

Preventive Health Screening Program in an Industrial Setting: Identifying Health Risks and Nutritional Deficiencies

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Introduction

Absenteeism from work due to "sickness" or preventable injuries results in decreased productivity and increased health benefit costs for the employer. Dr. Charles A. Berry points out that employers pay over half of the nation's health care bills and the insurance, absenteeism, replacement and training of employees lost through illness all add to this burden.¹ Accidents, heart disease and cancer account for nearly 75% of total deaths in the U.S.A. These diseases are associated with various risk factors (smoking, nutrition, exercise) and can be reduced through a health promotion strategy aimed at identifying a person's risk factors for the diseases and then educating and motivating the individual to reduce the risks.¹ Occupational Safety and Health Administration has instituted many regulations to prevent accidents in the work place, and large companies have started health promotion programs. Smaller companies lacking a medical department can also do much to improve the health of their employees. The Center has worked for the past several years in helping to establish a "Know Yourself/Beat-the-Odds" health promotion program with a manufacturer of paper products in Kansas. The program is conducted on site and consists of a series of blood profiles and panels. An antioxidant panel consists of vitamins A, C, E, beta-carotene and lycopene. The "lipid profile" contained total cholesterol, triglycerides,

HDL cholesterol, LDL cholesterol and VLDL and calculated risk factors. Blood glucose was performed on all participants and a prostate specific antigen (PSA) test was done on all males, when requested. The screening was done at the factory. Employees were drawn fasting and all blood specimens processed on site. The samples were immediately refrigerated and/or frozen and transported to the BioCenter Laboratory for testing.

Water soluble and fat-soluble antioxidant levels were measured because oxidants or free radicals have been associated with many degenerative diseases. Therefore, it is important for individuals to know their antioxidant levels.^{2,3} Also, since heart disease is still the leading cause of death in the United States, the lipid profile and glucose were performed to see if the employees had any of the usual risk factors (high cholesterol, high LDL, low HDL, diabetes) associated with cardiovascular disease. A PSA was also offered to the male employees as a screen for prostate cancer or benign prostate hypertrophy. The employees were instructed to list on the specimen collection sheet their date of birth, and any supplements taken with the concentration of the supplement and number of doses per day. The participation in the health promotion-screening program was strictly voluntary. Employees were assured that these were "nutritional" types of blood tests being performed, and had nothing to do with drugs of abuse screening. This last is of particular importance to employees as they often associate any laboratory tests performed on employees with screening for illegal drug use.

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Tables 1 through 7 show the results of the blood panels and profiles performed on 186 employees. The employees were divided into males and females and those who were taking supplements and those not taking supplements. Seventy-eight percent of the employees ($n=145$) were males, 22% ($n=41$) were females. Fifty-three percent of the males and 59% of the females were taking vitamins and the ages of the males ranged from 19 to 74 (mean = 47.2) years and the females 21 to 65 (mean=43.6) years. The most common vitamin listed as being taken was "1-A-Day" (Table 1, p.51).

Table 2 (p.51) shows the vitamin A result of all participants. One participant taking vitamins had a level above to normal range, while three had levels lower than the reference range. The low values were all from the group not taking vitamins.

Table 3 (p.51) illustrates the most pronounced finding of the study. Vitamin C was low in 39 males and 5 females, 38 of these were in the group not taking vitamins, while only six were taking vitamins. Several of the participants had levels that were in the biochemical scurvy range (less than 0.3 milligrams per deciliter). Only 8 participants taking vitamins had high vitamin C levels. Vitamin C is a water-soluble vitamin which is not stored in the body like the fat-soluble vitamins and may be rapidly depleted due to stress, pollution, or cigarette smoking. The average vitamin C level in males not taking vitamins was 0.69 mg/dL: 0.6 is the lower limit of the normal value for this test! Although still somewhat controversial, chronic low vitamin C levels in a person may lead to susceptibility to colds, flu and other viruses, fatigue and lower immunity.

Table 4 (p.51) shows the vitamin E results. There were no low levels and 11 of the participants (20%) had higher than normal levels. The lack of low levels is not surprising since the fat-soluble vitamins

are stored, remaining in the body longer than the water-soluble vitamins. However, the mean level of those not taking vitamins was half of those taking vitamins.

Serum beta-carotene results are shown in **Table 5** (p.52). Those not taking vitamins had a blood level of beta-carotene 65% less than those taking vitamins. This was most significant in the males not taking vitamins (19.9 µg/dL) compared to those taking vitamins (26.8 µg/dL). Four percent of the participants had lower levels of beta-carotene compared to the normal range.

Serum lycopene results are shown in **Table 6** (p.52). Lycopene is a very strong tissue antioxidant and is very effective against the singlet oxygen free radical.⁴ It was interesting to note that no participants had a lycopene level lower than the normal level. Twenty-two of the participants (12%) had a lycopene level above the normal range.

The test for PSA identified two males with elevated PSA results (**Table 7**, p.52). One male, age 58, had a PSA of 8.1 ng/mL while the second male had a PSA of 12.3 ng/mL. The normal accepted range for PSA is 0.0 to 4.0 ng/mL. These patients need to consult their physicians for further testing (digital rectal examination, repeat PSA and free PSA determination).

Other findings showed that 48 participants had elevated blood cholesterol, the highest level being 320 mg/dL (normal less than 200 mg/dL); 29 had elevated triglycerides, the highest level being 1128 mg/dL (high normal for procedure is 165 mg/dL). Elevated blood glucose was found in 12 individuals, the highest level was 316 mg/dL (65 to 109 mg/dL is reference range).

Based on the findings described above, this health promotion program identified many potential nutritional and other risk factors in some employees. If not treated, these could cause significant health care problems for these individuals and employment problems for the employer.

Table 1. Total number, age and gender of participants in study and percent taking vitamins.

	taking vitamins		age (years)	
			range	average
number(n)= 186	yes	no	19-74	45.4
males = 145(78%)	77 (53%)	68 (47%)	19-74	47.2
female = 41(22%)	24 (59%)	17 (41%)	21-65	43.6

Table 2. Serum vitamin A results of participants in study: normal range is 30 to 110 ug/dL.

taking vitamins	range total ug/dL	female average	male average	ug/dL		total normal	total	
				total	average		high	low
n=186	23-123	60.3	57.1	61.2		182 (98%)	1	3
yes=101	32-123	53.7	59.4	60.5		100 (99%)	1	0
no=85	23-102	58.6	57.4	58.8		82 (96%)	0	3

Table 3. Serum vitamin C results of participants in study: Normal range is 0.6 top 2.0 mg/dL.

taking vitamins	range total mg/dL	female average	male average	mg/dL		total normal	high	total	
				total	average			low	
n= 186	<0.3-3.4	1.04	1.17	0.94		134 (72%)	8 (4%)* (6M,2F)*	44 (24%) (39M,5F)	
yes=101	0.3-3.4	1.4	1.5	1.1		87 (86%)	8 (8%)	6 (6%)	
no= 85	0.3-1.6	0.73	1.3	0.69		47 (55%)	0	38 (45%)	

Table 4. Serum vitamin E results of participants in study: normal range is 0.6 to 2.7 mg/dL

taking vitamins	range mg/dL	total average	female average	mg/dL		total normal	total high	total	
				male	average			low	
n=186	0.6-4.9	1.63	1.8	1.6		166 (89%)	20 (11%)	0	
yes=10	1 0.7-4.9	2.0	2.1	2.0		82 (81%)	19 (19%)	0	
no= 85	0.6-3.1	1.2	1.2	1.2		84 (99%)	1(1%)	0	

Table 5. Serum beta-carotene results of participants in study: normal range is 5.0 to 65 ug/dL

taking vitamins	range ug/dL	total average	female average	male average	total normal	total high	total low
n=186	<5-124	24.3	30.6	22.5	169 (90%)	9 (6%)	8 (4%)
yes=101	<5-124	28.9	31.8	26.8	90 (89%)	7 (7%)	4 (4%)
no= 85	<5-112	18.8	24	17.9	79 (93%)	2 (2%)	4 (4%)

Table 6. Serum lycopene results in participants: normal range for lycopene is 10 to 50 ug/dL

taking vitamins	range ug/dL	total average	female average	male average	total normal	total high	total low
n=186	11-67	33.3	28.5	34.7	164 (88%)	22 (12%)	0
yes= 101	11-63	31.6	26.5	33.7	95 (94%)	6 (6%)	0
no= 85	15-67	37	35.4	37.2	69 (81%)	16 (19%)	0

Table 7. Serum PSA results in male participants: normal range for PSA is 0.0 to 4.0. ng/mL

taking vitamins	range ng/mL	total average	total normal	total high
n = 142	0.1-12.3	1.1	140 (99%)	2 (8.1 & 12.3 ng/mL)*
yes= 74	0.1-12.3	1.4	72 (97%)	2 (3%)
no = 68	0.2-3.3	0.87	68 (100%)	0

*= ages are 58 and 60 years, respectfully.

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