Cost-Benefit Analysis of Mood Uplifting Paintings in Hospitals

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The Net Present Value of Benefits (NPVB) of installing mood uplifting paintings on hospital stay lengths were projected using a Cost- Benefits analysis. Net benefits were estimated from the "effect size" of mood uplift from Abstract Romanticism paintings and the average cost of hospital stay at $2,000/day. We used a nominal Social Discount Rate of 4% and a period of ten years. The analysis was conducted for a sample of hospitals and states. The results showed that installation of Abstract Romanticism paintings would have net benefits and this enhancement to the patient environment would likely result in substantial healthcare savings.

INTRODUCTION

The primary purpose of this research was to find an innovative and progressive way to reduce the cost of U.S. hospital care. Hospital stay costs have been on a rising trajectory and are projected to rise bout 6% per year (US Bureau of Labor Statistics). We examined whether a modest change to patient environment could result in an overall cost reduction. We examined the cost-benefit ratio of installing artwork that would lift the mood of patients. The Abstract Romanticism paintings of Kamran Khavarani became our focus because the late Professor Albert Boime (2008b), perhaps the foremost Social Art Historian of our time, wrote that Khavarani's work "…resurrects the possibility that art can change the world by reaching out to the heart and imagination of the spectators." In addition, Mozayeni and her colleagues (Amirmostofian & Mozayeni, 2016; Mozayeni & Amirmostofian, 2016; Mozayeni, Heiner & Amirmostofian, 2017) found that viewing Khavarani's Abstract Romanticism paintings resulted in significant improvements in reported mood compared to viewing paintings of other artists. There is a growing awareness that visual elements of the patients' environment (like artwork on the wall, a window in the room) facilitate the healing process and are associated with reductions in hospital stay length (Eisen, Ulrich, Shepley, Varni, & Sherman, 2008; Hathorn & Nanda, 2008; Lankston, Cusack, Fremantle, & Isles, 2010; Sherman, Varni, Ulrich, & Malcarne, 2005; Sternberg, 2009; Ulrich, 2006; Ulrich, 2013; Ulrich, Bogren, Gardiner, & Lundin, 2018). Hathorn and Nanda (2008) argued that art should be used as a positive distraction—to divert patient attention from the stress of the hospital environment.

The literature shows that paintings do affect viewers' emotion in hospitals. Many hospital administrators are beginning to recognize that fact. Hathorn and Nanda (2008) reported that a 2003 national survey concluded that 73% of the 2,000 responding hospitals had permanent displays of visual arts. The art selections of hospitals matter. A case in point can be seen in Figure 1. This reproduction is installed in a major New York hospital that is a center for complicated surgeries, including heart surgeries and liver transplants. The figure depicts an operating room scene with surgical team, an array of surgical

tools, and even blood. Instead of promoting well-being, however, this might trigger a fear reaction in patients about to undergo surgery.

FIGURE 1
OPERATING ROOM ARTWORK INSTALLED IN A MAJOR NY HOSPITAL

Hospitals have begun to recognize the therapeutic benefit of visual art. Hathorn and Nanda (2008) called for evidence-based analysis of the effects of art interventions on health outcomes. We offer an evidence-based approach that explores the Cost-Benefit outcomes of installing visual arts with a calming effect in hospitals.

We argue that there would be a benefit if hospitals displayed art that stimulates positive emotions. First, we review the literature that shows that viewing art can evoke strong emotions. We summarize research that shows reduced distress leads to improved health outcomes. We make the case that installing uplifting art in hospitals leads to positive benefits, including reduced hospital stays. Finally, we present a Cost-Benefit model to illustrate the potential cost savings that can be realized when hospitals use *Abstract Romanticism* paintings.

Visual Art and Emotion

There is a growing body of literature that shows that visual art can evoke strong emotions. Tinio and Gartus (2018) showed that people reported experiencing very similar emotional responses to the same pieces of art. These emotions were diverse and varied in intensity. They also showed that the emotions viewers reported corresponded to the emotions depicted in the art. When individuals spent more time viewing the art, they reported more diverse emotions. Essentially, visual art displays evoked common emotional responses across viewers.

Pelowski et al. (2018) showed that viewers reported aesthetic experiences with pieces of visual art that were comparable. Viewers' reactions produced common emotional responses that were unique and distinct to the two pieces of art.

Kragel, Reddan, LaBar, and Wager (2019) reported that emotion schemas were embedded in the visual processing system. They demonstrated that visual images could be represented by a complex combination of visual features (e.g., angle, field size, eccentricity) that are linked to emotion schemas. They also showed that the FMRI's of individuals viewing visual art (photographs or video clips) processed emotional content in the visual cortex. This processing occurred at the sensory level and means that emotions are processed quickly and decoded at the same time as other visual features of the artwork. Kawabata and Zeki (2004) reported that the perception of different categories of paintings are associated with distinct and specialized visual areas of the brain, that the orbito-frontal cortex is differentially engaged during the perception of beautiful and ugly stimuli, regardless of the category of painting, and that the perception of stimuli as beautiful or ugly mobilizes the motor cortex differentially.

Reduced Distress Leads to Positive Health Outcomes

Sternberg (2009) suggested that a soothing environment can accelerate hospitalized patients' healing and reduce their stays. She argued "beauty" can trigger healing, instill peace, and reduce stress. She reviewed research indicating that the health of the environment is closely linked to personal health. In her research, she reported that arts in a hospital environment can reduce the duration of hospitalization. Hathorn and Nanda (2008) in their study of patients at a Utah Hospital, concluded that patients' experience was affected by the environment and not just the care they received. They suggested that "The physical environment is not a mere backdrop for healthcare delivery—it is an integral part of the hospital experience." (Hathorn & Nanda, 2008, p. 1).

Empirical evidence supported the idea that recovery was linked to less stress. In a review of the effects of psychological variables on surgical recovery, Mavros, et al. (2011) reported that perceived stress/anxiety was correlated with slower surgical recovery. For elderly men with diabetes, Baharlooei, Alavi & Adelmehraban (2017) found stress predicted the length of hospital stay. Greater stress was associated with longer hospital stays. Similarly, Wisely (2013) found that reducing psychological distress of burn victims improved wound healing and reduced the number of days it took for wounds to heal.

In his study of hospital environments, Ulrich (1984) found that hospital patients with window views of trees spent significantly fewer days (7.96) in the hospital than those without a window view (8.70). Patients with a tree view relied on less potent analgesics (acetaminophen and aspirin) and took fewer strong narcotics than those with a wall view.

Lankston and associates (Lankston, Cusack, Fremantle & Isles, 2010) investigated the effects of paintings in three new hospitals in Scotland: Scotland's Royal Infirmary of Edinburgh, the Stobhill Hospital, and the Victoria Infirmary in Glasgow. They reported that both patients and staff viewed art in hospitals positively. A qualitative evaluation of the Exeter Healthcare Arts Project found that the display of visual arts in that hospital was perceived by patients, staff and visitors to have a positive effect on optimism.

They reported that 43% of frontline clinical staff believed that the arts had a positive effect on healing and 24% believed that the arts improved clinical outcomes.

Figures 2 to 5 show samples of Kamran Khavarani's paintings. Albert Boime (2008) discovered this genre of painting and labelled it *Abstract Romanticism*. Based on previous research examining the uplifting power of the *Abstract Romanticism* (AR) genre of painting (Amirmostofian & Mozayeni, 2016; Mozayeni & Amirmostofian, 2016; Mozayeni, et al., 2017), we considered their use in hospitals.

Mozayeni and her colleagues examined the increase in mood that resulted from viewing *Abstract Romanticism* paintings. Amirmostofian and Mozayeni (2016) reported that viewing *Abstract Romanticism* paintings had a meditative effect on viewers. Mozayeni and Amirmostofian (2016) showed that viewers of *Abstract Romanticism* paintings, irrespective of their gender and age and their initial state of mood, reported an increase in positive mood. Mozayeni, et al. (2017)**,** conducted a *pattern analysis* of mood reports of individuals who visited three galleries, one of which was the *Abstract Romanticism* gallery (Khavarani's Gallery). Before and after moods were reported by viewers for each gallery they visited. Patterns for combinations of order, gender and age were examined. The plots for the time series of individual scores showed that when participants visited Khavarani's gallery, they reported a significant increase in their mood. They also showed that the uplifting effect of *Abstract Romanticism* paintings lasted after viewers left the gallery. This was not true after visiting the other galleries. In addition, there was no discernible effect of order, gender, or age on mood scores.

FIGURE 2
***ABSTRACT ROMANTICISM* PAINTING: 043L13WW_Freedom**

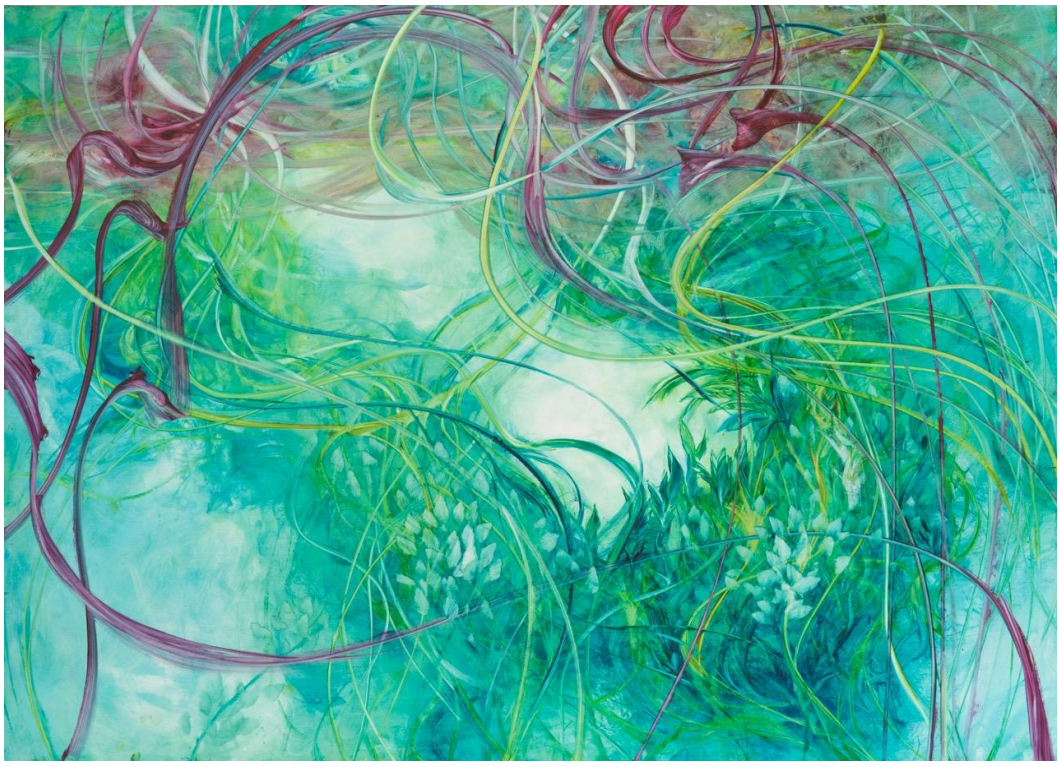

FIGURE 3
***ABSTRACT ROMANTICISM* PAINTING: 018L13WW_Tree of Life**

FIGURE 4
***ABSTRACT ROMANTICISM* PAINTING: 004L13WW_Unveiling**

FIGURE 5
***ABSTRACT ROMANATICISM* PAINTING: 007L13WW_The Beginning**

In the present study, we conducted a Cost-Benefit Analysis to predict the potential benefits of using the *Abstract Romanticism* genre of painting to reduce the length of hospital stays and thus associated costs. First, we examined three major hospitals in the U.S. and estimated what their cost savings would be if an *Abstract Romanticism* painting was installed in each patient room. Then we extended this to the three states with the most hospital beds and the three with the fewest hospital beds.

METHODS

A Cost-Benefit Model (Hyman, 2010) was applied to determine the Net Present Value of Benefits for the proposed project. The following were considered when developing our methodology and variables of our model:

a. The Cost-Benefit Model, which we adopt, is routinely used by the Federal Government and the World Bank. There are, however, a number of variables that need to be selected prudently. We detail our decision processes used to select these variables.
b. We take an evidence-based approach and derive our estimates from empirical data as elaborated below.
c. We are aware that other visual artworks (e.g., photographs of nature scenes) and genres of paintings may also have positive effects on patients' mood. Furthermore, we wish to acknowledge that we have NO information about the type of paintings currently installed in the sample entities in our study.
d. Our calculations of the cost of "paintings" is based on a quote from a dealer who carries Abstract Romanticism paintings. The quote is based on bulk purchases and with consideration for the nonprofit status of most hospitals. We have added $50 to the quoted price of $250 per piece for installation.
   Salvage Value of the paintings, we excluded the installation cost and did not include any appreciation premium to their resell values.
e. We considered a time horizon of ten years, assuming hospitals may wish to use other artworks after 10 years. Hence, we calculated the sum of PV of future benefits and compared them with the initial cost of the paintings. For the salvage value of paintings, we chose to focus on initial cost of the paintings instead of the appreciated market value of the artwork or their nominal value after 10 years.

Our variables were: 1) the estimated installed cost of paintings; 2) projected savings from shorter hospital stays, and 3) the social discount rate. We took a very conservative approach to our estimations to avoid typical pitfalls in setting up the Cost-Benefit analysis. We only calculated the direct benefits of installing the artworks on patients, although it is likely that there are indirect benefits to staff and caregivers, as well. Hathorn & Nanda (2008), observed that while patients and the public are the primary reasons to have arts programs, 55% of the programs they surveyed also focused on the reduction of stress and burnout in hospital staff. That said, we felt that we could not prudently quantify the dollar values for indirect benefits of installing artworks. Hence, we do not add a hypothetical figure to our equations of total benefits. There are, however, anticipated to be indirect benefits to the caregiver and employees which we cannot enumerate.

The PV of Costs and Benefits were calculated using Equations 1, 2 respectively. However, for Cost there is no PV calculation in our evaluations since costs occur one time only.

$$PVC= C_1/(1+r)^1 + C_2/(1+r)^2,\ldots\ldots.. C_n/(1+r)^n \quad (1)$$

$$PVB= B_1/(1+r)^1 + B_2/(1+r)^2,\ldots\ldots.. B_n/(1+r)^n \quad (2)$$

In general, the present value of X dollars to be received in n years from now at simple interest rate r is obtained by solving the equation $X= PV\ (1+r)^n$. Present value for benefits of X in n years is: $PV=X_1/(1+r)^1 + X_2/(1+r)^2+\ldots\ldots X_n/(1+r)^n$. Thus, Net Benefit, PV(B)-PV(C), was calculated based on Equation 3, where S denotes the Salvage Value of investment (when applicable).

$$B_1/(1+r)^1 + B_2/(1+r)^2,\ldots\ldots.. B_n/(1+r)^n - [C_1/(1+r)^1 + C_2/(1+r)^2,\ldots\ldots.. C_n/(1+r)^n + S \quad (3)$$

Cost Data

The estimated installed costs of the paintings were based on data for the number of beds and the bulk reproduction cost of $300 per installed painting. For each artwork, we assumed the bulk reproduction price would be 5% of the market price based on the 2018-19 gallery price of $5,000. For the quantities we

project, the estimated purchase price would be $250. Based on national average, we have added $50 for installation cost. The number of paintings needed for each entity was calculated based on the number of hospital beds for that entity according to the American Hospital Directory for States. We considered one painting per patient room, assuming a standard semi-private room with two patients in a room who could easily share viewing one piece. We do not need to discount this cost for future values, since it is a onetime purchase and installation cost.

Projected Savings (Benefit) From Shortened Hospital Stays

We based our estimate of benefit in terms of reduction in hospital stay, on the effect size of *Abstract Romanticism* paintings on mood uplift from research by Mozayeni and her colleagues (Amirmostofian & Mozayeni, 2016; Mozayeni and Amirmostofian, 2016; and Mozayeni, et al., 2017). We ran a Repeated Measures Multivariate Analysis of Variance on the raw data from Amirmostofian and Mozayeni (2016). The dependent measure was the participants' mood after viewing paintings. Participants viewed painting at three different galleries including the Khavarani's *Abstract Romanticism* gallery. Thus, gallery was the within-subjects independent variable. The results showed a significant gallery effect (F (2, 249) = 810.55, p = 0.000). The effect size (partial eta squared) was 0.867. Essentially, 87% of the variance could be attributed to an increase in mood after viewing the Abstract Romanticism paintings. According to Cohen (1977, 1992), this is considered a large effect size.

We divided the effect rate by 1000 based on the idea that the savings in hospital stay reduction will occur 1 in 1000 cases. Thus, the benefit factor is 0.000867. We then multiplied this by the number of hospitalization days reported in the Hospital Statistics by State report from the American Hospital Directory for 2018. Reduction in cost was projected by multiplying the reduction in days by an estimate of per day cost of hospitalization. We used a conservative average estimate of $2,000 per day, which was approximately 87% of the reported rate for Nonprofit Hospitals of $2,289/per day. Table 1 shows the beds and total yearly hospital days per entities in our study.

TABLE 1
BEDS AND DAYS DATA: NINE ENTITIES

Entity	#Beds	Hospital Days
Mayo Clinic	2033	454,344
Johns Hopkins	1652	489,330
Mass General (MG)	1052	320,673
CA	73,898	14,206,798
TX	58,878	12,100,178
NY	56,469	11,686,524
VT	828	189,096
Alaska	1,231	240,048
WY	1,240	115,548

Source: American Hospital Data (MCR) Report for 2018

The Social Discount Rate

For the Social Discount Rate, we used 4%. This reflected the Fed's Inflation Target Rate of 2%, plus the real rate of interest, as the nominal rate to account for inflation. We decided against the BLS's inflation

rate of 5.67% because it seemed implausible, given that the cost of a one-day hospital stay of $2,000 in 2019 would escalate to $113.933 in the tenth year.

RESULTS

Analysis by Hospital

We used Excel to conduct the Cost-Benefit Analysis for all our cases, including the three top-ranking hospitals in the U. S., which are also teaching hospitals, namely Mayo Clinic, Johns Hopkins and Mass General. The initial benefit alone for all three surpassed their costs. In the first year, the benefits for Mayo Clinic is $790,558, with a cost of $304,950. For Johns Hopkins the first-year benefit was $851,434 with a cost of $247,800. For Mass General, the initial benefit was $557,971, with a cost of $157,800. We report their respective ratios in Table 3. All initial benefits are discounted in Excel. Over 10 years, their Present Value of Net Benefit (PVNB) was $6,815,747, $4,791,268 and $7,423,091, respectively. These projections included the Salvage Value of the paintings (their initial values, less their installation costs, unadjusted for inflation or appreciation after 10 years). See Table 2.

TABLE 2
DATA FOR NPVB CALCULATIONS, BENEFIT, AND COST COMPARISONS (B_1/C)*

Entity (1)	Pieces (#Beds/2) (2)	Cost (C) (3)	Days (4)	Initial Benefit before discounting (B_1) (5)	$ Salvage** (6)	$ NPVB (7)
Mayo	1,016	304,950	454,344	790,558	254,150	**6,617,819**
JH	826	247,800	489,330	851,434	206,500	**7,140,828**
MG	526	157,800	320,673	557,971	131,500	**4,680,370**
CA	36,948	11,084,400	14,206,798	19,286,856	9,737,000	**161,343,625**
Tx	29,439	8,831,700	12,100,178	21,054,310	7,359,750	**176,128,137**
NY	28,234	8,470,350	11,686,524	20,334,552	7,058,500	**170,116,839**
VT	414	124,200	189,096	329,027	103,500	**2,754,751**
AK Alaska	615	184,500	240,048	417,683	153,750	**3,492,545**
WY	620	186,000	115,548	329,027	155,000	**3,259,270**

*B_1 denotes the initial benefit
**Salvage Value/piece=Initial installed price ($300)–installation cost of $50

Analysis by State

Next, to illustrate the potential for savings as a result of installing uplifting artwork in patients' rooms, we considered the top three states with the largest number of hospital beds and the three bottom states. The top three are California, Texas and New York. The bottom three are Vermont, Alaska and Wyoming. These states also represent variations in size and regions of the country.

As shown in Table 2, we found that California had a one-time cost of $11,084,440, but the benefit in the first year alone was $19,286,856. For Texas, the cost was $8,831,700, which is far offset by a benefit of $21,054,310. For New York, the cost was $8,470,350 and the first-year benefits were $20,3324,552.

We reported the ratios for Initial Benefit/Cost and the NPVB/Cost ratios in Table 3. Clearly, in all three states, the benefits in the first year alone far exceed the costs. When Net Benefits were projected over 10 years, the benefit for all years were obviously higher.

TABLE 3
INITIAL BENEFIT/COST AND NPVB/COST RATIOS

Entity	Initial Benefit/Cost	NPVB/COST
Mayo Clinic	2.5	21.70
Johns Hopkins	3.43	28.82
Mass General	3.5	29.66
CA	1.74	14.55
TX	2.38	19.94
NY	2.40	20.08
VT	2.67	22.18
AK (Alaska)	2.26	18.93
WY	1.08	17.52

As we report in Table 3, the initial benefit to cost ratio for all entities are higher than one, ranging from a low ratio of 1.08 (for Wyoming) and a maximum value of 3.5 for Mass General Hospital. Based on these ratios alone, it is obvious that the Net Present Value of Benefits (NPVB) in all cases far exceeded the one-time cost of the paintings. Although, mathematically it was obvious that the NPVBs would be higher, we calculated them to report the complete analysis.

For the top three states with the most beds, the NPVB value for California is above $161 million, for Texas over $176 million, and for New York over $170 million. For the smallest states, Vermont had a NPVB of nearly $3 million, Alaska was nearly over $3.5 million, and Wyoming was over $3.25 million. For the three hospitals in our study, the estimate is near $7 million for Mayo Clinic and over $7 million for Johns Hopkins, and more than $4.5 million for Mass General.

We also calculated the ratios of NPVB of all entities to their C, where C denotes a onetime cost. In our data the highest value of 29.66 for that ratio is for Mass General and the lowest value of 14.55 for the state of California, as we have recorded (See Table 3.).

Below, we summarize our findings and underscore our key points and offer policy recommendations for a public-private scheme for reducing the cost of hospital stays in the U.S.

CONCLUSION

In this study we used a Cost-Benefit Model to quantify the costs and benefits of using *Abstract Romanticism* paintings in patient rooms in three hospitals, and six states. The Cost-Benefit Model is commonly used by both the Federal Government AND World Bank for various projects. This model involves multiple estimates and researchers need to select these prudently to avoid double counting and exaggerated valuations. We have considered these judiciously to avoid such consequences.

We carefully measured Benefits and their NPVs. To determine the benefits, we conducted a Repeated Measures MANOVA Test to determine the "effect size" of mood change (0.867), as the result of viewing *Abstract Romanticism* paintings. We took a highly conservative fraction of this effect size (0.00087). This highly conservative fraction is an attempt to eliminate any risk associated with the effectiveness of the project. Along with that low rate, we also applied a conservative constant value of $2,000 per day for the cost of hospitalization which is below the average for non-profit hospitals for 2018.

Furthermore, we have selected a short time horizon to allow flexibility for entities to switch their artwork and used a fairly low social discount rate that is the sum of the Federal Reserve's Inflation Target Rate (2%), plus the real rate of interest (2%).

The cost of paintings in our calculations is based on an actual projection from a vendor who sells *Abstract Romanticism* painting reproductions, who provided a written estimate for bulk purchases of reproductions for nonprofit entities. We added $50 for installation of each piece. We also used an extremely conservative Salvage Value for the paintings after ten years, keeping at their initial values. We have assumed NO appreciation for the artworks and no inflation premium. The Salvage Value figure also excluded the installation cost.

Our benefits do not include secondary benefits to the employees (hence hospitals) or caregivers and resulting productivity gains to employees and to patients as a result of shorter hospital stays. We know that these represent the spillover of using uplifting art works in hospitals. Yet, their quantifications can be nebulous. So, we have not included them in our estimates. These additional benefits, mostly in the form of added productivity, can add social benefits through the economy as a whole.

Our results illustrated that the potential net benefit of using *Abstract Romanticism* Paintings to create "healing spaces" exceeds their cost by several fold.

For clarity, we enumerate the key facts relating to our methodology and hence the viability of this project.

1. Our research is evidence-based.
2. We based our evaluation of benefits on data demonstrating the effectiveness of Abstract Romanticism paintings to improve mood and took 1/1000 of that rate to minimize the risk of projects.
3. We determined the nominal value of benefits, with the conservative figure of $2,000 per day, well below the rate reported for the three types of hospitals and for the states we consider.
4. We enumerated only direct benefits.
5. We carefully determined our discount rate, which is the sum of the real rate of interest (2%), plus the annual Fed's Inflation target of 2%, amounting to 4% for estimating the nominal values for 10 years. We did not use the Bureau of Labor Statistic (BLS) inflation rate of 5.76% for hospital stay days to calculate the nominal values of benefits for the timeframe, because we considered it

implausible given the current rate of inflation in the U.S and the typical cost of one day in the hospital.

6. We take a highly conservative value for the Salvage price of the paintings. We do not account for their potential appreciation or their nominal values after ten years.

Policy Recommendations

We propose a progressive, innovative, and financially feasible way to reduce the cost of healthcare in the U.S. With leadership, such projects can benefit all stakeholders, including taxpayers by reducing costs associated with hospital stays. Currently, Medicaid and Medicare pay for about 50% of the cost of one day in a hospital and that cost is projected to rise. The daily hospital cost constitutes the largest component of healthcare costs in the U.S. (and beyond). It is projected to continue on that trajectory at an astonishing rate of nearly 6% per year, well above the CPI. If mood uplifting paintings are installed in hospitals, our results project that these programs may save billions of dollars. In addition, private insurance companies and patients themselves will realize substantial financial savings. Hospitals, who also benefit from their improved image and increased labor productivity, could partner with other beneficiaries to share the cost of the art contracts. Based on the "Benefit Principle," insurance companies can be invited to contribute to the cost of the artworks. The salvage value of the investment alone pays back for the initial costs. Thus, these results offer an evidenced-based research approach to reducing costs associated with patient hospital stays. The underlying rationale is that the Abstract Romanticism paintings will reduce stress and improve mood. We suspect that these results may have implications for any type of organization interested in improving their work environment. Based on these projections the installation of Abstract Romanticism artwork in office buildings may lead to improved worker mood and reduced stress levels. Future research may want to test the effects of these visual art installations on worker well-being and productivity.

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