Hypothesis

Socioeconomic Achievement Pressure Hypothesis: The Causal Environmental Mechanisms in Hodgkin Lymphoma Development

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Abstract

The Socioeconomic Achievement Pressure hypothesis is presented as the environmental cause of Hodgkin lymphoma across the human lifespan and across all ethnicities. This claim is supported by an almost complete coverage of the Hodgkin lymphoma epidemiology with this hypothesis.

Based on this hypothesis I contend that the risk for Hodgkin lymphoma can be explained by excess achievement and intellectual pressure in specific individuals because they find it hard to fulfill or to comply with the high standards of socioeconomic and/or intellectual requirements of their family, community or peers. The prolonged and intense cognitive stress might ultimately lead to Hodgkin lymphoma development. Thus intellectual and cognitive stress appear to be the causal sociocultural mechanisms in Hodgkin lymphoma development.

Cognitive and intellectual stress appear to cause deregulations of the lymphatic system. The experienced severity of cognitive stress determines what kind of lymphoma the patient will develop. Both intensity and the duration of exposure to cognitive stressors are crucial in lymphoma development. The personal characteristics of the patient are crucial to understand the incidence of Hodgkin lymphoma.

Hodgkin lymphoma epidemiology also provides for the causal mechanisms how family dynamics really work. It also clarifies that sociocultural mechanisms rather than genetic explanations appear to be the causal mechanisms underneath the similarities in behavior and preferences of identical twins. This research provides important clues to conduct more thorough and conclusive research on twins, family dynamics and lymphomas in animals.

Keywords: Hodgkin lymphoma; Socioeconomic achievement pressure; Cognitive stress; Ethnicity; Twins; Family dynamics

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1. Introduction

The causal mechanisms in Hodgkin lymphoma development are largely an enigma in cancer research. The purpose of this paper is to present answers for the underlying mechanisms in Hodgkin lymphoma development. To support this claim the Socioeconomic Achievement Pressure hypothesis is presented as the environmental cause of Hodgkin lymphoma across all ages and ethnicities. The premise of this hypothesis is that socioeconomic achievement pressure experienced across different stages in life by specific persons from distinct social classes and ethnicities match the incidence of Hodgkin lymphoma. This causal mechanism will be discussed extensively in this paper by examining the epidemiological data of Hodgkin lymphoma in connection with socioeconomic, lifespan, socioeconomic mobility, parenting and twin research.

This hypothesis is primarily focused on Hodgkin lymphoma but the same causal environmental mechanism may cause other forms of lymphomas and the different forms of adult leukemias. Several studies have found an increased risk of other lymphoreticular malignancies (non-Hodgkin lymphoma and leukemia) in first degree relatives of patients with Hodgkin lymphoma and vice versa [1]. Although these risks among relatives of patients are not strong, it is likely that these malignancies are separate forms of the same underlying etiology. The current situation in Hodgkin lymphoma research is that there are no guidelines for preventing Hodgkin lymphoma. This is because the cause is unknown and is thought to be multifactorial. However the aim is, by presenting this testable hypothesis, to provide conclusive answers for the Hodgkin lymphoma enigma.

2. Cognitive and intellectual stress causes deregulation of cognitive functions

The experienced severity of cognitive stress by the afflicted person determines what kind of lymphoma the patient will develop. This personal subjective element in cancer development is not fully acknowledged in cancer research [2]. The socioeconomic pressures on cognitive functions are in my view the causal links for the different types of lymphomas, moreover intellectual and cognitive stress has also behavioral consequences that interfere with the hematological system which is the causal link for leukemia in adults. The reason why cancer research has developed an elaborate system of cytological and molecular specificities to differentiate between lymphomas and leukemias has to do with the focus on the mutated gene dogma and frankly speaking ignorance about what is really going on in cancer development [3]. How to understand what is really going on in cancer development is discussed in a separate paper [4].

The causal biological connections will be found in the hematological and neuroendocrine processes which are disrupted when these environmental processes are processed by the brain. I hypothesize that the cancer process involves the interference of the amygdala which configures the aberrant forms of these neuroendocrine hormones. The amygdala is involved in processes which implicate some form of learning, thus it interferes and overrules the normal biological neuroendocrine processes which in general involve the hypothalamus [5]. These cognitive and intellectual pressures can happen across the lifespan of humans which means that the intensity of stressful situations is also causal in these forms of cancer. Therefore it is not only the duration of exposure to aberrant forms of neuroendocrine hormones or other stressors which are crucial in lymphoma development. How does intellectual...
achievement pressure influence the blood and neuroendocrine systems and ultimately triggers the cancer process?

This question will be examined and explained by looking at homeostatic imbalances and the deregulation of the human intra- and extracellular buffer systems. This will be discussed in a separate paper.

From cancer research it is clear that lymphoma happens first in the lymphatic system. I contend that cognitive and intellectual stress will cause deregulation of the lymphatic system. Genetic susceptibility or a viral connection appears to be the wrong explanatory model to uncover the causal environmental connections of lymphoma [6-8]. Instead socioeconomic achievement pressure seems to be the causal explanatory model in the development of Hodgkin lymphoma.

3. The different forms of socioeconomic achievement pressure across human lifespan

This hypothesis is derived from combining Hodgkin lymphoma epidemiology and the data from social psychology, socioeconomic mobility studies, life span studies and parenting research [9, 10]. The analysis of these lines of research resulted in the explanation of the peaks in the Hodgkin lymphoma incidence. Socioeconomic achievement pressure across different stages in life has a cultural, ethnic, individual and economic background [11-14]. How these sociocultural patterns and mechanisms have an impact on individuals and communities in Hodgkin lymphoma development will be discussed in the next chapters.

3.1 Lower socioeconomic groups in developing countries

The Hodgkin lymphoma incidence of lower socioeconomic status (SES) groups in developing countries which peaks predominantly at a young age can be explained with socioeconomic research from the OECD, socioeconomic mobility studies and research on poverty [15, 16]. Socioeconomic achievement pressure in low SES groups in those countries can be explained with the overall economic situation of the specific country.

One of the consequences of a low SES is that especially children are pressured (un)consciously by their parents and their social environment for socioeconomic achievements. These pressures are concerned with education and different kinds of entrepreneurial endeavors to support family income which require considerable mental and cognitive capabilities from these children. These prolonged forms of cognitive stress can be an excessive strain on the cognitive functions and neuroendocrine systems of specific children.

Columbia is a well-known example in Hodgkin lymphoma research. When the Columbian economy was down as the rest of Latin America in the 70’s the Hodgkin lymphoma incidence peaked noticeably only in young children of low SES [17, 18]. This intellectual and cognitive pressure shifted towards young adults when the economic outlook structurally improved because by then it was worthwhile to pursue higher education. When the overall economy moves into a higher gear or the economic outlook is perceived as positive, people will be motivated to seize the opportunity and will increase their physical and intellectual activity to improve their living conditions.

By the 90’s the Hodgkin lymphoma incidence in young adults in Columbia matched that of Denmark which pattern is in line with the rest of the industrialized world. Still the cognitive stresses and strains remained for young children from lower SES because of parental pressure and the impressionable age of the children. More young adults were stimulated by the new economic opportunities to improve themselves by taking up higher education. The Hodgkin lymphoma incidence in these children and adolescents can be explained by the individually experienced cognitive and intellectual stress and pressure by engaging in the new opportunities. The cognitive stress is most likely caused by a lack of a solid educational background with academic deficiencies in some persons to succeed in higher education or to perform proficient in a complex business environment.

These patterns will show up in every newly industrialized country who adopts an individualistic western style economic and cultural model.

3.2 Young adults of high SES the first peak in the Hodgkin lymphoma incidence

Adolescents and young adults from high income groups also experience cognitive and intellectual stress which may
explain the first peak in the Hodgkin lymphoma incidence in industrialized countries. I assert that the causal environmental risk in this group is the need for excellent school achievements [19]. High SES adolescents experience socioeconomic and cognitive pressure from peers, their parents and social environment because they have to achieve certain academic levels at school and in college. This achievement pressure appears to be unsustainable or strenuous for specific persons [20, 21]. This pressure is also applicable for job situations after college which might comprise too many responsibilities or expectations for some persons [22, 23]. The personal characteristics of the patient which includes his or her cognitive functions and neuroendocrine system is crucial to understand the incidence of Hodgkin lymphoma in young adults because it is not a major form of cancer in terms of casualties.

3.3 Old age group the second peak in the Hodgkin lymphoma incidence

The cancer incidence in the group above 50 years is predominately in high SES groups. I contend that some persons in these groups may experience cognitive and intellectual pressure because they think or are convinced that they have to keep up with the continuously changing complex social and technological world. Especially people of high SES who are often highly educated or used to be independent professionals are sensitive for social pressure to show that they are capable of handling the complex technological world of the younger generations. People in this group may feel pressured above their personal tolerance level to keep up with all the new developments in society because of the cultural paradigm of lifelong learning among elderly in our society [24].

In particular the emphasis on lifelong learning among elderly can be experienced as an intolerable cognitive burden by some persons. Because of better health and earlier retirement, participation of elderly in continuing education has increased substantially over the past decades. I suspect the sociocultural pressure to be involved in such programs is not fully acknowledged by the initiators of these programs. Moreover participants in such programs tend to be active, well-educated and financially well-off which may be misleading information about their cognitive capabilities. Much less programs are available for elders with little education and limited income. By looking at these sociocultural trends in a different way it is ironic to notice that more high SES people are represented in the Hodgkin lymphoma incidence.

The important message is to understand that the same cognitive and intellectual pressures which can explain the first peak in the Hodgkin lymphoma incidence in young adults are responsible for the second peak in old age.

4. Ethnic and religious groups

The differences in Hodgkin lymphoma incidence among different ethnic groups can be explained by looking at the specific characteristics of the cultures involved. In this section the explanatory characteristics of the Jewish, Asian and African American cultures in connection with the Hodgkin lymphoma incidence will be discussed. I would like to emphasize that these findings are no value judgments about specific ethnic communities but that they are logical deductions from Hodgkin lymphoma epidemiology and the other relevant research to formulate this hypothesis.

4.1 Increased risk among Jews

In Hodgkin lymphoma epidemiology it is evident that there is an increase risk among Jews [25]. Early studies from the 1940 and 1950 have found that older but not younger Jews were at increased risk. In a study from the 1970’s both young adults and older Jews had notably higher rates of the disease than non-Jews. Excess risk among young adults and middle-aged Jews persisted through the late 1990’s. From studies in the 1970’s and confirmed in later studies from Great Britain, Los Angeles and Israel follows that the risk related to being Jewish was still two to three times higher for all age groups after controlling for indices of socioeconomic status. There is an 80% excess risk among Jews between 15 and 54 years, however this finding was not evident among those subjects aged 55 years or more.

People from the Jewish community are one of the most successful cultural or ethnic groups in the United States. Jews are high achievers in a wide variety of socioeconomic territories such as science, finance, media and entertainment. The affluence among American Jews increased substantially across the last three generation which created an image of high achievement and success as the paramount
characteristic of this group. This image is not restricted to outsiders but I suspect that this successful image also can be experienced as a burden by some persons of this community, because they have to live up to those high standards. Based on this hypothesis I contend that the increased risk for Hodgkin lymphoma among Jews can be explained by excess achievement and intellectual pressure in some persons because they find it hard to fulfill or to comply with the high standard of socioeconomic and intellectual success of the Jewish community.

I also assert that the crucial factor in the excess risk for Hodgkin lymphoma in this community can be explained by the internalized cultural image of their successful group by specific members of this community. These persons may experience cognitive and intellectual pressure to live up to those standards which they are actually not capable of.

It also important to notice that the excess risk, predominantly among 15-54 years, decreases dramatically once people pass the age of retirement which indicates that the source of performance and intellectual pressure has diminished or vanished. This is mostly likely retirement from a cognitively and intellectually high pressured career. The epidemiological data which support this hypothesis also show that Jewish achievement is a sociocultural phenomenon and has nothing to do with genetics which is what some behavioral geneticists seem to think.

### 4.2 Low rates in Asian populations

The lowest rates in the Hodgkin lymphoma incidence are found in Asian populations, although rates increased with 8.3 % between 1993-2003 among young adults aged 15-39 years. The cultural dynamics of this group can explain the low incidence and also the sharp rise in their young adults [26].

I contend that the Asian cultural values are the crucial factors why Asian populations have a low Hodgkin lymphoma incidence. This statement is derived from comparing sociocultural values of both Asian and American culture. Asian and American social and cultural forces in pursuing personal goals can be categorized as collectivist versus individualistic values. Asian youths are influenced by collectivist values and they typically view striving to achieve as a moral obligation and see this as a part of their responsibility to family and community. North American young people view working hard in individualistic terms, rather as a personal choice [27]. The individualistic approach can be a source of potential stress and cognitive dissonance which a person in a collectivist culture is less exposed to because of an overlap in personal and cultural values and goals [28]. An important clue why Asians in the US, until recently, in general suffer less from lymphomas is because it appears that collectivist cultures provide in better stress coping mechanisms than the individualistic western cultures, which appear to sustain stressful situations. Thus the main reason why Asians in the US are less susceptible to cognitive and intellectual pressure regarding socioeconomic achievements is because a variety of social forces combine to foster a strong commitment to learning in Asian families and schools with build in social support and thus adequate stress coping mechanisms.

Cultural forces also profoundly affect self-esteem of persons. An especially strong emphasis on social comparison in school may explain why Chinese and Japanese children, despite their higher academic achievement score lower in self-esteem than North American children, a difference that widens with age [29]. This is important to understand because the effect of not meeting required cognitive and intellectual standards seems not to have such a devastating personal effect in these cultures as it can have in western culture. This can be deduced from the international Hodgkin lymphoma incidence.

The sharp rise of Hodgkin lymphoma in young adults of Asian descent in America can be attributed to adopting an individualistic view of achievement in line with American culture. Asians in America are also known as a high achieving ethnic group which can cause cognitive pressure in some persons to live up to that image of success. Young adults of Asian descent face the same cognitive and intellectual pressure as young adults with a Jewish background. Sociocultural dynamics can explain socioeconomic success of communities and also disease in some of their group members because of the excessive personal effort to live up to or to comply with the high standard of their successful community.

### 4.3 Fewer Blacks develop Hodgkin lymphoma

The risk for Hodgkin lymphoma in young children appears
to be greater in young children from poorer socioeconomic conditions such as in the black and Hispanic communities. Fewer black children develop Hodgkin lymphoma, although the difference is stronger after age 10 [30].

With this hypothesis in mind, the Hodgkin lymphoma incidence in young children of these predominantly low SES communities can be explained by parental pressure on these children to perform well in school to escape their dire socioeconomic situation. This is because the main influencers of children under 10 years are predominantly their parents. The causal factor for Hodgkin lymphoma in these children can be explained by a lack of good support and preparation to perform well in school. When a child lacks adequate means and support to perform well in school and therefore is deficient in academic skills it may cause cognitive and intellectual stress in some of these children. This situation is worsened when in the meantime their parents and social environment are emphasizing the importance of high achievement in school [31].

This conclusion is supported on one side by research which noted that parental values and beliefs (e.g. academic achievement) do not differ by social class, in other words: everyone in society is convinced by the advantages of a good education and on the other side by the observation that poor families are less likely to provide as rich a home-based learning environment for their children which in turn appears to reduce their children’s chances of academic success [32].

This pressure to perform well in school, diminish when a majority of children of these communities are more influenced by their peers when they become adolescents with a more anti-education and anti-academic achievement attitude which explains the gap in the Hodgkin lymphoma incidence between the white and black communities. However without disregarding the main causal mechanism in developing Hodgkin lymphoma, other socioeconomic endeavors in the day to day struggle to provide for an income or for personal development can also be a source of cognitive and intellectual stress which may also explain the incidence of Hodgkin lymphoma in adolescent and young adult blacks and Hispanics.

Contributing factors such as self-conscious emotions during the development from childhood to young adult can play an important role in explaining the difference in the Hodgkin lymphoma incidence between ethnic subgroups. Black children have the highest self-esteem compared to white age mates. In my view this high self-esteem in black children is a form of compensatory narcissism which conceals deep seated insecurities, in this case about intellectual capabilities. Pride motivates children to take further challenges and guilt prompts them to make amends and to strive for self-improvement. But the sociocultural reality of blacks does not show very much examples of academic or intellectual success and pursuing this path may cause intense shame because of the assumed high risk of failure. A shame-induced, sharp drop in self-esteem can trigger withdrawal, depression and intense anger at those who participated in the shame evoking situation [33, 34].

Another factor to explain why fewer blacks appear in the incidence of a disease which is actually an unfortunate indicator or proxy of how much effort is put in cognitive and intellectual achievement, is the belief that fixed intelligence and the belief that your intellectual performance measures your worth. Furthermore the chance to learn is sacrificed because of the belief that learning is risky and the power of effort is denied because of the belief that effort is only for the incompetent. All of this is applicable to the attitude of many blacks towards personal academic and intellectual achievements [35]. Of course there are exceptions to this cultural pattern but the socioeconomic and educational data support this analysis. This belief fundamentally shatters any effort to pursue intellectual endeavors which might expose someone to be intellectually inferior. Rather than to be exposed as intellectually inferior, the path of not seriously competing or participating in academic or intellectual effort is chosen by large parts of the black community in the US.

Ironically the lack of pursuit of intellectual success by the black community in general, compared to other ethnic groups in the US, conceals the vulnerable persons for cognitive and intellectual stress which explains the lower incidence of Hodgkin lymphoma in the black (and Hispanics) population.

The conclusion of this analysis on the Hodgkin lymphoma incidence in blacks supports the premise of this socioeconomic achievement pressure hypothesis although it is a rather sobering conclusion with mixed blessings.
5. Familial aggregation

The familial aggregation in the Hodgkin lymphoma epidemiology can be explained with studies from sociology, psychology and parenting research. Also elucidating are the sociological studies in the behavior of siblings including twins. How to understand the epidemiological data boils down to having a close look at family dynamics and especially how parents and children bond across different stages of child development. At the same time it is important to understand the bonding, rivalry and dominance between siblings, including twins, in especially high SES families. An important factor in this hypothesis is the appreciation of academic achievement and success by high SES families which is crucial to understand the observed patterns in bonding between parents and siblings in families of patients with Hodgkin lymphoma.

I contend that the Hodgkin lymphoma epidemiology provides for the causal mechanisms how family dynamics really work. This claim is based on the fact that this information is gathered from the families of patients afflicted with a potentially deadly disease. The danger and fear of a deadly disease minimizes the risk of ambiguous, false and socially desirable answers although some caution is always warranted because of the element of self deception in (some) patients as my research in the environmental causes of breast cancer has shown [36]. Cancer epidemiology provides with almost certainty the hard evidence about sociocultural connections and behaviors of people across ages, genders, religions and ethnicities.

It is noted in parenting and lifespan research that there are differences in bonding and rivalry between siblings of the same and of different genders in families and that this will change across the lifespan from childhood till adulthood [37]. Furthermore the sociocultural and familial influence on the behavior of twins is very important to understand. This claim is important and should not be confused or regarded less valid than the too often erroneously and too easily proposed genetic inheritance explanations on all complex human behavior and especially in the case of twins.

It is also noted that in families the younger members are more susceptible to follow the cultural rules of the family regarding academic achievements which make them vulnerable for overextension to comply with the standards of their families or their ethnic community. It is also evident that in families, bonding between siblings is more likely between siblings of the same gender and that dominance between siblings is more influential during puberty and adolescence. In adulthood siblings live a more independent life and are less influenced by each other and by their parents and are certainly less influenced by younger family members. However adults, especially those with a high SES are more likely to be influenced by their peers and social class.

The fact that older relatives and parents of patients are not vulnerable for Hodgkin lymphoma is because they are the point of reference for academic achievement by the younger generations of the family. They may not be aware of this fact but they are the guiding rod for the younger generations of their families. They also must take notice that not every member in their family is able to achieve academic excellence and parents and older relatives have to protected specific members of the younger generations from themselves. The Hodgkin lymphoma risk of older relatives and parents is connected to their parents, their peers or ethnic group or social class for socioeconomic achievement pressure.

These mechanisms and explanations are the reason why the three fold increased risk is not uniform for all close relatives of Hodgkin lymphoma patients.

5.1 The remarkable increased risk in Monozygotic (MZ) Twins

The remarkably increased risk observed in monozygotic twins (identical twins) with no increased risk for the heterozygotic twins (fraternal twins) can be explained by comparing the epidemiological data from cancer research with observations from parenting research on twins [38]. This analysis on the bonding dynamics between MZ and HZ twins is also important to show why the dominant genetic inheritance model in both cancer and twin research is inadequate and not applicable to fully understand complex human behavior. The analysis of the peculiar incidence of MZ and HZ twins in the Hodgkin lymphoma data needs some special attention. For one their behavior supports this socioeconomic achievement pressure hypothesis and this analysis also sheds light on the causal mechanisms which drive the behavior and preferences of
MZ twins which appear to be difficult to support with hard evidence in twin research.

To prove the validity of my hypothesis I have summarized the research on MZ twins from twin and parenting studies and completed those finding with additional clues from Hodgkin lymphoma epidemiology to explain the causal mechanisms of the similarities in the behavior of MZ twins [39].

Parents of MZ twins are aware of the temptation to treat them as one and consciously force themselves to treat them as individuals. However the most elucidating observations about twins comes from the unconsciously made remarks by mothers of twins who noticed that it is important to treat them differently but it is very easy to fall into the habit of saying ‘the twins’ and ‘they’. Twins tend to speak that way too. They tend to say ‘we don’t like him’ or ‘so and so doesn’t like us’. Also important is the observation that the immediate social environment, such as neighbors, discounts the fact that identical twins are two different people because they have the inclination to call them by the same name. As a result identical twins are (un)consciously influenced and internally motivated by their social environment to, for example, dress alike and to play with the same toys and to function as if they are one person with inseparable identities.

In general the self-sufficiency from childhood on will lead twins seek less contact with others and therefore to relative social isolation from adults. Twins often prefer each other’s company to being separate and they worry about each other when they are separated. One of the observed pervasive fears and dislikes of twins was being compared with each other in an evaluative (school) context. The researchers assumed incorrectly that the reason presumably was because of the possibility of feelings of inferiority, rivalry and hostility. The real reason in my view is that identical twins are conditioned from childhood on by interactions with the undiscriminating social environment to a level that their self-identities are intertwined. They are as a result not capable or cannot tolerate external information which might undermine their intertwined self-identities.

Dominance in school-age twins, it appears, depends on many factors: intellectual ability, physical prowess and interpersonal skill. However the most important external source of influence, the inseparable sociocultural image of them which is what they are continuously exposed to and the SES of their family and community is not thoroughly investigated.

5.2 Why similar preferences in identical twins is peculiar

From this research it is clear that identical/MZ twins are very susceptible for the cultural image of their social class or community because the pursuit of socioeconomic achievement is more prevalent in families with a high SES. Socioeconomic and intellectual achievement is primarily measured by the grade or title which is received but it does not represent an adequate picture of the required effort to obtain a particular grade or title. In many high SES families and some ethnic groups the achievement of an academic degree is regarded as very important and in most cases it is the level of education which is important rather than the type of study.

But it appears from this research that the individual MZ twin cannot differentiate from the other twin and look for an achievement outlet which suits him or her best according to the self-experienced innate abilities. In this way he or she can still comply with the socioeconomic achievement requirements of their family and social class which they are very keen to fulfill. Otherwise they wouldn’t have appeared in the Hodgkin lymphoma incidence. Instead it seems that the individual MZ twin is copying the dominant twin and both are probably following the family tradition of education or profession which is most likely not the strongest intellectual field of interest of the MZ twins.

MZ twins seem to copy the behavior of each other or the examples from important family members. Individually they seem not capable to follow an independent route which is more suitable and therefore intellectually less strenuous for the individual twin. Hence it is very peculiar that MZ twins have an excess risk for a disease that exposes excessive effort and stress because of cognitive and intellectual pressure. It seems like the individual MZ twin cannot determine for himself or herself what his or her personal preferences and capabilities are. And both identical twins seem to be guided by external cues from the social environment instead of internal behavior monitoring.

The epidemiological data confirms that fraternal/HZ twins can make independent behavioral decisions which will benefit their health and personal socioeconomic achievements. These conclusions are confirmed in studies
From parenting research. The sobering and simple fact is that HZ twins don’t look identical and are as such not confronted by an undiscriminating external social environment. That is the main reason why HZ twins according to this hypothesis develop a separate identity from each other which is also independent from siblings and the sociocultural environment [40].

From Hodgkin lymphoma epidemiology it is evident that the driving force in the development of similarities in the behavior and preferences of identical twins is the sociocultural environment. The continuous affirmation of their identical physical appearance and their treatment as one inseparable unit by the sociocultural environment is internalized (un)consciously by MZ twins. These sociocultural influences and stimuli will result in the development of inseparable self-identities in considerable numbers of MZ twins. Thus their inseparable self-identity is created and fed by the sociocultural environment, which is (un)consciously experienced by the MZ twins because this continuous process actually starts from the day they were born. As such, a number of MZ twins do not develop an independent self-identity separate from the other twin. The mechanisms of self-identity must not be confused with external traits or mannerisms which are shown to the world in action-reaction situations because those (re)actions are not a full expression of the self-identity of the person. Extreme situations, like the life and death situations in cancer development are more elucidating to understand the causal mechanisms behind the similarities in behavior and preferences of MZ twins. These real life situations produce epidemiological data which is less prone to be biased by self-deception by the twins themselves.

5.3 Concluding remarks on the high excess risk of MZ twins in Hodgkin lymphoma

This research shows that MZ twins are very aware of their social environment and there is an apparent strong urge to conform to both the external as well to the internal image of themselves the social environment presents to them. This can only be explained by the simple fact of being physically identical which is reinforced (un)consciously to them from childhood on by parents and social environment. The fact of being physically identical and the reactions of the social environment on their physical similarity is the main force which drives MZ twins to have similar behaviors and preferences. This conceals the fact for both researchers and the MZ twins that although they are MZ twins and have obtained similar preferences that they are cognitively and intellectually not the same. This conclusion follows from the analysis of Hodgkin lymphoma epidemiology and it refutes most of the genetic explanations on MZ twin behavior. To put it more clearly: A lack of social and cognitive independence in MZ twins explains the similarities in their behavior and preferences. And human behavior is too complicated to be regulated by genetics alone. Sociocultural mechanisms rather than genetic explanations appear to be the genuine causal mechanisms underneath the similarities in MZ twin behavior and preferences.

6. Discussion

This paper which presents a hypothesis on the environmental mechanisms of Hodgkin lymphoma combines research from: social psychology, socioeconomic mobility, life span studies, parenting and twin studies. This investigation led to the conclusion that Hodgkin lymphoma is caused by cognitive and intellectual achievement pressure and stress.

Although this hypothesis might be very plausible, the presented connections between Hodgkin lymphoma and socioeconomic and intellectual achievement pressures have to be verified and validated by epidemiological research. This socioeconomic achievement pressure hypothesis should comply with the well-known Hill’s concepts of causation. These are: Experiment (RCTs), Strength of association (Effect size), Consistency of an association (Replication), Specificity, Relationship in time, Biological gradient, Biological plausibility, Coherence of the evidence and Reasoning by analogy [41].

I think both new epidemiological studies are relevant as well as a review of the old studies based on the premise of the presented hypothesis. By alerting and monitoring members of the communities at risk and by educating them about the causal sociocultural mechanisms of this disease, this theory will have a positive impact on the incidence of Hodgkin lymphoma. Based on the finding of this research it will also be possible to screen old studies for the type of personalities of patients in order to profile for potential victims of this disease. Thus this hypothesis provides for a
screening program for potential Hodgkin lymphoma victims. Ultimately this theory will have a predictive and preventive purpose for persons who are susceptible for the mechanisms which might lead to Hodgkin lymphoma.

It has also not escape my attention that cognitive stress might also be the explanatory model of lymphomas in pet animals [42]. Moreover this research provides important clues to conduct more thorough and conclusive research on twins and family dynamics.

7. Conclusions

In this paper the Socioeconomic Achievement Pressure hypothesis is presented as the environmental cause of Hodgkin lymphoma across the human lifespan and across all ethnicities. This claim is supported by an almost complete coverage of the Hodgkin lymphoma epidemiology with this hypothesis. Genetic susceptibility or a viral connection appears to be the wrong explanatory model for Hodgkin lymphoma. Instead intellectual and cognitive stress appear to be the causal sociocultural mechanism in Hodgkin lymphoma development. It has also not escape my attention that cognitive stress might also be the explanatory model of lymphomas in pet animals.

Based on this hypothesis I contend that the risk for Hodgkin lymphoma can be explained by excess achievement and intellectual pressure in specific individuals because they find it hard to fulfill or to comply with the high standard of socioeconomic and/or intellectual requirements of their family, community or peers. The prolonged and intense cognitive stress might ultimately lead to Hodgkin lymphoma development.

From cancer research it is clear that lymphoma happens first in body’s lymphatic system. Cognitive and intellectual stress appear to cause deregulation of the lymphatic system. The experienced severity of cognitive stress by the afflicted person determines what kind of lymphoma the patient will develop.

Both intensity and duration of exposure to aberrant forms of neuroendocrine hormones or other stressors are crucial in lymphoma development. The personal characteristics of the patient which include his or her cognitive functions and neuroendocrine system are crucial to understand the incidence of Hodgkin lymphoma because it is not a major form of cancer in terms of casualties.

The causal biological connections will be found in the hematological and neuroendocrine processes which are disrupted when these environmental processes are processed in the brain. I hypothesize that the malignant cancer process involves the interference of the amygdala which configures the aberrant forms of these neuroendocrine hormones.

Hodgkin lymphoma epidemiology also provides for the causal mechanisms how family dynamics really work. Moreover it clarifies that sociocultural mechanisms rather than genetic explanations appear to be the causal mechanisms underneath the similarities in behavior and preferences of identical twins. This research provides important clues to conduct more thorough and conclusive research on twins, family dynamics and lymphomas in animals.

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