

A 6-Week Worksite Positivity Program Leads to Greater Life Satisfaction, Decreased Inflammation, and a Greater Number of Employees With A1C Levels in Range

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Objective: To determine whether a 6-week Positivity Program could impact employee cardiovascular inflammation, blood sugars, cortisol, dehydroepiandrosterone (DHEA), and/or life satisfaction. **Methods:** Pre- and post-study blood draw and life satisfaction questionnaire tracked changes in 10 cardiovascular and inflammatory biomarkers for 63 employees who participated in a 6-week Positivity Program comprised of three interventions: gratitude, HeartMath's Heart Lock-In, and yoga stretches with guided imagery. **Results:** Improvements were recorded in life satisfaction as well as in seven of 10 cardiovascular and inflammatory biomarkers, including high sensitivity C-reactive protein (HsCRP) (−27%), hemoglobin A1c (HbA1c) (−1%), glucose (−2%), myeloperoxidase (MPO) (−5%), lipoprotein-associated phospholipase-A2 (Lp-PLA2) (−9%), apolipoprotein B (ApoB) (−6%), and DHEA (1%). No improvements were recorded in cortisol (11%), small-dense LDL (sdLDL) (0%), or oxidized LDL (OxLDL) (7%). **Conclusions:** Data suggest that engaging in 6 weeks of a workplace Positivity Program may improve employee life satisfaction, blood sugar levels, and some markers of cardiovascular inflammation.

Keywords: C-reactive protein, employee wellness, hemoglobin A1c, positive emotions, reducing inflammation

Sarasota County Government (SCG) is a self-insured organization with approximately 3200 employees. Including retirees and dependents, Sarasota County insures approximately 7200 people. The Health & Benefits Department of SCG includes an employee Wellness Program. The SCG Wellness Program is charged with empowering employees to live healthier lives with the desired outcome to help keep health insurance costs within the market rate of inflation or lower.

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Learning Objectives

- Discuss evidence for the impact of life satisfaction and cardiovascular and inflammatory biomarkers on chronic disease risks.
- Summarize the elements of the 6-week workplace positivity program evaluated in the present study.
- Discuss the effects of the positivity program on life satisfaction and biomarkers of blood glucose, inflammation, and stress responses.

Because of this goal, the Wellness Program creates and offers diverse programs to their employees with the intent of positively impacting variables affecting employee well-being and healthcare costs. The 6-week Positivity Study was a Wellness Program offering created in response to the clear data that links chronic disease with high healthcare costs. According to the Centers for Disease Control & Prevention (CDC), 75% of all healthcare costs are linked to chronic conditions.¹

LITERATURE REVIEW

Some of the chronic diseases associated with the greatest healthcare expenditures include heart disease, obesity, diabetes, hypertension, and cancer.¹ In a review of literature, the investigators focused on four elements shown to impact chronic diseases: life satisfaction, hemoglobin A1c (HbA1c), inflammation, and cortisol/DHEA balance.

Life Satisfaction

Prospective studies have indicated that the prevalence of smoking, obesity, physical inactivity, and heavy drinking, all of which have been shown to negatively impact health and healthcare costs, increase with decreasing life satisfaction.²⁻⁴ Conversely, increased life satisfaction is associated with good health behaviors, enhanced health, and even longer life.^{2,3} One recent study showed that higher life satisfaction was specifically associated with fewer doctor visits over time.⁵ Therefore, increasing life satisfaction was one goal of the 6-week Positivity Study.

Inflammation

It has been established that chronic, low-grade inflammation is closely linked to disease states⁶ including diabetes,⁷⁻⁹ as well as providing conditions that lead to cancer.¹⁰⁻¹² Inflammation has also been linked to an increased risk of heart disease, heart attack, sudden death, stroke, and peripheral arterial disease.^{13,14} C-reactive protein (CRP) levels, which indicate heightened states of inflammation in the body, seem to be correlated with levels of cardiac risk.^{15,16} Thus, decreasing inflammation was an intended goal of the 6-week Positivity Study.

Hemoglobin A1c

Hemoglobin A1c, which is an indicator of average blood sugar over the previous 2 to 3 months, can be an indicator of possible insulin resistance, prediabetes, and diabetes. According to an American Diabetes Association (ADA) study,¹⁷ people with diagnosed diabetes, on average, have medical expenditures approximately 2.3 times higher than what expenditures would be in the absence of diabetes. In addition, the study reported that diabetes accounts for more than one in five healthcare dollars spent in the United States.¹⁷ Therefore, lowering participant blood sugars was one goal of the Positivity Study.

Cortisol and DHEA

Studies have indicated that the above mentioned high cost chronic diseases (obesity, diabetes, hypertension, heart disease, and cancer) are associated with a hormonal balance of high cortisol and/or low DHEA levels.^{18–23} Therefore, the Positivity Study was also aimed at decreasing participant cortisol levels and/or increasing participant DHEA levels.

INTERVENTION SELECTION

Three areas already used in discourse and practice within some of the County's Wellness programs were positive emotions, yoga, and guided imagery. These areas were explored in more depth to find out if the literature showed enough promise for including them as study interventions.

Emotions

Negative emotions have been reliably associated with poorer health.²⁴ Chronically high levels of negative emotions are associated with adverse health behaviors, such as smoking, excessive alcohol consumption, greater body mass, and lower physical activity.²⁵ Other studies have found that negative emotions, including anxiety, anger, hopelessness, and depression are associated with morbidity and mortality from chronic illnesses such as cardiovascular disease,^{26–30} cancer,³⁰ and diabetes.^{31,32} There is also epidemiological evidence that suggests negative emotions are not only correlated with such diseases, but may even play an important role in the development of these high cost chronic diseases such as diabetes³² and hypertension.^{33,34}

If negative emotions are correlated with, and in some cases shown to play a role in the development of, chronic diseases, hypotheses have arisen stating the possibility that positive emotions could play a role in mitigating factors associated with chronic disease. Indeed, studies have finally begun to focus on positive emotions hoping to answer these questions. Recently, research has acknowledged the important role of positive emotions for our physical health.^{35–42} One study recently demonstrated that positive affect predicted lower levels of inflammation (inflammatory cytokines) in participants.⁴³ Another study reported that diabetics who learned to access the positive emotion of self-compassion had a significant decrease in their blood sugars as evidenced by HgbA1c levels.⁴⁴ Further, research by McCraty et al⁴⁵ indicated that positive emotion (in this case, appreciation) was linked to lowering cortisol and raising DHEA. Lastly, research shows that the practice of another positive emotion, gratitude, has led to lower blood pressure, a stronger immune system, being less bothered by aches and pains, and exercising more.^{46,47}

Because of these evidence-based findings, an important focus of the Positivity Study interventions was helping employees access and experience positive emotions, specifically gratitude and appreciation.

Yoga

The effectiveness of yoga for stress management has been well established in research and literature.⁴⁸ In addition, there is a

large body of research evidence attesting to the positive health benefits of yoga.^{49,50} Specifically, studies have shown yoga's positive impact on hypertension and heart disease,^{51–54} as well as its effectiveness in decreasing levels of salivary cortisol^{55,56} and blood glucose.^{57,58} One study concluded that regular yoga practice could minimize the inflammatory response.⁵⁹ In addition to these and other individual studies, several literature reviews have been conducted that examined the impact of yoga on specific health conditions including cardiovascular disease,⁶⁰ metabolic syndrome,⁶¹ and diabetes.⁶²

Because of this body of work, the County's Wellness program chose to incorporate yoga as an intervention in the Positivity Study.

Guided Imagery

According to the National Institutes of Health's National Center for Complementary and Integrative Health (NCCIH), "Relaxation techniques, including guided imagery, may be helpful in managing a variety of health conditions."⁶³ Research has indicated that guided imagery may be helpful in the treatment of stress and anxiety,^{64–68} and pain,⁶⁹ as well as in boosting the body's healing process generally.^{70–72} More specifically, research has shown that the practice of guided imagery can lead to decreasing mood disturbances and a reduction of cortisol levels.⁷³

Based on these findings, the Positivity Study also included guided imagery as an adjunct to one of the three interventions.

Three Wellness-Study Interventions

Based on the body of literature surrounding the above topics, and on the areas of expertise of the Positivity Study investigators, three specific interventions were chosen for the 6-week study period in an attempt to lower inflammatory markers, decrease HgbA1C, decrease cortisol, increase DHEA, and/or increase life satisfaction in Sarasota County Government employees. Those three interventions were: Gratitude Practice, accessing appreciation in the form of the Heart Lock-In® practice (from HeartMath Institute, Boulder Creek, CA), and yoga stretches with guided imagery.

Before outlining specific details of each study intervention, we move first to a description of the study participants themselves.

SETTING

As noted above, Sarasota County Government (SCG) has approximately 3200 employees. The average age of the County's employees is 47.2 with 30.24% women and 69.44% men in the total employee population. Sarasota County is spread across 556 square miles and its employees are dispersed throughout the county working out of more than 70 buildings. The County's Wellness Program institutes classes, courses, and programs—on-site at several of its main locations and also on-line—in order to allow employees access to various health promoting activities.

PARTICIPANT RECRUITMENT

The resources were not available to invite all 3200 County employees to participate in the study. Therefore, the following two groups of County employees were invited to participate in the Wellness Study.

1. Employees who were already signed up for the County's annual on-site Cardiovascular Screening were invited to join. The invitation email went out to those $n = 143$ employees.
2. County employees who had previously completed a Wellness Program series called HeartMath® (HeartMath Institute, Boulder Creek, CA) were invited to join. That invitation email went out to those $n = 201$ employees.

The employees from those two groups were solicited, through email invitations, to participate. There was no cash

incentive offered to employees to be in the Study. To be accepted into the Study employees had to:

1. Be signed up for the County's annual Cardiovascular Screening and have their screening bloodwork/labs drawn by a Cleveland HeartLab phlebotomist at a County facility between January 10, 2017 and February 9, 2017.
2. Attend a Wellness Study Kick-Off Session where participants filled out a life satisfaction questionnaire, and were given study materials and full instructions regarding how to proceed with the 6 weeks of interventions.
3. Sign informed consent/waivers to be in the study.
4. Agree to follow the study intervention guidelines for the 6-week study period including logging daily/weekly intervention practices, turning in the study calendar/log at the completion of the study period (see intervention details below), and filling out a life satisfaction questionnaire for a second time.
5. Agree to get a second blood draw done, within a specified 2-hour window of time from a Cleveland HeartLab phlebotomist at the off-site Cleveland HeartLab location 6 to 8 weeks post completion of 6-week intervention period (see study timeline below).
6. Agree that they could voluntarily drop out of the study at any time with no questions asked and without any negative consequences occurring.

Following the email invitations 88 employees followed through with having their initial blood work drawn as well as attending one of the Wellness Study Kick-Off Sessions (see below). Of those 88 who originally signed up to participate, 63 employees completed the 6-week Positivity Study, engaging in the three interventions, turning in their 6-week Study Calendar/Log, completing a second life satisfaction questionnaire, and having their blood drawn a second time.

Thus, the pre- and post-data came from bloodwork as well as life satisfaction surveys from 63 self-selected participants.

POSITIVITY STUDY INTERVENTIONS

We now move to a description of the three Positivity Study interventions.

Intervention No. 1 Gratitude Practice

The Gratitude Practice was the only intervention that participants were asked to do every day for the entire 6-weeks of the study. Thus, they were asked to complete the gratitude intervention 7 days a week for 6 weeks for a total of 42 days. Participants could use the Gratitude Practice sheets provided in the Wellness Study Binder (see Kick-Off Session description below), but they could also use any other "hard copy" material like a personal journal, notepad, or notebook, or anything else they could write on; they could also use technology such as texting or E-mailing, but it was important that the three daily "gratitude statements" were written down in some way and not just thought about.

Also, instead of writing only a list of the three things they were grateful for each day (eg, "smell of my candle," "my son's laugh last night while he was reading," "the colors of the sunrise this morning," etc), participants were instructed to use a full sentence for each of the three things they felt grateful for each day. Thus, they were asked to begin with, "Today, I am grateful for..." or "Today, I am grateful that..." The participants were asked to write three sentences each day.

Another important part of the Gratitude Practice intervention was that each day's gratitude list was to be specific. Instead of writing something general like, "Today, I am grateful for my health," which might not elicit a positive feeling of gratitude, they were asked to come up with something more specific such as,

"Today, I am grateful that I haven't had a cold all year" or "Today, I am grateful that I slept well last night and felt rested this morning."

Finally, regarding the Gratitude Practice intervention, participants were instructed to have all three things they were grateful for be different each day for the duration of the Wellness Study. That would mean by the end of the 6-week study period participants would have to come up with a total of 126 different things for which they were grateful. Thus, if a participant wrote, "I'm grateful for how my daughter hugged me this morning," then they were asked not to use that same thing again during the 6-week study period. However, they could use the same topic as many times as they wanted so, "Today, I'm grateful for my daughter's beautiful laugh" would work.

The three stipulations of the Gratitude Practice intervention: that they must be written down instead of simply thought about; that they must be specific; and that they must be different each day, were put into place with the intention of helping the employees amplify the experience of gratitude and also for the purpose of re-training the brain to make a habit of looking for positive circumstances for which they could be grateful.

Intervention No. 2 Heart Lock-In®

The Heart-Lock In® (HLI) is a practice from the Institute of HeartMath that involves an attempt to access and sustain a positive or renewing emotion such as appreciation, love, or care, and then to radiate that positive feeling toward oneself and also out to others. All three study investigators are Certified HeartMath® Trainers and were thus able to effectively teach the HLI practice to study participants. For this intervention, the participants were asked to practice a Heart Lock-In® 5 days a week for 5 minutes each practice, thus a total of 30 times during the 6-week study period.

At the Wellness Study Kick-Off Sessions, the study investigators taught the below Heart-Lock-In® steps to participants. Participants were given the written instructions for how to do the HLI technique. After teaching the technique, the investigators then lead participants through a 5-minute Heart Lock-In® so that everyone had successfully been through their first HLI of the 6-week study period.

Heart Lock-In® steps (from the HeartMath: Transforming Stress® training manual):

Step 1: Shift your attention to the area of your heart and breathe slowly and deeply.

Step 2: Activate and sustain a genuine feeling of appreciation or care for someone or something in your life.

Step 3: Radiate these feelings of care or appreciation toward yourself and others.

Intervention No. 3 Yoga Stretches with Guided Imagery

The third Positivity Study intervention was the practice of following a 30-minute yoga video session which included 5 minutes of guided imagery at the end. The 30-minute yoga video was created by the study investigators with the help of the County's Communications Department. This video was comprised of easy stretches with conscious breathing that investigators assumed all participants could do; however, during the Kick-Off sessions (described below), simple modifications were encouraged by the investigators for any participant unable to practice any particular stretch/movement. The guided imagery portion included the directions/suggestions that the participant's body was bringing itself into balance, healing itself, and increasing well-being. The guided imagery recording/script made specific reference to inflammation markers decreasing to healthy levels, cortisol, and blood sugars (A1c) decreasing to healthy levels, and DHEA increasing to healthy levels.

Each study participant was given a hard copy DVD of the yoga stretches with guided imagery practice. They were also sent a

link of the same practice which could be accessed on their work or home computers, phones, or other mobile technology. In addition, they were given the 5-minute guided imagery script both in hard copy form as well as on an audio link.

The participants were asked to do the yoga stretches with guided imagery intervention three times per week for the duration of the 6-week study, thus a total of 18 times during the intervention period.

In addition to the County created video of the yoga stretches with guided imagery intervention, during the duration of the Wellness Study one of the study investigators lead on-site classes of this same 30-minute yoga program at two of the most highly populated buildings. In this way, study participants could do the intervention (on their own time) in a group and at a county facility. The investigators added these on-site resources because the yoga stretches with guided imagery intervention took significantly longer to do (30 minutes) than the other two interventions (5 minutes or less). The intention in adding these resources was to increase accountability and motivation for the participants to engage in this intervention.

POSITIVITY STUDY KICK-OFF SESSIONS

The three study interventions outlined above were explained in depth to participants at the Study Kick-Off Sessions.

The Wellness Study Kick-Off Sessions were 60-minute pre-intervention meetings which were designed to help the employees become prepared to move successfully through their 6-week Study period. Eighty-eight employees attended one of the Wellness Study Kick-Off Sessions held at various County locations, or, if they were not able to come to one of the scheduled Kick-Off Sessions, attended a one-on-one session with a Study investigator who presented the same information given during the Kick-Off Sessions.

At the pre-intervention Kick-Off Sessions:

1. The investigators explained the role of the County's Wellness Program in the bigger picture of helping keep healthcare costs at market inflation or lower. Participants also heard/learned that Sarasota County is self-insured, and how that increases each employee's responsibility—if employees are interested in keeping their healthcare costs down—for taking efforts toward increasing their own physical and mental well-being.
2. Participants signed an informed consent that included the provision to drop out of the study at any time with no questions asked, and without any negative consequences.
3. Participants filled out the pre-Study life satisfaction questionnaire.
4. Investigators handed out a Wellness Study Binder to each employee which included all necessary study materials:
 - a. Study introduction letter
 - b. Instruction sheet for Positivity Study intervention No. 1 Gratitude Practice
 - c. Gratitude Practice daily pages which included some examples that used the stipulations of the Intervention: full sentences that were written, specific, and different each day.
 - d. Instruction sheet for Positivity Study intervention No. 2 Heart Lock-In®
 - e. Instruction sheet for Positivity Study intervention No. 3 yoga stretches with guided imagery
 - f. Activity calendar for logging practice of all three interventions
 - g. Resources page offering further reading and study regarding Positivity concepts.
5. Investigators went through the Wellness Study binder explaining each intervention in detail. After describing the Gratitude Practice intervention participants were asked to share some examples out loud. Where necessary the investigators invited the participants to be more specific, and continued until every participant

gave an example that fit the stipulations for the Gratitude Practice intervention. Participants were then guided to proceed with completing their first Gratitude Practice, writing and finishing three, "Today, I'm grateful for..." sentences on a Gratitude Practice Daily Page contained in their Wellness Study Binder.

6. The investigators next explained the Heart Lock-In® Intervention and as a group all participants (and investigators) did a 5-minute Heart Lock-In® by following along with the investigators' guided instructions.
7. Participants then marked in their Wellness Study Binder Activity calendar that they had completed a Gratitude Practice Intervention and a Heart Lock-In® Intervention.
8. The investigators described the Gentle Stretches with Guided Imagery Intervention, showing some of the basic stretches that were included in the yoga intervention. The participants were given general modification instructions for some of the stretches, in case anyone in the group needed them. The investigators then described the Guided Imagery portion of the third intervention, discussing different ways to visualize or imagine their cells responding positively to the guided imagery script. Near the end of each Kick-Off Session participants were invited to close their eyes and listen to the 5-minute Guided Imagery script, read by one of the Study investigators. This was the same script that ended the Yoga Stretches with Guided Imagery practice video.
9. Q & A session followed and participants were encouraged to contact any of the investigators by phone or email throughout the study with any questions about the interventions.

POSITIVITY STUDY TIMELINE

The Positivity Study proceeded in the following order.

1. County employees who were possible study participants had their first blood draw (as part of the Annual Cardiovascular Screening put on by the Wellness Program) between January 10 and February 7, 2017.
2. Employees interested in the study went to a (group or one-on-one) Wellness Kick-Off Session between January 13 and February 7, 2017. At a Kick-Off Session, they completed the pre-intervention life satisfaction questionnaire.
3. After a participant had his/her first blood draw and attended a Kick-Off Session then s/he could begin the 6-week Study intervention period. Thus, there were rolling 6-week Study intervention start dates aligned with the Kick-Off Session dates.
4. At the completion of each participant's 6-week intervention period, there was a 6 to 8 weeks window of waiting before the second blood draw was taken. This was so there was approximately 3 months between the first and second blood draws, giving the lab markers time to show change if any were affected by the three interventions.
5. During their 6-week intervention period participants received information about going for their second blood draw. Each participant received an individualized email giving specific dates when they could get their post-labs drawn. These dates represented a 2-week window which was 6 to 8 weeks following the conclusion of their 6-week intervention period. Investigators specified/scheduled not only a 2-week date range, but also a 2-hour time window that coincided with the same time participants' first labs were drawn. This was in an attempt to keep pre- and post-draws within a similar time-frame because cortisol and DHEA levels are known to fluctuate throughout the day.
6. Only those participants who turned in the Activity Calendar/Log for the 6-week study period, and who filled out a second life satisfaction questionnaire were eligible to have their second blood draw taken.

7. 6 to 8 weeks after the completion of the study intervention period, and only after turning in the 6-week activity calendar and the second life satisfaction questionnaire, participants could complete the post-intervention blood draw. Note that we can accurately describe the second blood draw having been completed either 6 to 8 weeks following the completion of the 6-week intervention period, or 12 to 14 weeks following the first blood draw. Both of these descriptions accurately describe the timing of the post-intervention bloodwork.
8. Sixty-three of the original 88 followed through to completion of the study turning in their Activity Calendar/Log, completing the second life satisfaction questionnaire, and also having their blood drawn a second time.
9. After the second blood draw was taken participants had a one-on-one post-counseling session (in person or telephonic) with a study investigator who explained the meaning of the labs drawn and any changes that showed in their lab work.

DATA AND METHODS

The Positivity Study measures consisted of pre- and post-intervention life satisfaction scores, and pre- and post-intervention bloodwork. As discussed in the Settings section above, the average age of the County’s total employee population is 47.2 years, with 30.24% being women and 69.44% being men. However, the biographical data of the County’s Wellness study participants were as follows:

- Study participant average age 56 years.
- Female participants 79.69%.
- Male participants 20.31%.

Pre-Intervention Metrics

Upon enrolling in the Positivity Study and prior to engaging in the 6-week intervention practices, 88 original participants had their labs drawn pre-intervention, attended a pre-intervention Kick-Off session, and filled out the pre-intervention Satisfaction with Life

Scale (SWLS).⁷⁴ The pre-intervention labs drawn included inflammatory markers (OxLDL, hsCRP, Lp-PLA2, MPO, Apo B, sdLDL), blood sugars (glucose and HgbA1c), and cortisol and DHEA.

Post-Intervention Metrics

Sixty-three of the original 88 participants completed the study by turning in the 6-week Study Calendar/Log, filling out the post-intervention SWLS questionnaire,⁷⁴ and having their post-intervention metrics completed. At the conclusion of the 6-week Intervention period, and following an additional 6 to 8 weeks waiting period (thus 12 to 14 weeks after the initial blood draw), those 63 participants had the same labs drawn to include inflammatory markers (OxLDL, hsCRP, Lp-PLA2, MPO, Apo B, sdLDL), blood sugars (glucose and HgbA1c), and cortisol and DHEA. As noted above, those participants also completed their post-intervention life satisfaction questionnaire.

Inflammation, Blood Sugars, Cortisol, and DHEA

Eighty-eight individuals had labs drawn pre-intervention and 63 had labs drawn post-intervention. Metrics were recorded pre- and post-intervention for evaluation purposes. Mean percent change was calculated for each lab pre- and post-intervention to determine difference in score post-intervention. Improvements were recorded in seven of 10 inflammatory, blood sugar, and hormonal biomarkers, including HsCRP (-27%), HbA1c (-1%), glucose (-2%), MPO (-5%), Lp-PLA2 (-9%), ApoB (-6%), and DHEA (1%). No improvements were recorded in cortisol (11%), sdLDL (0%), or OxLDL (7%).

Figures 1–11 illustrate participant’s metrics pre- and post-intervention.

Average HsCRP Levels Improved

By far, the most significant of the lab changes during the Positivity Study was the high sensitivity C-reactive protein, or CRP, which showed a 27% decrease in Study participants. CRP is a protein found in the blood and its presence indicates a heightened state of

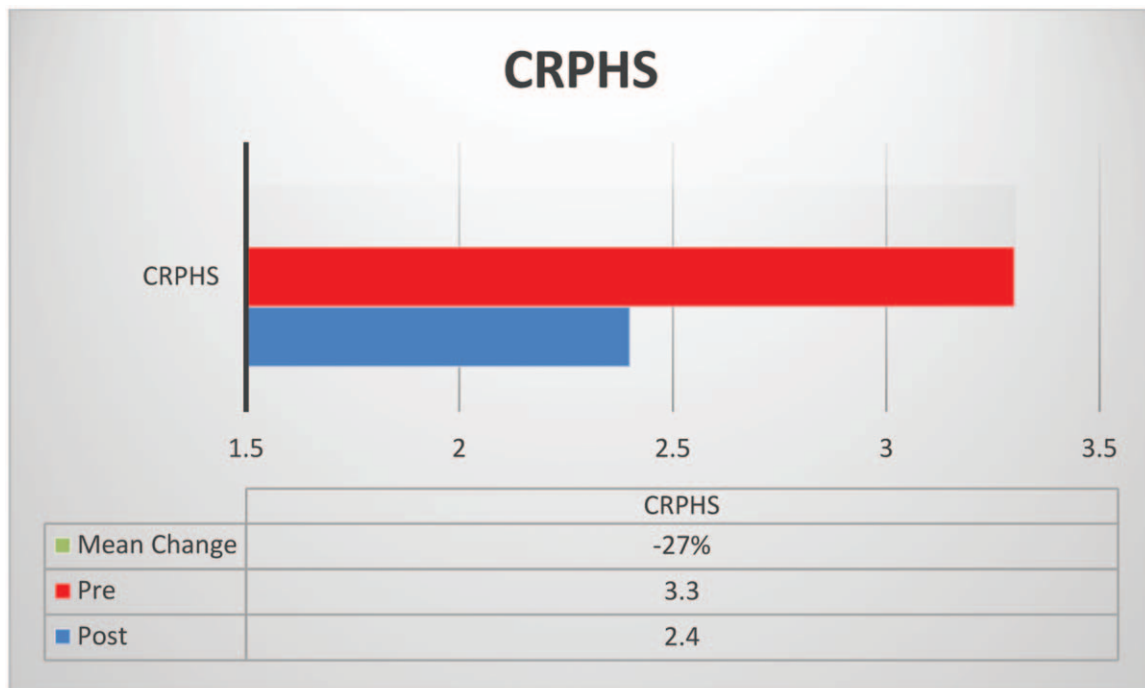


FIGURE 1. CRPHS—high sensitivity C-reactive protein (hsCRP).

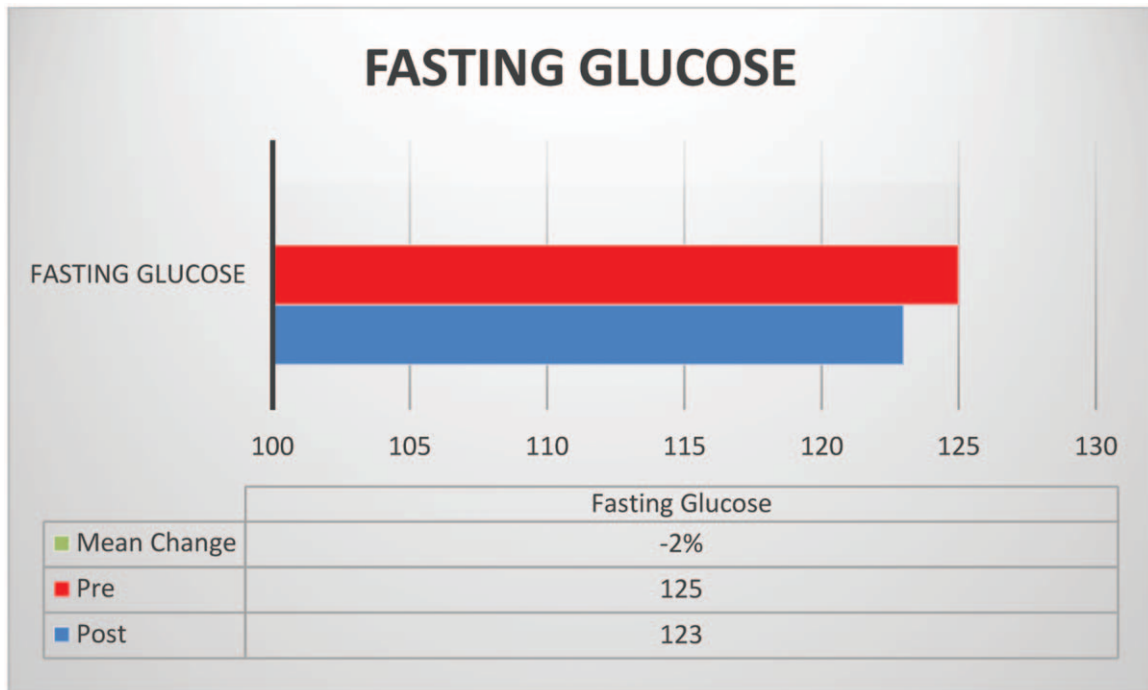


FIGURE 2. Fasting glucose.

inflammation in the body. Thus, a high level of CRP in the blood is a marker of higher inflammation. Inflammation has begun to be much discussed in research and literature in conjunction with cardiovascular risk discussions. Prior to focusing on inflammation, lipids held the attention of researchers and healthcare institutions as a clear marker of cardiovascular risk. However, while routine lipid

(or cholesterol) screenings have played an important role in cardiovascular risk assessment since the 1970s, it is now known that lipids do not provide a complete picture of cardiovascular health. In fact, according to Cleveland Heart Lab, nearly 50% of all heart attacks and strokes occur in patients with “normal” cholesterol levels.

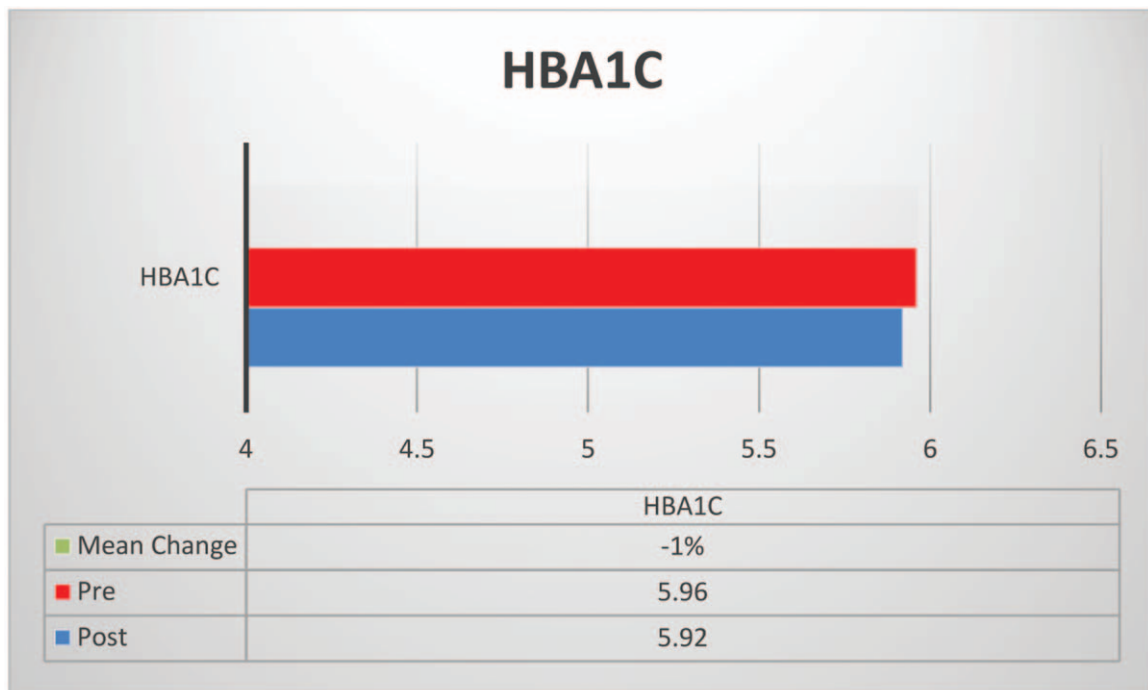


FIGURE 3. HBA1c—hemoglobin A1c (HbA1c).

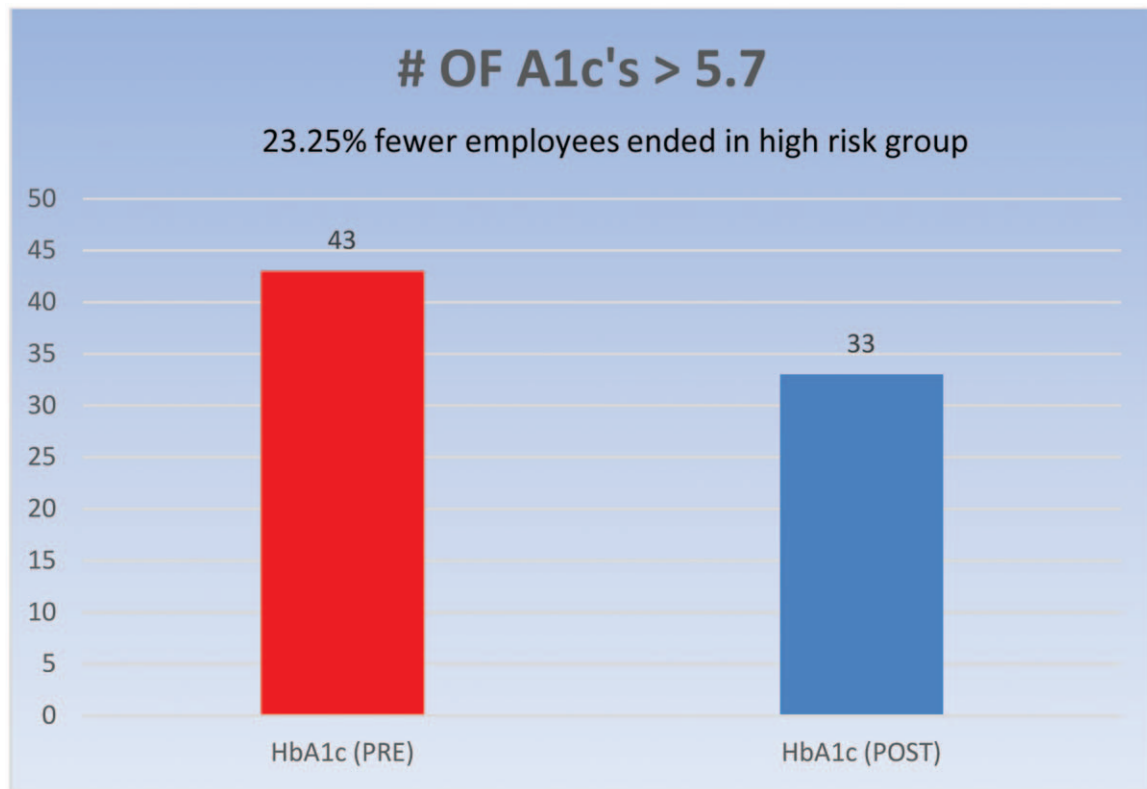


FIGURE 4. Numbers of employees with hemoglobin A1c greater than 5.7.

This points to the importance of newer research that shows inflammation to be an important indicator of cardiovascular health. Inflammation is now definitively understood to be a risk factor for cardiovascular disease.^{14,75-78} Inflammation has been linked to an

increased risk of heart disease, heart attack, sudden death, stroke, and peripheral arterial disease. CRP levels, which again, indicate heightened states of inflammation, seem to be correlated with levels of cardiac risk. In fact, according to the Cleveland Clinic, CRP

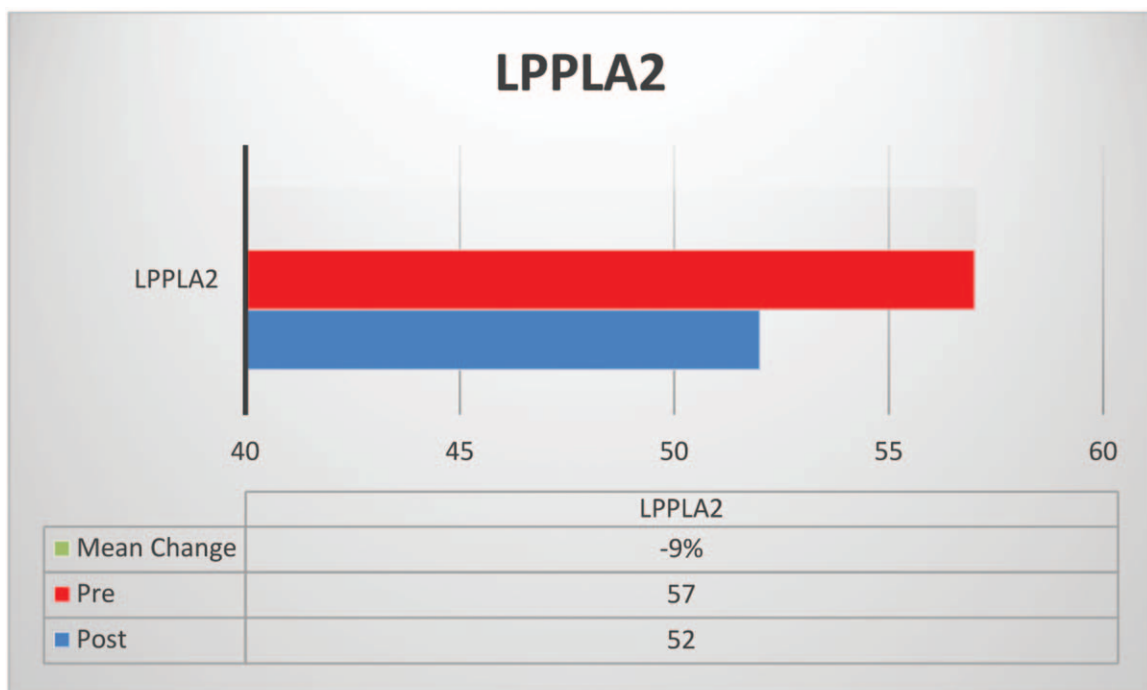


FIGURE 5. LPPLA2—lipoprotein-associated phospholipase-A2 (Lp-PLA2).



FIGURE 6. APOB—apolipoprotein B (ApoB).

seems to be at least as predictive of cardiac risk as cholesterol levels.⁷⁶ In addition, the Physicians Health Study, a large scale clinical trial involving 18,000 (apparently) healthy physicians, showed that having elevated levels of CRP was associated with a threefold increase in the risk of heart attack.⁷⁷

More recently, the large Canakinumab Anti-Inflammatory Thrombosis Outcomes Study (CANTOS) showed evidence that

lowering inflammation lowers cardiovascular risk. Dr. Paul Ridker, from Brigham and Women’s Hospital, discussed the study stating, “The simple part of this is cardiovascular disease, where we now have clear evidence that reducing inflammation can lower vascular risk with no change in LDL cholesterol.” He continued, “This is the first time that we have real data that lowering inflammation lowers cardiovascular risk.”⁷⁸

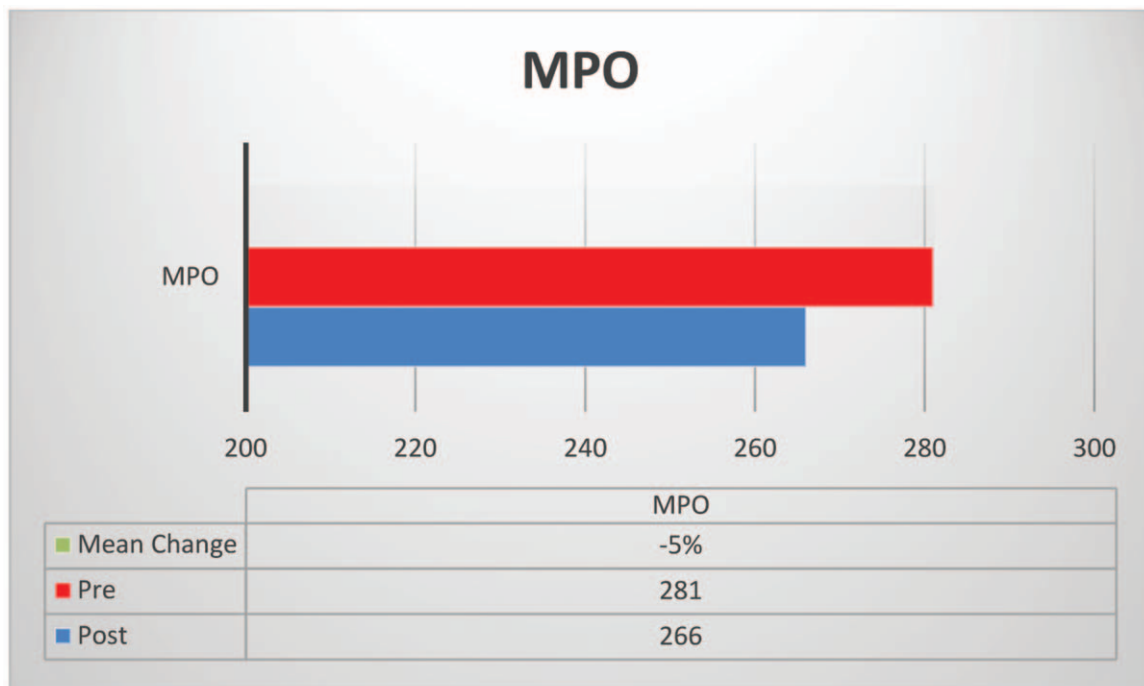


FIGURE 7. MPO—myeloperoxidase.

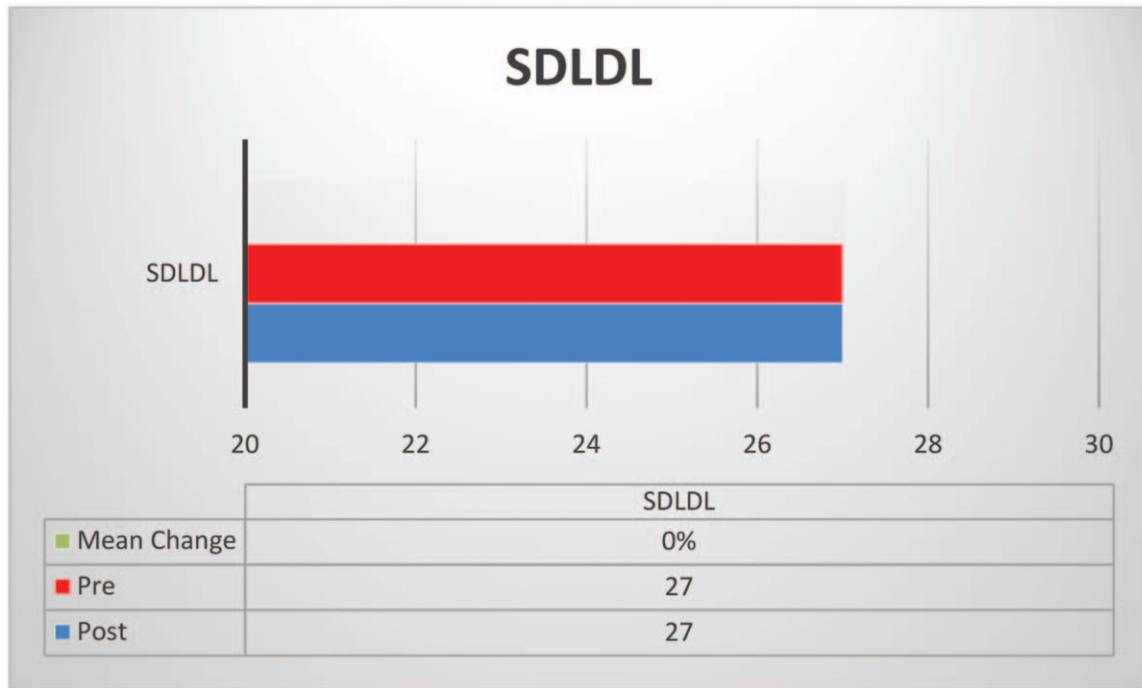


FIGURE 8. sdLDL—small-dense LDL.

Clearly, showing a reduction in HsCRP levels is an important finding of the Positivity Study. If lower levels of inflammation lead to lower risk of cardiovascular disease, and if lower levels of inflammation are indicated by a reduction in CRP levels, then this Study has positive implications for the possibility of lowering cardiovascular risk in employees. This is especially important considering the adverse effects often associated with the use of drugs. Again quoting Dr Ridker, “But here’s where it gets more

complicated. Like any drug, Canakinumab has adverse effects.”⁷⁸ An important consideration of the Positivity Study is that no drugs were used, thus adverse drug effects were not experienced by the participants.

The reduction in CRP shown by the Positivity Study data fall in line with the Stellar et al⁴³ study which recently demonstrated that positive affect predicted lower levels of inflammation in participants. More research is needed to firmly establish a link between the

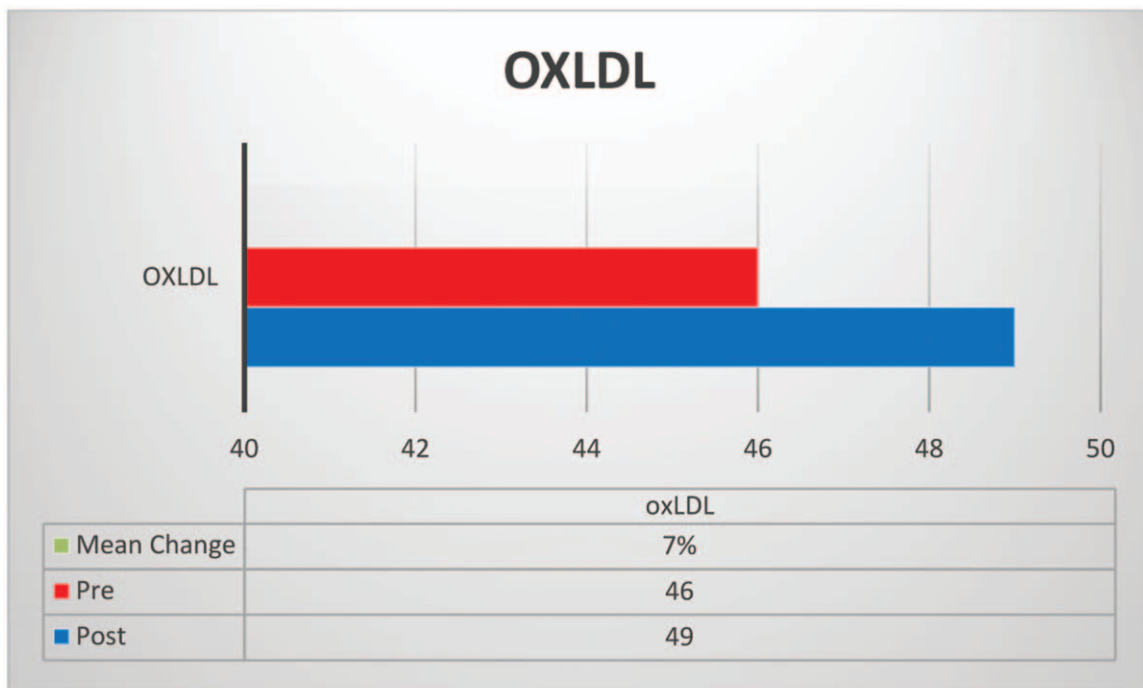


FIGURE 9. OxLDL—oxidized LDL.

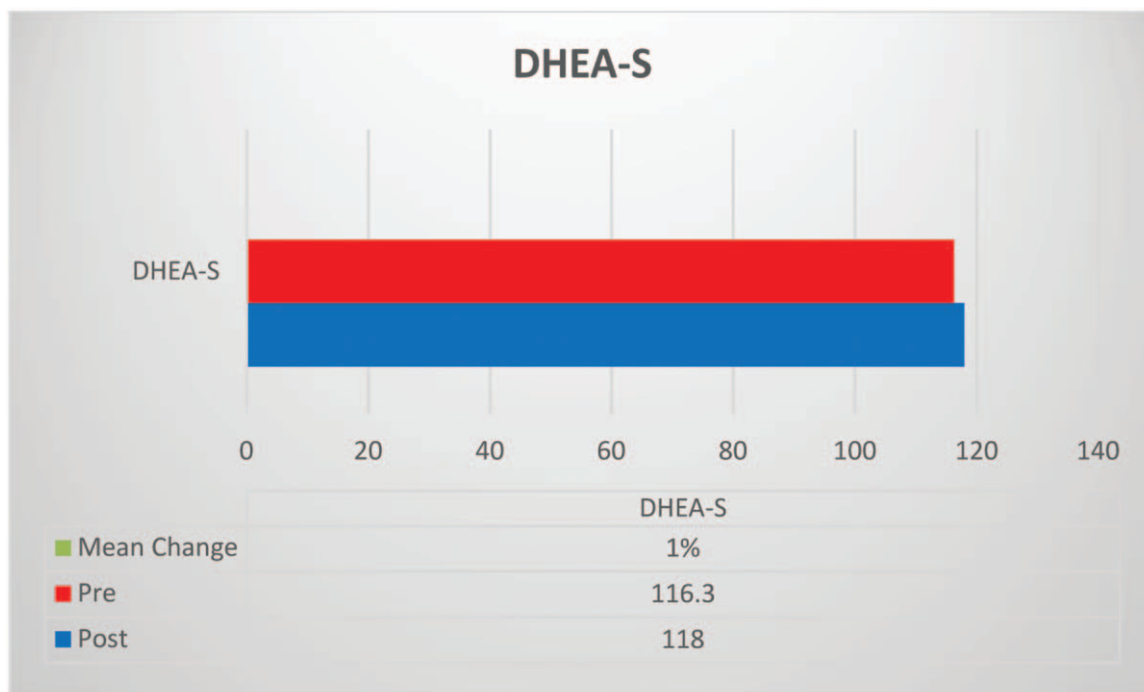


FIGURE 10. DHEA—dehydroepiandrosterone.

Positivity Study interventions and any positive outcomes experienced by the participants, including lowering inflammation.

Average HbA1c Levels Improved

The Hemoglobin A1c is an indicator of an average blood sugar over the previous 2 to 3 months. It can be one indicator of possible insulin resistance, prediabetes, and diabetes. Affected by

food intake, exercise, sleep and stress, the Hemoglobin A1c can demonstrate a trend toward or away from a greater health risk category. According to a 2012 American Diabetes Association (ADA) study, people with diagnosed diabetes, on average, have medical expenditures approximately 2.3 times higher than what expenditures would be in the absence of diabetes.¹⁷ The same ADA study reported that, “care for people with diagnosed diabetes

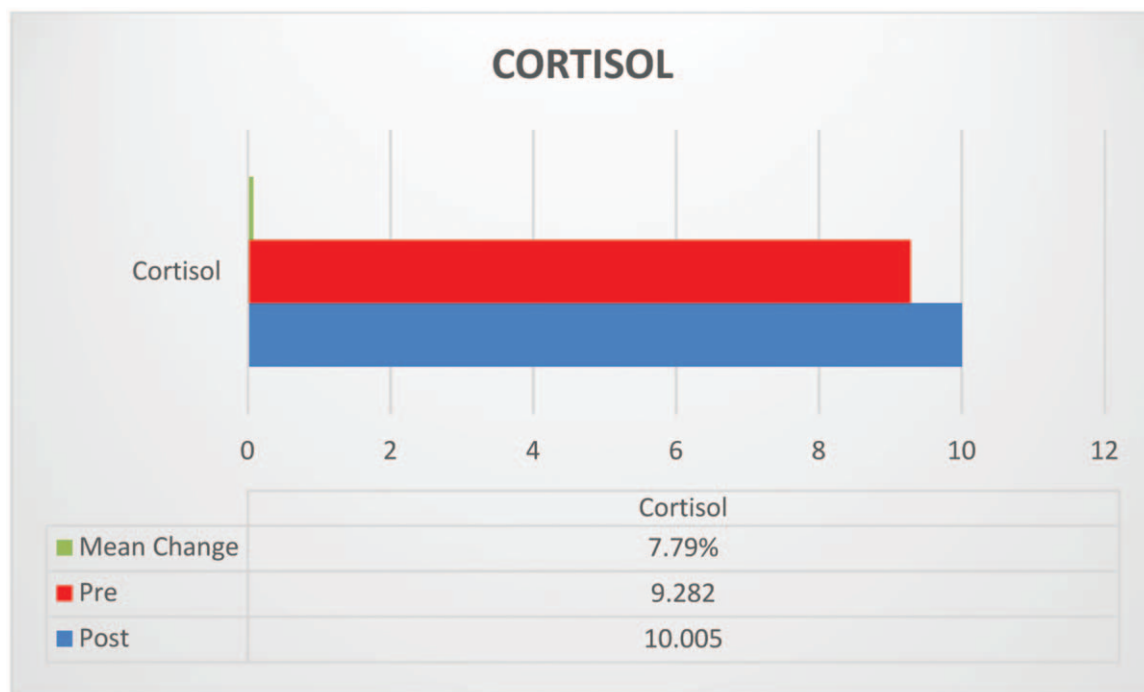


FIGURE 11. Cortisol.

accounts for more than one in five health care dollars in the United States, and more than half of that expenditure is directly attributable to diabetes.”¹⁷ Therefore, lowering participant blood sugars was one goal of the Positivity Study.

From the Study data, it was seen that both glucose and A1c improved in the Positivity Study participants. Although the percent decrease was small, HbA1c (−1%) and glucose (−2%), it is worth noting that 25.6% of participants who had elevated A1c at the beginning of the Study moved into normal range by the end of the Study. At the beginning of the Study, pre-intervention bloodwork showed that 43 of the 63 participants had out-of-range A1c levels of greater than 5.7; post-intervention bloodwork showed that 10 of those 43 moved back into normal range so that at the end of the Study only 33 of the 63 participants remained in the out of range level of A1c more than 5.7.

The Friis et al⁴⁴ randomized controlled study showed that the positive emotion self-compassion could reduce A1c levels in a statistically significant way. With the important general well-being and specific healthcare implications that exist for those who live with diabetes, further studies are needed to reveal if other positive emotions, like gratitude and appreciation, which were used in the current Positivity Study, can also lower blood sugars. If evidence continues to suggest they can, then more stringent research designs are warranted to find out what kind of processes and over what time periods would allow a positive enough effect to show statistical significance.

Life Satisfaction

Ed Diener, Robert A. Emmons, Randy J. Larsen, and Sharon Griffin’s Satisfaction with Life Scale⁷⁴ (SWLS) was used to indicate life satisfaction of the Wellness Study participants both before and after 6 weeks of practicing the three Study interventions. Participants were asked five questions to evaluate their satisfaction with life, with response being scored on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). The five SWLS questions were:

1. In most ways my life is close to my ideal
2. The conditions of my life are excellent
3. I am satisfied with my life

4. So far, I have gotten the important things I want in life
5. If I could live my life over, I would change almost nothing).

Eighty-eight individuals participated pre-intervention and 63 participated post-intervention. Responses were recorded pre- and post-intervention for evaluation purposes. Mean response was calculated for each score both pre- and post-intervention. Percent change for each score was calculated to determine the differences in Likert score post-intervention.

For all SWLS questions there was a noticeable increase in the percentage of participants marking a positive result (6—agree or 7—strongly agree) post-intervention. Figures 12–16 illustrate participant’s response pre- and post-intervention.

Average Life Satisfaction Scores Increased

As noted in the literature review discussed at the beginning of this article, studies have indicated that some behaviors which are known to negatively impact health and health costs (including smoking, obesity, physical inactivity, and heavy drinking) increase with decreasing life satisfaction. More pointedly, increased life satisfaction is associated with good health behaviors and enhanced health, so increasing life satisfaction was one goal of the 6-week Positivity Study. Pre- and post-SWLS (Satisfaction with Life Scale) scores indicated that this did happen as on average, participants’ self-reports of life satisfaction increased by one point for the first four survey statements, and by two points for the fifth statement (see Data and Methods section for SWLS statements). Though further research with the three study interventions is needed to confidently assess what accounted for the positive changes, some trends worth noting were observed.

Qualitatively, the researchers noticed that participants’ ability and ease in finding things to be grateful for increased significantly from the beginning of the study to the end. In the Kick-Off Sessions, during the explanation of Intervention No. 1 Gratitude Practice, when the investigators elicited examples from each employee of a, “Today I am grateful for...” statement, some participants had difficulty coming up with specific examples of what they felt grateful for. Also, the researchers noted that the last

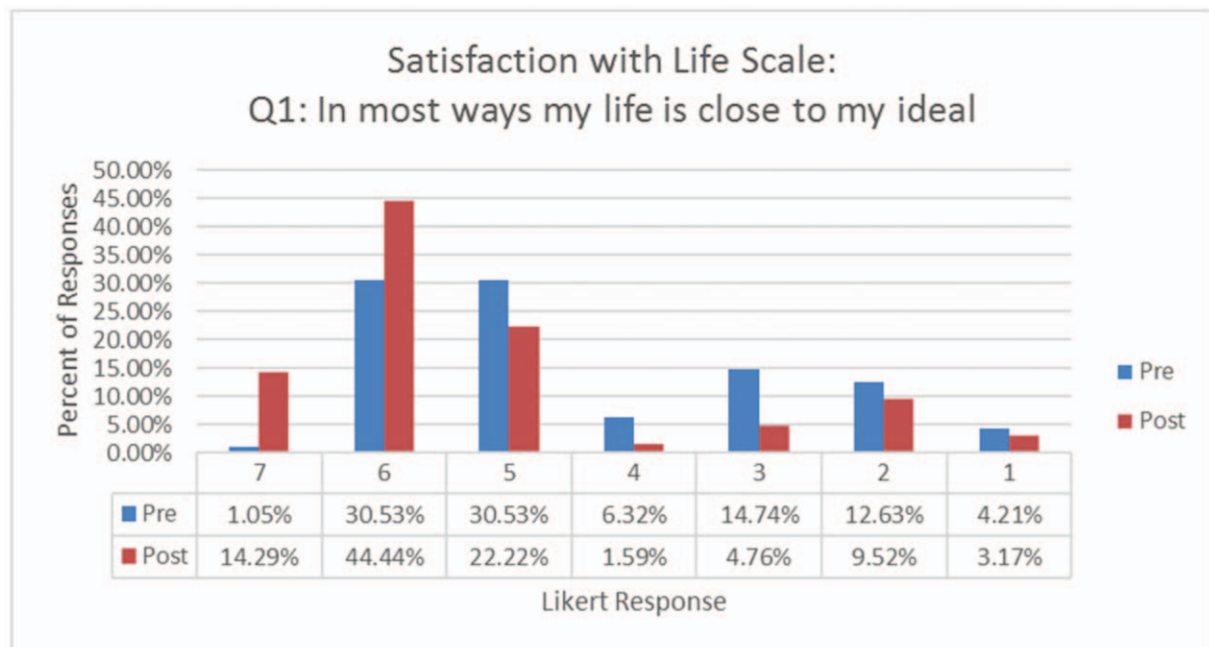


FIGURE 12. SWLS Q1—satisfaction with life scale question No. 1.

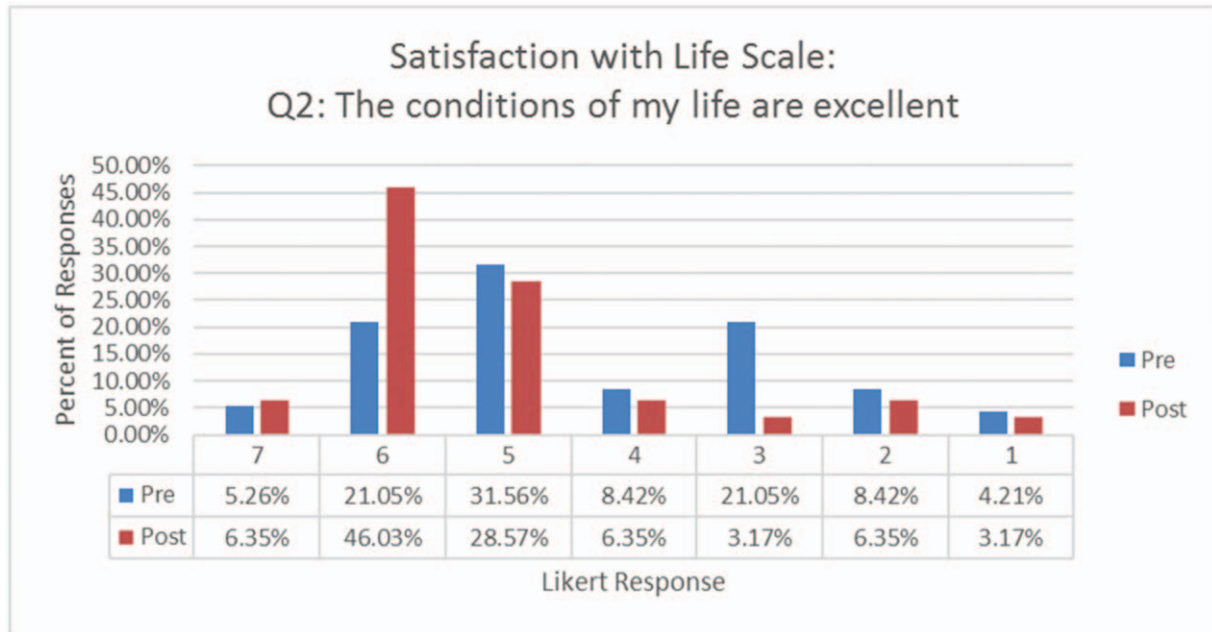


FIGURE 13. SWLS Q2—satisfaction with life scale question No. 2.

requirement of Intervention No. 1—that each participant come up with three different things to be grateful for each day for the entire 6-week period—was met with obvious concern from the participants with comments such as, “We’re supposed to come up with three *different* things to be grateful for every day for 6 weeks?” Most of the participants voiced concern that it would be difficult to find that many different things to be grateful for with several expressing statements such as, “That’s going to be hard. I’m going to run out of things,” and “That’s over 100 things to find to be grateful for!”

When these concerns came up the investigators acknowledged that, until it became a new habit, it would take some effort to

create or uncover gratitude for that many different things. The researchers reiterated that the intention was to help the employees look for positive circumstances often enough to create a new habit of gratitude, and encouraged them to make a sincere attempt to find even small things for which they could be grateful.

Months after the completion of the Positivity Study, the investigators witnessed that, at least for some of the study participants, gratitude had indeed become quicker and easier for them to access. At a Wellness class held months after the Study was completed, the investigators were teaching Gratitude Practice to

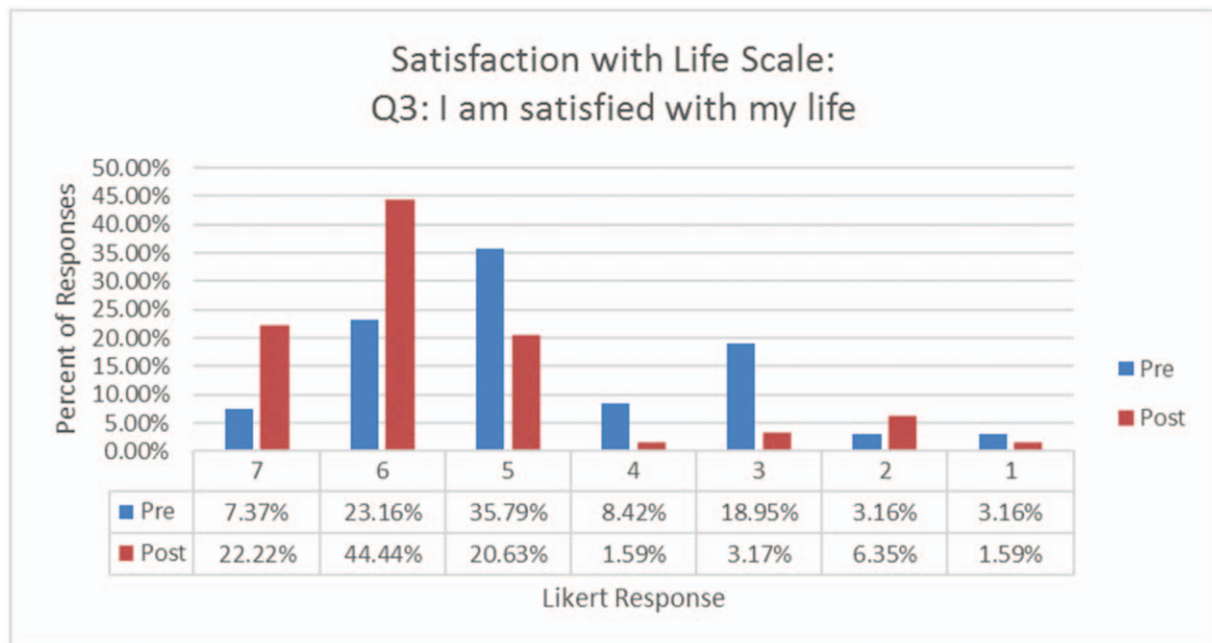


FIGURE 14. SWLS Q3—satisfaction with life scale question No. 3.

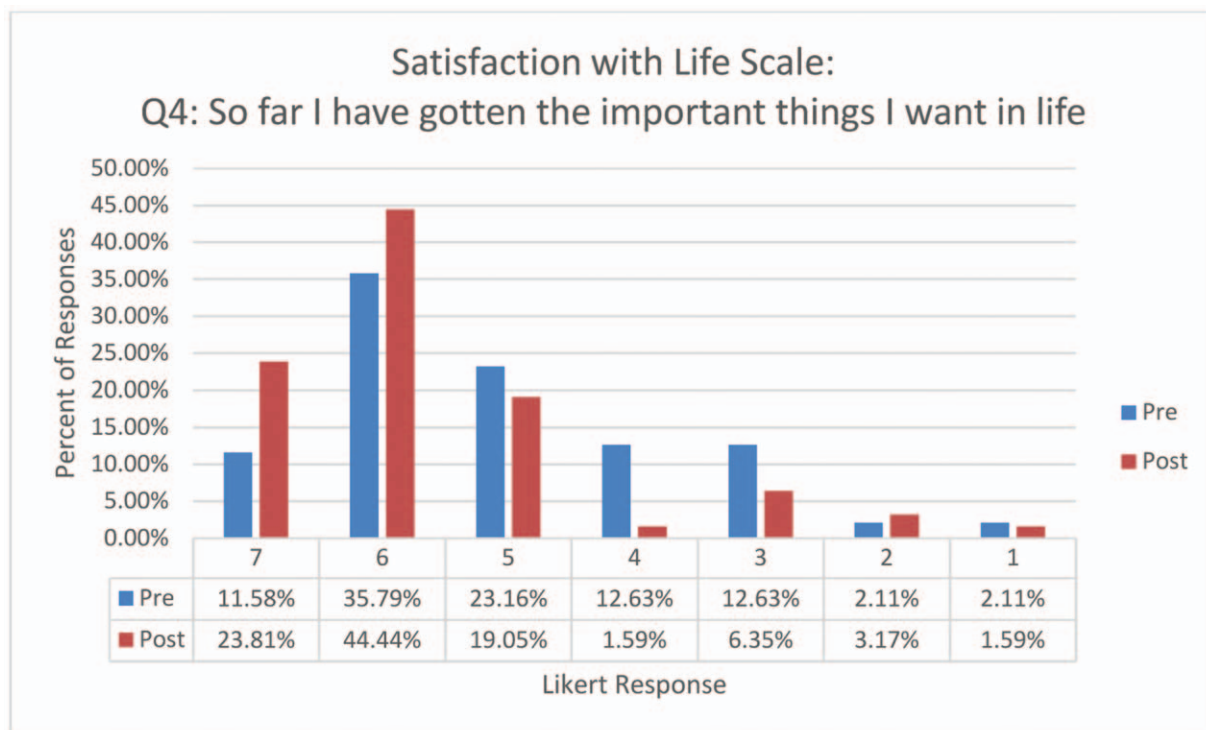


FIGURE 15. SWLS Q4—satisfaction with life scale question No. 4.

a group of employees who consisted of mostly employees who had not been in the study, but some who had been in the study. When it came time for the class to write down specific examples of things they were grateful for, the investigators were surprised to observe that without exception every attendee who had been a Positivity Study participant was able to quickly write down three things for which they were grateful, compared with their non-Study class

counterparts who took much longer to come up with “grateful statements.” Thus, even months after the study, it was observed that Study participants were much more easily able to come up with a list of things they were grateful for than students who had not gone through the Positivity Study.

This new ability to access gratitude easily may be one reason for participants increased Life Satisfaction.

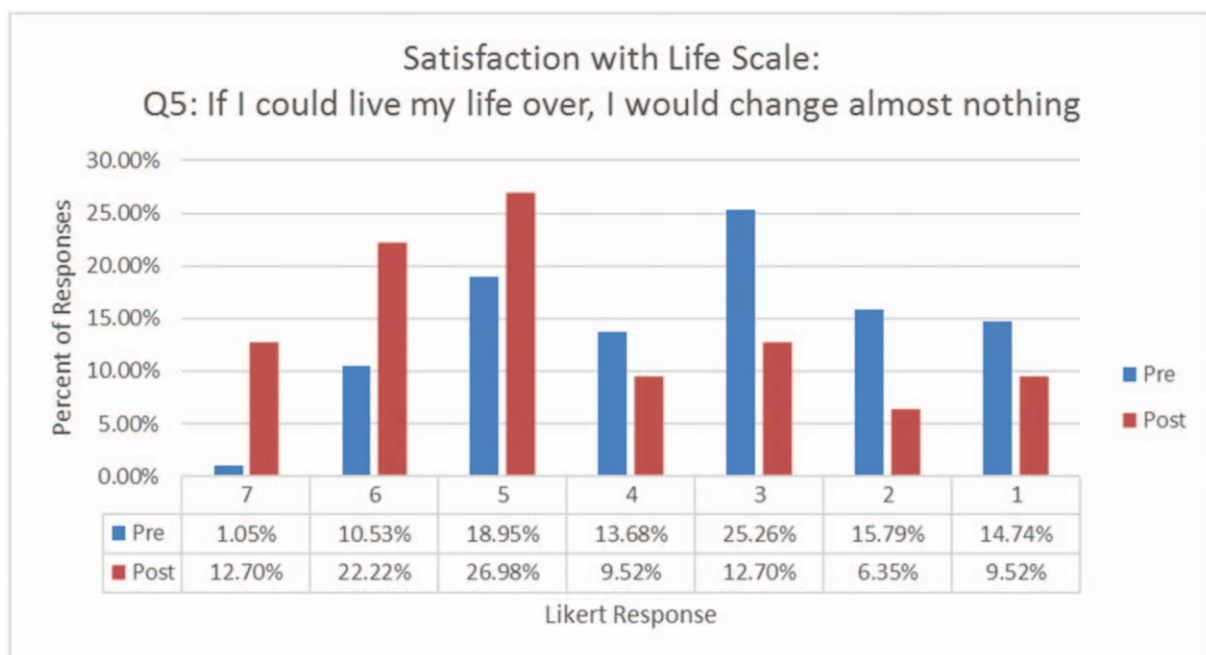


FIGURE 16. SWLS Q5—satisfaction with life scale question No. 5.

CONCLUSION/DISCUSSION

Based on current literature and research, evidence has suggested that employee inflammatory markers, blood sugars, cortisol, and/or DHEA levels could be positively affected by following a 6-week Positivity Program. Preliminary studies had already shown that positive emotions like gratitude and appreciation may not only be able to decrease cortisol and increase DHEA, but also be able to decrease inflammation and blood sugars as well. Research evidence also suggested that yoga and guided imagery may be beneficial in reducing inflammation. The 6-week Positivity Study adds necessary findings to these important studies. Improvements were recorded in all Satisfaction with Life Scale categories, as well as in 7 of 10 cardiovascular and inflammatory biomarker categories, including HsCRP (−27%), HbA1c (−1%), glucose (−2%), MPO (−5%), Lp-PLA2 (−9%), ApoB (−6%), and DHEA (1%).

The data suggest that engaging in 6 weeks of a workplace Positivity Program may improve employee life satisfaction, some markers of cardiovascular inflammation, and blood sugar levels.

LIMITATIONS

The first limitation of the Positivity Study was that it was descriptive in nature. While the data show promise of positive outcomes for those who participate in the Study practices, comparison groups, and/or randomized controlled designs would more confidently point to the ability of these interventions to create positive changes.

If the Positivity Study was responsible for positive changes experienced by the participants, another limitation of the Study is that it is not clear which of the three interventions, or combinations of interventions, was directly responsible. This is especially true since the three interventions contained four possible change agents: accessing daily gratitude, accessing appreciation, engaging in yoga stretches, and utilizing guided imagery. More research needs to be done to delineate which interventions, or combination of those interventions, were most impactful.

Another challenge of the Positivity Study was that after 6-weeks of participating in interventions which may have had a positive impact, there was a 6 to 8 weeks waiting period—where participants were no longer asked to do the interventions—before bloodwork was taken. The second blood draw was taken 12 to 14 weeks after the first blood draw was because it is generally appropriate to wait 3 months to see the full effect of a change in treatment on A1C and in some markers of inflammation as well. Therefore, in future studies, having 3 months of Interventions, instead of only 6-weeks, might show more accurately the results of having followed the Study interventions.

In addition, if the investigators replicate this Study they will not include measuring cortisol and DHEA labs with this population for three reasons. First, according to local Holistic Board-Certified physician Daniel Watts, MD, DHEA levels in premenopausal women spike and then have a quick decrease (personal communication with Study investigators May 4, 2017). The average age of participants was 56 and almost 80% of participants were women. It may be that during the 12 to 14 weeks between the pre- and post-blood draws some of the participants were experiencing this change, thus making the cortisol/DHEA results skewed.

Secondly, unlike the inflammatory markers and life satisfaction scores, cortisol and DHEA levels fluctuate throughout the day. Though an attempt was made to have the pre- and post-blood draws done within a 2-hour window of each other, it did not always happen as it was scheduled to which may have created inaccurate results.

Lastly, while it takes approximately 3 months for changes to show in A1c and inflammation levels, cortisol and DHEA levels can change much more rapidly. It may have given a more accurate result reading if cortisol and DHEA levels were read immediately after the 6-week intervention period, and not 6 to 8 weeks after the end of the

intervention period. However, due to the extra funding that would have been needed to add a third blood draw, and also due to the fact that the Investigators did not want to tax participants with a third blood draw, the Study only contained a pre- and post-blood draw. Future studies may not want to include cortisol and DHEA as variables if similar blood draw time frames exist.

A last limitation of the Positivity Study to be discussed was the lack of adherence, by many participants, to the three Study intervention guidelines. The Study investigators asked the participants to voluntarily do three interventions for 6 weeks with no financial incentive. While the investigators were pleased with the overall totals of interventions completed, even more significant outcomes may have been observed if more participants followed through with more of the intervention practices.

Additional studies in this area could benefit from rewarding participants (financially or with other incentives) for continued participation. Also, more on-site practices of the three interventions might also have increased adherence. As an example, over the course of the Study, the investigators were told by several participants that the on-site Yoga Stretches with Guided Imagery sessions (described in the Intervention section above) did help them continue with the Yoga Stretches intervention. On-site sessions of the other two interventions may have been helpful as well.

While there are clear limitations to the Positivity Study, the findings indicate that more research into the areas of positivity practices are warranted. Wellness programs of other large organizations might benefit from introducing positivity programs to their employees.

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