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## Sun Protection Behaviors in Patients with Actinic Keratosis

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**Final Manuscript**

Sun Protection Behaviors in Patients with Actinic Keratosis

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### Abstract

The purpose of this project was to increase sun protection discussion and education in patients with actinic keratosis at a dermatology clinic. Actinic keratosis is one of the most common dermatologic diagnoses in patients 45 and older. Fifty-eight million Americans have one or more actinic keratoses and they are caused by years of UV sun exposure without sun protection. They are often a precursor to squamous cell carcinoma and adequate sun protection can prevent future lesions from developing and slow or stop the progression of current lesions. The Sun Exposure and Protection Index was implemented for patients with actinic keratosis to facilitate discussion and education. A total of 39 patients were screened. After completion of the survey, patients received sun protection education that was personalized according to their individual risk factors and situation. Although a majority of patients admitted to protecting themselves from the sun, a large percentage could improve their habits. The implementation of the Sun Exposure and Protection Index increased patient knowledge about sun protection and reinforced the importance of consistently protecting themselves from the sun.

## Sun Protection Behaviors in Patients with Actinic Keratosis

### **Problem Identification**

Every day, approximately 9,500 people in the United States are diagnosed with skin cancer making it the most common cancer in the United States (American Cancer Society, 2020). According to the American Academy of Dermatology (AAD), non-melanoma skin cancers such as basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) affect more than 3 million Americans each year (2017). From the years 1976-1984 and 2000-2010, rates of BCC increased 145% and rates of SCC increased 263% (Muzic et al., 2017).

Even more common than skin cancer is a precancerous skin lesion called actinic keratosis (AK). Fifty-eight million Americans have one or more AKs (Skin Cancer Foundation, 2021). From the period of 1993-2010, AK was the most common diagnosis in patients 45 and older among all dermatologist visits (Landis et al., 2014). Some cases of AKs will progress into squamous cell carcinoma. Therefore, AKs are considered pre-cancerous lesions (Skin Cancer Foundation, 2021). They are the result of years and years of inadequate sun protection and damage by UV radiation to the skin and are most likely to appear on areas of the body that are the most severely damaged by the sun such as the face, ears, scalp, hands, neck, and lips (AAD, n.d.). In addition to being a precursor to SCC, there is a strong correlation between AK lesions and development of BCC and malignant melanoma (MM) (Guorgis et al., 2020). Several factors are associated with an increased skin cancer risk but reducing exposure to UV sunlight is the single most effective way to prevent skin cancer. Many organizations including the AAD (n.d.) and the Centers for Disease Control and Prevention (CDC) (2020) encourage routine practice of safe sun protection behaviors.

### **Purpose Statement**

The purpose of this project was to increase education and discussion of sun protection in patients with AK. Because these individuals already have at least one AK lesion, they are at increased risk for skin cancer and the future development of additional AKs. Implementing the Sun Exposure and Protection Index (SEPI) survey allowed for education, discussion, and reinforcement of sun protection behaviors.

### **Review of the Literature**

#### **Epidemiology and Etiology of AK**

In the early 1990s, AK was one of the most frequently diagnosed dermatologic conditions (Feldman et al., 1998) and 14% of all dermatological office visits were for AKs alone (Gupta et al., 2002). Although dated, these statistics clearly demonstrate the high prevalence of AK in the United States because cases of skin cancer are continuing to rise. AKs usually present as small, rough, dry, scaly, and/or crusty patches or papules of the skin that can be skin-colored, pink, red, tan, or a combination of colors and are often easier to feel than see at their earlier stages (Skin Cancer Foundation, 2021). The most significant factor in the development of AKs is chronic exposure to UV radiation over one's lifetime, from the sun or indoor tanning (Skin Cancer Foundation, 2019). DNA damage and changes in immune responses are a result of this excessive UV radiation which triggers a cascade of mechanisms and carcinogenesis of the skin which result in the formation of AKs. Naturally, AKs are common in older, fair skinned individuals on parts of the body that tend to get the most sun exposure. In the absence of treatment, AKs can go into remission, remain stable, or progress into SCC. There is no way to predict which AKs will progress into SCC so that is why prompt treatment and adequate sun protection is encouraged (Berman & Cockerell, 2013).

### **Diagnosis and Management of AK**

The diagnosis of AK is frequently clinical but biopsies are sometimes recommended in individuals with histories of skin cancer, in immunosuppressed patients, and in high-risk locations like the lips and ears. Other signs that may warrant a biopsy include bleeding, tenderness, rapid changes in size, hyperkeratosis, and failure of treatment (Lebwohl et al., 2018).

Treatment of AK can be performed a number of ways and is often dependent on a few factors; the location and number of lesions, characteristics of the lesions, patient preference, and patient tolerance to side effects (Berman, 2020). Cryotherapy is the most common treatment option for isolated AKs because it does not require local anesthesia, it's fast, and relatively inexpensive. Surgical intervention is another therapy that is most often used for isolated lesions but best saved for hypertrophic or hyperkeratotic lesions (Berman, 2020). Individuals with multiple AKs are frequently treated with topical agents like fluorouracil and imiquimod, photodynamic therapy, or field ablation with dermabrasion, chemical peels, and CO2 laser resurfacing (Ceilley & Jorizzo, 2013).

To reduce the risk of further sun damage and progression of AKs, the CDC recommends to practice good sun protection habits which includes staying in the shade during the hours of 11am and 3pm, wearing sun-protective clothing, wearing a wide-brimmed hat and sunglasses, and applying a broad-spectrum sunscreen (2020).

### **AK and Skin Cancer Risk**

AKs are known as precancerous lesions and are made up of proliferative, transformed keratinocytes that form as a result of a lifetime of sun-exposure (Rigel & Stein Gold, 2013). A diagnosis of one AK likely means you will develop more in the future and the probability of how many AK lesions will progress into SCC is difficult to say (Skin Cancer Foundation, 2021).

However, there is evidence to suggest that the risk for SCC and BCC is 10-fold in the presence of more than 20 AKs when compared with the risk of zero AKs (Green & Battistutta, 1990).

To further emphasize the relationship between AKs and skin cancer risk, a cohort study was conducted by Guorgis et al. (2020). The aim of this study was to look at the risk of developing skin cancer during a follow-up period of 10 years in a group of 2,893 patients in Sweden with a diagnosis of AK. They were then compared to a group of 14,668 individuals without a diagnosis of AK. At the end of the 10 years, patients with AKs had 5.1 times higher risk of developing a form of skin cancer (SCC, BCC, and MM) compared with the control group without a diagnosis of AKs (Guorgis et al., 2020).

Not only is there a known relationship between AKs and nonmelanoma skin cancer, Chen et al. (2005) found an association between AKs and melanoma skin cancer. This study was conducted with 25,248 predominantly white subjects with a mean age of 77.9 years. Researchers found that the odds ratio (OR) of developing NMSC skin cancer was 6.7 times greater in subjects with AK compared with those without a diagnosis of AK. For melanoma, the OR was 3.9 times greater compared to those without AK and for carcinoma in situ of skin (CISS), the OR was 5.6 times greater compared with those without AK (Chen et al., 2005).

### **Sun-Protection Behaviors in Patients with Skin Cancer**

While skin cancer is the most highly preventable type of cancer, it is also the number one most commonly diagnosed cancer in the US (Rogers et al., 2010; Parkin et al., 2011). Protection from the sun is the most effective way to prevent skin cancer, yet many individuals at risk for skin cancer or with histories of skin cancer do not partake in adequate sun protection measures.

A descriptive, cross-sectional study by Nahar et al. (2019) was conducted that aimed to evaluate sun protection behaviors in 311 patients diagnosed with NMSC based on the

information-motivation-behavioral skills (IMB) model. Results of the study showed that individuals diagnosed with NMSC continued to receive high levels of sun exposure. Only 24% of participants were aware that the sun is the strongest during the period of 10am and 4pm. Additionally, about 25% of participants reported experiencing at least one or more sunburns after their NMSC diagnosis. Only 36% of participants noted they apply sunscreen on all exposed areas and 34% reported wearing long sleeves to protect themselves from the sun. As for wide brimmed hats and long pants, less than half admitted to wearing them regularly. Another alarming statistic is the 28% of participants who never or rarely used sunscreen (Nahar et al., 2019). The results of this study could likely be altered by the participants' poor knowledge of sun protection which further emphasizes the impact of routine assessment and education of sun protection behaviors in patients who are at risk for skin cancer. Adequate knowledge of sun protection will likely improve these results and lead to increased sun protection habits.

Fischer et al. (2017) performed a population-based study to compare sun protective behaviors between adults with and without previous NMSC diagnosis. Participants with previous diagnosis of NMSC had similar odds of recent sunburn when compared with participants without a history of skin cancer even though they practiced better sun-protection behaviors. Patients with histories of NMSC were more likely to seek out shade, avoid the sun, wear protective clothing, wide-brimmed hats, sunscreen, and use multi-modal sun protection. Although these individuals practiced improved sun protection behaviors enough to help reduce the risk of subsequent NMSC from arising, it is likely their sun-protective practices may lack consistency leading to sunburns which are highly associated with skin cancer (Fischer et al., 2017).

These studies demonstrate the importance of routine sun protection education, especially in patients with previous histories of skin cancer and emphasize the fact that a skin cancer



diagnosis does not exclude them from receiving education. Even though these patients had diagnoses of skin cancer, it is evident they lack the knowledge to decrease their risk of further damaging their skin from the sun.

### **Evidence-Based Interventions**

#### **SEPI Survey**

The Sun Exposure and Protection Index (SEPI) was used as the screening questionnaire for this project. The SEPI questionnaire is from Sweden and validated in Sweden and Australia. It is also available online to download for free in several different languages (Detert et al., 2015). The purpose of this survey is to assess sun protection behavior and the willingness to increase sun protection (Widemar & Falk, 2018). It was developed based on the transtheoretical model of behavior change (TTM) and combines TTM to assess readiness to increase sun protection (Detert et al., 2015). It is intended for use in patient-provider interactions and is preferred over other surveys for a few reasons. It is short, easy to understand, and can easily be filled out prior to or during an office visit. It also contains two parts; part one addresses current sun protection behaviors and part two addresses the readiness to change current sun protection behaviors. These two parts can provide opportunities for education and risk reduction for patients who do not practice adequate sun protection behaviors. Addressing these two parts in the same questionnaire is a huge benefit to the provider as it gives them a general overview of the participants' sun protection behaviors and the likelihood they are to change their current habits. To test the validity and reliability of the SEPI, a study was conducted in both Sweden and Australia comparing the SEPI with the Readiness to Alter Sun Protective Behaviour (RASP-B) which had been previously validated (Detert et al., 2015). The RASP-B is a similar questionnaire that contains twelve questions that assess current sun protection behaviors and stages of change

regarding those sun protection behaviors (Borschmann & Cottrell, 2009). An evaluation of the survey was conducted in Sweden and Australia by having participants simultaneously fill out the SEPI with the RASP-B and the Sun-protective Behaviours Questionnaire. The SEPI was then again filled out one month later to test reliability. The study found the SEPI survey to be acceptable in regards to overall validity and reliability (Detert et al., 2015).

### **Individualized Counseling and Education**

Hedevik et al. (2019) conducted a randomized controlled trial in a Swedish primary care setting to look at the long-term effects of individualized sun protection education. Participants completed a Likert scale-based questionnaire about sun protection habits and received individualized sun-protection education in one of two different ways; one in the form of a letter and the other in-person by their general practitioner. The same questionnaires were then administered 3 and 10 years later. This study found that although there were statistically significant declines observed in all groups in regards to sun exposure, the groups who were individually advised on sun protection habits in-person showed a remarkably greater decrease in mean score over the years (Hedevik et al., 2019).

Another randomized controlled trial by Falk and Anderson (2008), looked at the likelihood of a patient to change their sun protection habits and attitudes after an information intervention. Participants of a primary health care center filled out a questionnaire regarding sun protection habits and were then randomized into one of three groups that determined the way in which they would receive feedback. Group 1 received feedback in the form of a letter, group 2 received feedback by an individual doctor's consultation and group 3 also received feedback by an individual doctor's consultation with the addition of a photo test. After 6 months, the questionnaire was repeated and the results showed that individuals who received feedback by a

doctor's consultation had a significantly better impact on the subjects when compared with those who received feedback in the form of a letter. The photo test did not seem to make a difference in group 3 (Falk & Anderson, 2008).

A systematic evidence review was conducted to assist in updating the United States Preventive Services Task Force (USPSTF) recommendation on counseling to decrease risk for skin cancer (Lin et al., 2011). This review concluded that regular sunscreen use can prevent SCC but the evidence is unclear on the effect of sunscreen use alone in preventing BCC and MM. As a result, this review suggests that the USPSTF update their guidelines to include the recommendations that behavioral counseling to decrease skin cancer should be focused on multimodal sun protection rather than just sunscreen alone (Lin et al., 2011). Additionally, a more recent systematic review was conducted for the USPSTF that suggests counseling and behavioral interventions can increase sun protection habits (Henrikson et al., 2018).

Current recommendations by the USPSTF (2018) for reducing skin cancer include individual behavioral counseling specifically for those with fair skin types, with special attention to those with risk factors. Interventions are recommended for individuals of all ages and are similar to those by the CDC. These interventions include the use of sunscreen with sun protection factor (SPF) of 15 or greater, wearing hats, sunglasses, and sun-protective clothing, staying out of the direct sun during the hours when the sun is at its strongest, and avoiding indoor tanning beds and unnecessary sun exposure (USPSTF, 2018).

These studies and recommendations from the USPSTF clearly demonstrate the benefit to sun protection education. In-person education and counseling is recommended for individuals of all ages, especially for those with risk factors, and has proven to lead to long-term improvement in sun-protection behaviors in patients of primary care or dermatology clinics.

### **AK and Sunscreen**

A cohort study was conducted on elderly Japanese patients on the effect of sunscreen use in the prevention of development of AKs over 18 months (Kunimoto et al., 2016). The participants were 60 and over with AKs that were instructed to apply sunscreen to all exposed parts of their bodies, making sure to reapply every 2-3 hours. Participants were evaluated at the beginning of the study, 6 months, 12 months, and 18 months. Although 18 months of sunscreen use demonstrated zero change in the number of AK lesions or advancement in histological grade, researchers found a decrease in the number of CD31-positive vessels and a significant improvement in scaling and vessel dots on dermoscopic study. Additionally, they also found an association with the number of AKs and the amount of sunscreen use. The results of this study conclude that consistent sunscreen use plays a role in the progression of AK lesions to high grade AK and SCC (Kunimoto et al., 2016).

Furthermore, a similar study was performed by Naylor et al. (1995) on sunscreens and the suppression of actinic neoplasia. Participants enrolled in the prospective, double blind, controlled trial had either AK or a form of nonmelanoma skin cancer, experienced frequent sun exposure, and did not use sunscreen on a regular basis. They were placed into two groups; daily application of sunscreen and placebo. After the two-year period, the rate of appearance of new precancerous skin lesions was less for the group that applied sunscreen daily than for the placebo group. The study shows the effect of daily sunscreen use in significantly reducing cutaneous neoplasia (Naylor et al., 1995). A similar randomized, controlled trial was conducted on the reduction of AK by regular sunscreen use. Participants with one to thirty AK lesions were invited to participate and were assigned to a group that applied sunscreen cream or a group that applied base cream without active ingredients of the sunscreen and were instructed to apply to the head,

neck, forearms, and hands. At the completion of the study, the number of AK lesions in the base-cream group increased by 1.0 per participant and the number of AK lesions in the sunscreen group decreased by 0.6 per participant. The sunscreen group also showed fewer new lesions and more remissions when compared with the base-cream group. This study shows that routine daily use of sunscreen prevents the development of more AKs and also has the ability to precipitate remission of existing ones (Thompson et al., 1993).

### **Project Development and Implementation Timeline**

The project need was discovered after closely observing the patient population and most common diagnoses at the dermatology office. Patients at this clinic presented for a variety of reasons but the overwhelming majority of them presented for skin exams with existing diagnoses of AK and histories of skin cancer. The evidence-based project was then presented and approved by the provider of the dermatology office in September 2020. A literature review on AK was performed and the SEPI survey was identified as the screening tool. The project was then submitted to the University of San Diego's Institutional Review Board (IRB) and received exemption. There was no IRB at the project site. After receiving exemption, packets were assembled that included a description of the project stapled on top of the two-page SEPI survey. The description of the project specifically indicated that participation was entirely voluntary and choosing to participate or not participate would not affect the quality of the visit. Implementation began at the beginning of October 2020 and continued until the end of November 2020. Data from the SEPI surveys was entered into an excel spreadsheet and further analyzed during December 2020. In March 2021, findings were disseminated to clinical staff.

### **Description of Project, Facilitators, and Barriers**

This project took place over a 3-month period at a dermatology office in Southern California. The patients at this clinic are seen for a variety of dermatological concerns but the majority of the patients at this office presented for skin exams with Fitzpatrick type I, II, or III skin with AK, histories of skin cancer, and/or sun damaged skin. The only inclusion criteria for this project was a diagnosis of AK. This office had several medical professionals but the NP student worked directly with the registered nurse (RN) and physician for this project. Days that the NP student was present, the RN would room the patients and give them the survey packets. Patients filled out the survey in the time between when they were roomed and when their visit with the physician began. After the visit, the NP student calculated the SEPI score and educated the patient on sun protection based off their individual results. During this time, patients were also encouraged to ask questions.

Barriers to this project included a small sample size. Due to the fact that surveys were only distributed to patients with a diagnosis of AK, not all patients seen during the days the NP student was present had this diagnosis and the NP student only attended clinic one day per week.

### **Project Outcomes**

Two months after implementation of the SEPI survey, 18 females and 21 males were screened for a total of 39 patients. Ages ranged from 38-88 years old with 72% of participants 60 and older. Frequencies and percentages were calculated for Part I and Part II of the SEPI survey. Part I, shown in Table 1, includes questions about current sun protection behaviors and Part II, shown in Table 2, addresses the readiness to change current sun protection behaviors.

For Part I (see Table 1) on average, participants were responsible with their sun protection. The most significant results to note are the frequency of sunburns in these

participants; 67% said they have had zero sunburns in the last 12 months, while 33% had at least one. This is noteworthy because these individuals are at increased risk for skin cancer and even one sunburn a year is significant. Next to note are the results of how often these participants stay indoors or in the shade to protect themselves from the sun. Only 18% stated they “always” purposely stay indoors or in the shade, while 82% performed that less than always. In regards to the quantity of participants who still take vacations with the intention of spending more time in the sun, 44% said they never do, while 56% still admit to taking a vacation for the sole purpose of spending more time in the sun.

For Part II (see Table 2), the SEPI survey addresses readiness to change current sun protection behaviors. The most frequently observed category for every section in this part of the SEPI survey was 0, indicating the majority of participants have, for a long-time avoided unhealthy sun protection behavior. The most important data was the small number of participants that chose 4, which if picked, suggests unwillingness to change current behaviors. For example, for sunbathing, 8% of participants have never thought of giving up sunbathing, 0% of participants have never thought of using sunscreens, 5% of participants have never thought of using covering clothes, 0% of participants have never thought of using a sun hat or cap, and 3% of participants have never thought of trying to stay in the shade during the hours of strongest sunlight. This represents a low number of patients unwilling to change and alternatively, a high number of patients willing to improve their sun protection habits. This was encouraging to see as with routine assessment and education the possibility of improving these patients’ behaviors overtime is high.

Overall, most patients admitted to protecting themselves from the sun in one way or another but the majority could improve their habits. The goal of this project was to increase sun

protection in these patients through education that the use of multi-modal sun protection is the most effective way of protecting themselves from the sun. The results of Part II of the survey were encouraging as it indicates the high propensity of these patients willing to change their habits.

### **Conclusions & Summary**

Screening individuals at high risk for skin cancer using a simple and quick survey is an inexpensive and effective way to improve use of sun protection and increase education and discussion of sun protection habits. Many organizations like the CDC and AAD recommend consistent multimodal protection from the sun to reduce the risk of skin cancer. Implementation of the survey allows providers to routinely assess their patients' current sun protection habits, educate those who need it, and recommend ways to improve habits in the future. During every visit, the survey serves as a reminder to patients that sun protection is an important factor in skin cancer prevention and it is in their control to practice good habits. Future projects could include implementation of the SEPI survey in the primary care or dermatology setting focusing on adolescents and young adults at risk for skin cancer.



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**Table 1***SEPI Survey Part I*

Variable	<i>n</i>	%
How often do you sunbathe with the intention to get tanned?		
0 = Never	30	76.92
1 = Seldom	3	7.69
2 = Occasionally	6	15.38
Missing	0	0.00
How many times have you been sunburnt during the last 12 months?		
0 = None	26	66.67
1 = 1-2 times	8	20.51
2 = 3-5 times	2	5.13
3 = 6-10 times	2	5.13
4 = more than 10 times	1	2.56
Missing	0	0.00
How long do you usually stay in the sun (on average) between 11am and 3pm?		
0 = <30 min	15	38.46
1 = 30 min-1 hr	7	17.95
2 = 1-2 hours	12	30.77
3 = 2-3 hours	3	7.69
4 = >3 hours	2	5.13
Missing	0	0.00
How often do you take a holiday with the intention of spending more time in the sun?		
0 = never	17	43.59
1 = seldom	13	33.33
2 = 1-2 weeks a year	9	23.08
Missing	0	0.00
When in the sun, how often do you use sunscreens?		
0 = always	19	48.72
1 = often	10	25.64
2 = occasionally	3	7.69
3 = seldom	5	12.82
4 = never	2	5.13
Missing	0	0.00

When in the sun, how often do you use covering clothes for sun protection?

0 = always	14	35.90
1 = often	12	30.77
2 = occasionally	6	15.38
3 = seldom	3	7.69
4 = never	4	10.26
Missing	0	0.00

When in the sun, how often do you use a sun hat or cap for sun protection?

0 = always	22	56.41
1 = often	12	30.77
2 = occasionally	4	10.26
3 = seldom	1	2.56
Missing	0	0.00

How often do you stay indoors or in the shade in order to protect yourself from the sun?

0 = always	7	17.95
1 = often	19	48.72
2 = occasionally	9	23.08
3 = seldom	3	7.69
4 = never	1	2.56
Missing	0	0.00

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*Note.* Due to rounding errors, percentages may not equal 100%.

**Table 2***SEPI Survey Part II*

Variable	<i>n</i>	%
<b>Sunbathing</b>		
0 = I have for a long time avoided sunbathing	31	79.49
1 = I have recently given up sunbathing	1	2.56
2 = I intend to give up sunbathing	1	2.56
3 = I could think of giving up sunbathing	3	7.69
4 = I have never thought of giving up sunbathing	3	7.69
Missing	0	0.00
<b>Sunscreens</b>		
0 = I have for a long time used sunscreens	31	79.49
1 = I have started to use sunscreens	4	10.26
2 = I intend to start using sunscreens	2	5.13
3 = I could think of using sunscreens	2	5.13
4 = I have never thought of using sunscreens	0	0.00
Missing	0	0.00
<b>Covering clothes</b>		
0 = I have for a long time used covering clothes for sun protection	23	58.97
1 = I have started to use covering clothes for sun protection	6	15.38
2 = I intend to start using covering clothes for sun protection	1	2.56
3 = I could think of using covering clothes for sun protection	7	17.95
4 = I have never thought of using covering clothes for sun protection	2	5.13
Missing	0	0.00
<b>Sun hat or cap</b>		
0 = I have for a long time used a sun hat or cap for sun protection	31	79.49
1 = I have started to use a sun hat or cap for sun protection	3	7.69
2 = I intend to start using a sun hat or cap for sun protection	3	7.69
3 = I could think of using a sun hat or cap for sun protection	2	5.13
4 = I have never thought of using a sun hat or cap	0	0.00



for sun protection		
Missing	0	0.00
Shade		
0 = I have for a long time tried to stay in the shade during hrs of strong sunlight	25	64.10
1 = I have started trying to stay in the shade during the hrs of strong sunlight	5	12.82
2 = I intend to start trying to stay in the shade during the hrs of strong sunlight	2	5.13
3 = I could think of trying to stay in the shade during the hrs of strong sunlight	6	15.38
4 = I have never thought of trying to stay in the shade during the hrs of strong sunlight	1	2.56
Missing	0	0.00

*Note.* Due to rounding errors, percentages may not equal 100%.