a*} race car (1), horse (1),^{*a*} train (1), bicycle (0), tractor (0)

^aDenotes each time 1 participant rated a video as outstanding.

^bDenotes each time 2 participants rated a video as outstanding.

^cDenotes each time 3 participants rated a video as outstanding.

TABLE 3.

Primary Diagnoses (No. of Patients)

Cardiac (6)

Hypertensive heart disease with heart failure (2), hypertrophic obstructive cardiomyopathy (1), acute bacterial endocarditis (1), coronary artery disease (2)

Oncology (13) Pancreatic cancer (4), colon cancer (2), lung cancer (3), malignant ascites of probable female genital origin (1), glioblastoma multiforme (1), liposarcoma (1), esophageal cancer (1)

Neurology (1) Parkinson disease (1)

Pulmonary (5) Chronic obstructive pulmonary disease (4), idiopathic pulmonary fibrosis (1)

Nephrology (2) End-stage renal disease (2)

Others (3) Amyloidosis (1), multiple system atrophy (1), inclusion body myositis (1)

Mean Symptom Scores (ESAS-r)^a

		Scores		
	Before (SD)	After (SD)	Change (%)	Ρ
Immediate effect				
Nature video total $(n=30)b$	24.2 (14.6)	17.0 (14.4)	-7.2 (30)	<.001
Drowsiness	3.53 (2.86)	1.93 (2.66)	-1.60 (45)	<.001
Tiredness	3.67 (2.82)	2.37 (2.71)	-1.30 (35)	<.001
Depression	2.23 (2.28)	1.43 (1.78)	-0.80 (36)	.01
Anxiety	3.00 (2.75)	1.97 (2.37)	-1.03 (34)	.04
Absence of well-being	3.31 (2.58)	2.59 (2.69) ^C	-0.72 (22)	.048
Dyspnea	3.23 (2.82)	2.58 (3.05)	-0.65 (20)	.046
Lack of appetite	2.90 (3.24)	2.23 (2.69)	-0.67 (23)	.07
Pain	1.35 (1.84)	1.15 (1.87)	-0.20 (15)	.34
Nausea	0.90 (1.77)	0.87 (1.96)	-0.03 (4)	.92
Bucket-list videos total (n=15)	21.6 (18.6)	17.8 (17.1)	-3.8 (18)	11.
A lot of experience (n=7)	17.1 (16.8)	16.0(16.1)	-1.1 (7)	69.
Strong connection (n=9)	22.1 (20.2)	21.2 (20.3)	-0.9 (4)	69.
Outstanding (n=12)	18.8 (17.8)	13.0 (13.4)	-5.8 (31)	.03
Delayed effect: 2 d later (total scores)				
Nature video (n=20)	21.4 (14.1)	22.8 (20.4)	+1.4 (6)	.65
Bucket-list videos (n=8)	24.0 (15.9)	24.9 (12.1)	+0.9(4)	.85
Immediate effect of nature video by PPS	(total scores) ^d			
PPS=60% (n=8)	24.4 (18.7)	19.9 (16.7)	-4.4 (18)	.03
PPS=50% (n=14)	22.7 (14.8)	16.2 (13.8)	-6.5 (29)	.05
PPS 40% (n=8)	26.8 (10.7)	15.6 (14.6)	-11.2 (42)	<.001
a				

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Abbreviations: ESAS-r, Edmonton Symptom Assessment Scale-revised; PPS, Palliative Performance Scale.

 $b_{\text{Possible score of 90 (scale 0-10).}}$

 $c_{n=29.}$

d Approximate descriptions: 60%, occasional assistance; 50%, considerable assistance; 40%, mainly assistance (7) or total assistance (1). –, decrease; +, increase.

TABLE 5.

Comments From Patients

"This is neat. Every direction you look, there is something to look at."

"I feel great. It's great to get out of the building and get some fresh air."

"I'm doing great. Aren't you jealous?"

"I feel in control of my body."

"It's majestic, so many cool places that I've never been."

"Sure beats sitting in my hospital bed looking out the window and seeing nothing."

"I feel beautiful and peaceful. I feel good."

"It's all so real looking. Like I could touch it. This one is so amazing."