THE RELATIVE AGE EFFECT ON MINOR SPORT PARTICIPATION

by

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ABSTRACT

The purpose of this study was to determine if there was a relative age effect among Quebec minor sport participants of swimming, soccer, team handball and volleyball.

The birthdates of 13,169 registered participants of these sports were studied. Chi-Square analyses revealed the distribution of participants births across the quarters of the year to be significantly different from the normal expectancy. Most frequently the pattern was a systematic decrease in numbers of participants born from the first to the last quarter of the year.

It was concluded that participation in each of these sports is affected by relative age. These relative age effects appear in many age categories due to developmental and maturational age differences (in months) of participants, and to physical ability and skill differences at crucial times in the seasons of each sport.

RÉSUMÉ

Cette étude avait pour but de déterminer si il y avait un effet relatif de l'âge parmi les participants de sports mineurs au Quebec en natation, soccer, handball et volleyball.

Les dates de naissance de 13,169 participants inscrits aux sports mentionnés ci-haut furent etudiées. L'analyse du Khi-carré révéla, ce de facon significative, que la distribution des dates de naissance des participants dans chaque quartier de l'année est différente de la distribution dite normale. Plus précisement, nous retrouvons une baisse significative du nombre de participants nés du premier au dernier quartier de l'année.

La participation dans chaque sport mentionné ci-haut est donc affecté par l'effet relatif de l'âge. Cet effet relatif de l'âge apparait dans plusieurs catégories d'âge du aux differences (en mois) d'âge et de dévelopment des participants, et du aux différences d'habiletés et d'aptitudes physiques lors des temps cibles de la saison de chaque sport.

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CHAPTER I

INTRODUCTION

Our society is preoccupied with age, categories and classifications. Often individuals are categorized as young, adolescent, middle aged and elderly. We place individuals according to their chronological ages into categories. Between certain ages we are students, then working adults, and finally we are retirees.

The grouping of individuals into a category by chronology is often a necessary and required practice. Our education laws dictate that a child of six years of age must enter grade one. It has been found that children entering first grade younger than the chronological age of six years have a distinct disadvantage in academic achievement, social and emotional adjustment when compared to average age entrants (Beattie, 1970; Halliwell, 1966).

When children are grouped in accordance with the year in which they were born, there appear physical, intellectual and behavioral maturational differences between the children born early in the year (January, February and March) and those born late in the year (October, November and December). These differences between individuals within the same age category or grade have been termed "The Relative Age Effect" (Barnsley, Thompson & Barnsley, 1985).

Age groupings and classifications are also involved in sporting activities. Children are classified by age as Mites,

Novices, Atoms, Pee Wees, Bantams, Midgets, Juveniles, Juniors and Seniors. These categories in minor sports usually involve a two year period based on the year of birth, with December 31st being the cut-off point. Hence, participants are placed within categories according to their chronological ages in years. The classification of participants in physical activities is used in order to equalize competition, facilitate instruction, maximize program continuity and promote safety of the participants (Barrow & McGee, 1971).

Barnsley et al. (1985) and Barnsley and Thompson (1988) conducted pioneering investigations that involved studying the Relative Age Effect in relation to the two year category system in minor hockey and it's effect on participation in elite and professional hockey leagues. The premise of the investigations was that those born early in the year in each age category are bigger, stronger and better coordinated than those born later in the year but in the same category. That is, those born early in the year experience a developmental advantage while those born late in the year experience a developmental disadvantage.

The investigators hypothesized that the result of this system would be that the older participants (those born earlier in the year) achieve more success, receive greater rewards and continue to play within the system longer than the younger participants (those born later in the year). The younger participants would be more likely to experience

frustration and failure and as a result might leave hockey for other recreational activities.

The results from Barnsley and colleagues' (1985) and Barnsley and Thompson's (1988) research on the age grouping practices of minor hockey in Canada were that there is an extremely strong positive relationship between month of birth and hockey success. Those individuals born early in the year have as much as four times greater chance of making it to an elite level of hockey play than those born late in the year. They concluded that many minor hockey participants never get a chance to reach their full potential in the game because they are born late in the year and are negatively biased by the system from the beginning. The product of the Relative Age Effect on hockey participation and success has been termed the "Birthdate Phenomenon" (Barnsley et al., 1985).

1.1 Nature And Scope Of The Study

The Birthdate Phenomenon has been found within the Canadian minor hockey system. However, no other research in regard to the Relative Age Effect or the Birthdate Phenomenon has been found on participants of minor sports.

Therefore, the purpose of this study was to examine the generality and mechanisms of the Birthdate Phenomenon on a variety of minor sports. Most Canadian minor sports employ

the same two year age categories with a December 31st cut-off date as does minor league hockey. With this type of system, children may potentially be engaged in competition with children as much as twenty-four months older than they are. Hence, every time the children born late in the year enter a new age category, they must compete with the older individuals for a position on the team. Can we really expect children to prosper in a system that pits them against their peers who have such a maturational advantage during the critical developmental periods of childhood and adolescence ?

1.2 Significance Of The Study

Western society is preoccupied with sports, professional and amateur. This is evident in the amount of time, money and energy that the average citizen devotes to involvement and watching sports. The professional sport environment is a multimillion dollar business. Minor sport is also a field where much time, energy and money is spent. If sport is such a large part of our society, then we should be striving to provide a fair environment where individuals can reach their fullest potential. From all evidence, the present Canadian minor hockey system provides a very unjust bias in favor of some individuals while systematically penalizing others.

According to Weiss (1962), children become interested in activities when they succeed and when the activities are geared to their levels of ability. When children do not achieve at their supposed level of ability, there is a lowering of interest and motivation and resultant tendency to withdraw from the activity. In order to succeed, tasks must be appropriate to their capability and maturation (Carter, 1956). When we match children with up to twenty-four months difference in maturation, the tasks for the older and younger participants are much different.

This study will seek to determine the generality and mechanisms of the Relative Age Effect, specifically the Birthdate Phenomenon in minor sport. This phenomenon is a product of the Relative Age Effect where there appears a relationship between participation and the individual's month of birth. The Birthdate Phenomenon is present in a sport where the numbers of participants drops off systematically according to month of birth from January to December. The existence of this phenomenon in hockey has been discovered and is suggested to be a reason why some individuals succeed in minor sport organizations and make it to an elite level and why others drop-out of the same organization at an early age. A variety of minor sports will be examined to determine if the Birthdate Phenomenon is present. The results from this investigation should help us in understanding the potential biases within our minor sports.

1.3 Statement Of The Problem

The Birthdate Phenomenon has been discovered in minor league ice hockey (Barnsley et al., 1985; Barnsley & Thompson, 1988), but as of yet has not been studied in relation to other minor sports. Other sports need to be examined to determine the generality and mechanisms of this phenomenon.

Many minor sports employ the two year age categories as in minor hockey. Most sports in Canada also use December 31st as the cut-off date for the various age categories. This method of grouping places participants born within a given two year period together in an age category. Every two years, when individuals enter a new age category, those born late in the year must compete for a position against those individuals born early in the same year, as well as, those individuals who are in their second year within the age category. The effect of this system is that the individuals born after January continue to be the younger competitors throughout their careers and continually compete against individuals ranging from one month (if born in February) to twenty four months (if born in December of the second year) older than they are.

Due to the organization of minor sports, it is hypothesized that the grouping structures as described above create relative age advantages for those participants born early in the year. The purpose of the study is to examine the

generality and the mechanisms of the Birthdate Phenomenon among other minor sports.

1.4 Hypotheses

1.4.1 The relative age differences between participants in minor sport, created by the grouping procedure used, result in participation rates that vary for those born at different times in the year. More specifically it was hypothesized that statistically;

1.4.1.1 Significant differences would exist between the observed number of sport participants born in each quarter of the year and a theoretical even distribution of births across the quarters. These significant differences would be found in the overall participation rates for each sport for males and females separately, as well as, at each age category within each sport.

1.4.1.2 The observed numbers of participants born each month of the year, for the overall participation rates for each sport would be represented by a positive relationship between the percentage of births in each month and a ranked order of months from January to December.

1.5 Delimitations

The geographical delimitation of this study is that the subjects are only from the province of Quebec, Canada. The subjects are all registered participants of the Quebec minor sport federations identified.

1.6 Limitations

The limitations of this study are that all the subjects are registered participants within their respective sport federations. The sample does not include subjects from educational or professional organizations also involved in organizing these sport activities.

1.7 Definitions

The following terms are defined as used in the present study.

1.7.1 Relative age effect - performance differences as a result of the age and maturational or developmental differences between individuals grouped within a category or grade by age in years.

1.7.2 Birthdate phenomenon - a product of the relative age effect within a sport where the numbers of participants drops-off systematically according to month of birth from January to December.

1.7.3 Chronological age - the age of a participant as described in years and months.

1.7.4 Minor sport - amateur sport where individuals are grouped into categories by age.

1.7.5 Elite - amateur or professional sport participation which represent the highest calibre of performance in an age category, level, league, district or geographical location.

CHAPTER II

REVIEW OF THE LITERATURE

Age is a very important criteria for inclusion in the organizations and institutions within our society. The practice of age grouping is involved in our education, in our leisure activities and within our minor sports. The differences in maturation and performance among individuals grouped by age has been termed the "Relative Age Effect" (Barnsley et al., 1985).

The effect of students entering grade one early has been studied in relation to academic achievement, social and emotional development, as well as, future success in elementary, high school and college. The effects of entrance age into kindergarten and grade one have been studied with special populations labelled as gifted and learning disabled as well.

Recently the effects of relative age has been studied in relation to professional and minor sport. Barnsley et al. (1985) studied the effect of age groupings and month of birth on participation within hockey. The authors report finding an extremely strong relationship between month of birth and the proportion of players in the leagues studied. They believe that this is another example of the Relative Age Effect previously discovered in relation to educational achievement. The investigators recommend further research

into the area in order to gain a better understanding of the underlying mechanisms and the generality of the phenomenon.

2.1 The Relative Age Effect In Education

The difference in ages of children entering and within an age category or school grade has been termed relative age. The effects produced by grouping children with various entrance ages into kindergarten and first grade on academic, social and school success have been studied in great depth.

Halliwell (1966) conducted a comprehensive review of the literature pertaining to the effects of school entrance age on children. The analysis indicates conclusively that early admission to grade one (children under the age of six years) results in lower achievement throughout schooling.

2.1.1 School entrance age and academic success.

The method used most widely to examine the effects of age grouping in education has been to compare children according to their chronological and mental ages upon entering kindergarten or grade one. When younger children are matched intellectually, emotionally and socially with older children, the older children should show a higher level of maturation. The result of this type of grouping is that

the younger child will have an age handicap in competing for achievement and social status in the class (Weiss, 1962).

Analysis of entrance age and school success shows a definite relationship between them. The examination of entrance age on school success dates back to as early as the 1920's and is still prominent in the 1980's. One of the first investigations into the Relative Age Effect was conducted by Elizabeth Bigelow (1934). The investigator found that when children were admitted into grade one with a chronological and mental age lower than six years, they had very little chance of succeeding in school. Since this early research, investigators have continued to study the effects of entrance age on school success. The majority of the findings support the existence of the Relative Age Effect. That is, when children are grouped into Kindergarten and first grade, those children who are older upon entrance show significantly higher achievement throughout their education careers (Beattie, 1970; Gredler, 1980; Halliwell, 1966; Halliwell & Stein, 1964).

It has been discovered that children with average intelligence who entered grade one before the chronological and mental age of six years did not realize optimum academic achievement. The areas examined include social and emotional development, reading, arithmetic and language skills (Bear, 1958; Bigelow, 1934; Carroll, 1963; Dickinson & Larson, 1963;

DiPasquale, Moule & Flewelling, 1980; Green & Simmons, 1962; Hamalainen, 1952; Pidgeon & Doods, 1960; Weiss, 1962).

Maddux, Stacey and Scott (1981) comment that the reviews on relative age generally agree that among unselected children entering Kindergarten and first grade, the younger ones, not admitted on the basis of high scores on psychological and intelligence tests, generally do not achieve or adjust as well as those who are older. They suggest that parents may wish to consider delaying first grade entrance for those children who show signs of immaturity. King (1955) found that attaining a few additional months of chronological age at the beginning of grade one is an important factor in a child's ability to meet the imposed restrictions and tensions that school necessarily presents.

Evidence appears within the studies on relative age that younger children are not only at a disadvantage in the first grade but continue to suffer throughout their educations. Jinks (1964) found that the disadvantage of being born late in the school year is not eliminated by the end of primary schooling. These findings are supported by Carter (1956), Carroll (1963), Gowen and Gooch (1926), Kingston (1962), and Pidgeon and Dodds (1960).

King (1955) found that throughout their schooling, younger entrants had difficulty attaining up to grade level in academic skills, and a large portion fell below grade level standards. He also found that a large number of

younger entrants had to repeat a grade, had lower average daily attendance and were likely to show more indication of poor personal and social adjustment to schcol.

There are also instances in the study of entrance age, where no relative age effects are observed. The younger entrants did as well or better than the average age entrants in the studies of Birch (1954), Hobson (1948), Miller (1957), Nemzek and Finch (1939). Closer examination of the methodology of these studies, however, makes it apparent that these authors do not dispute the Relative Age Effect.

Nemzek and Finch (1939) failed to find a relationship between age at entrance and total honor point average based upon marks earned in high school. In this study, the experimenters did not take into consideration the students who dropped out during or before high school. In the era in which the study is set, we find that many of the students who might normally have been in high school probably had dropped out during the depression of the 1930's because of family hardship. It is possible that the younger entrants, who predictably were not as successful as those who were older, dropped out or were removed from the public school system by the family. Hence, the conclusion of this study may not be totally warranted.

Birch (1954) found that forty-three children admitted to school early were making satisfactory school achievement and adjustment in all areas of academic, social, emotional

and physical progress. However, the researcher in this study was only concerned with the advanced children, those who were considered to be intellectually above the normal range for first grade (Ammons & Goodlad, 1955).

Hobson (1948a) and Miller (1957) also conducted their studies with populations that were tested to have a mental age above six years of age. This would appear to be the reason they did not find evidence of a Relative Age Effect.

The indication from the research on entrance age is that if children are admitted to school before a chronological and mental age of six years, they may experience difficulties that will continue throughout their educational careers. These younger entrants suffer from a relative age disadvantage compared to average age entrants.

2.1.2 Mental age and giftedness as criteria for school entrance.

The mentally advanced child is that child whose mental age is superior to his or her chronological age. The evidence thus far suggests that the student whose mental age is six years or over, but whose chronological age is not yet six, can succeed adequately and achieve in school (Braga, 1971; Green & Simmons, 1962; Hobson, 1948a).

Hobson (1948b) found that there is no difference in social and emotional maturity between mentally advanced early

entrants and their chronologically older classmates. The author also found that underage children admitted on the basis of an average age of six years old between mental and chronological age (a mental age higher than six years and a chronological age less than six years) did as well as the chronologically older children academically and socially. The indication here is that mentally advanced children who have been properly screened for mental age, emotional stability and maturity for early entrance, in general, rate as well as their classmates on academic, social and emotional criteria (Braqa, 1971).

The ability to read is critical in order to succeed in school. It has been found that early entrants do not achieve and succeed as well as later entrants in the area of reading (Dean, 1939; Gates, 1937; Halliwell & Stein, 1964; Hampleman, 1959; Karlin, 1957; Morphett & Washburne, 1931). Research on mental age and reading readiness has found that a minimum mental age of at least six years must be obtained at the time of school admission for students to be successful. Morphett (1931) found that the group having a mental age between six years and six and a half years had a sharp rise in the percentage making satisfactory progress in first grade as compared to those who were admitted under this age. Findings by Dean (1939) support these results. Dean states that the mental age at entrance which was required to do average work in first grade reading was found to be six years and six

months. He found that below this age far more students failed than succeeded. In another study, it was found that those children who started school at six years and four months or more as a group were superior to their younger classmates on reading achievement by the time they got to the sixth grade level (Hampleman, 1959).

According to Birch (1954), early admission of mentally advanced children is a very promising educational practice. As has been demonstrated with the studies on mental age, those students with a mental age of six years and above do achieve satisfactorily in school.

A distinction is sometimes made between mentally advanced and gifted students in regards to the effects of early versus late entrance. A gifted child may not just be an individual who's mental age is slightly ahead of his or her chronological age. A gifted child is often defined as having the ability to generalize, to see connections and to use alternatives (Roeper, 1977). According to Roeper, giftedness in a preschool child may not result in outstanding academic readiness. Roeper (1977) warns that the young child gifted with superior thinking abilities, who has been living with these abilities, may not be ready to deal emotionally with that which he understands intellectually. In some cases this may cause a child to act retarded socially and academically.

The warnings and recommendation of Roeper (1977) have been substantiated by Maddux, Stacy, and Scott (1981). They found that the children labeled gifted tended to have entered first grade when they were relatively old. According to the analysis in their study, significantly fewer early entrants were gifted and more late entrants were so classified.

After examination of the studies on mental age, giftedness and resulting school success, a series of questions remain unanswered. What if the children who were admitted early because of mental age had waited to the proper chronological age before entering ? Would they still be generating average results or would they too be considered gifted ? Could a few additional months of chronological age have given them the maturity and ability to excel in school ? No research has been found to satisfactorily answer these questions.

2.1.3 Relative age effect and learning disability classifications.

Ilg and Ames (1972) claim that the most common cause of difficulty in school is immaturity and that educators create a large percentage of learning problems by attempting to teach academics to many children who are not ready to learn. If this is the case, then many students are being labelled and treated as learning disabled when in fact a relative age

effect is actually responsible. Those children who were born late in the year (admitted to school early) are suffering from immaturity rather than any learning disability (DiPasquale et al., 1980; Donofrio, 1977; Maddux, 1980).

Maddux (1980) found that significantly more early entrants and fewer late entrants were found in the learning disabled group. Donofrio (1977) also found that children born late in the year are significantly more likely to be referred to psychological services for academic problems in the primary grades than the children born early in the year. He concluded that the later born individuals are encountering more difficulty in school. DiPasquale et al. (1980) studied students referred for psychological services. They found that a relative age effect was present. Children born late in the year were significantly more likely to be referred to psychological services for academic problems in the primary grades than children born early in the year. The authors conclude that the birthdate effect was due to academic rather than behavioral referrals. The students did not have the intellectual maturity to handle the academic work load.

If, as the results from these studies indicate, a significant number of students labeled learning disabled are in fact products of relative age effects, then the educational system is at fault. The educational system should insure that a child is at a chronological and mental age that will provide the optimum chance for success in school.

2.1.4 Gender differences in the relative age effect.

It appears that the Relative Age Effect is more pronounced among males than females. The findings indicate that older boys had higher achievement scores than did the younger. The indication from the studies by Carroll (1963), Carter (1956) and Davies (1939) is that older females tend to do slightly better than younger females; however, these findings were not significant. DiPasquale et al. (1980) in a study concerned with learning disabilities and entrance age found evidence of a relative age effect in the male, but not in the female data.

These findings are in line with the accumulated evidence of a relationship between the slower maturation rate of boys and the higher rate of academic trouble (Carroll, 1963).

2.2 The Relative Age Effect And Birthdate Phenomenon In Sport

The practice of age grouping as has been described in educational settings is also prominent within minor sports. It has been seen that this practice produces in schools disadvantages for those studerts born late in the school year. It would also, therefore, seem that grouping children by age for sporting activities may produce disadvantages for those participants born late in the year.

Barnsley et al. (1985) picked up on this idea and attempted to investigate the Relative Age Effect on participation within hockey. The authors reasoned that if relative age did affect, or was correlated with hockey performance, there would be more successful hockey players born in the early months of the year. They studied the frequency of births in months for the individuals participating in the 1982/83 season in the National Hockey League, Western Hockey League and the Ontario Hockey League. The results of this study revealed an extremely strong relationship between month of birth and the proportion of players in the leagues studied. Rank order correlations were computed between the months of the year and the number of participants born in each month. They resulted in significant relationships between the month of birth and the percentage of hockey players in that league born that month. The correlation obtained for the National Hockey League was, .89 ($p<.01$), for the Western Hockey League, .99 ($p<.01$), and for the Ontario Hockey League it was .98 ($p<.01$). Through additional analysis they discovered that N.H.L. players are almost twice as likely to be born in the first quarter of the year as in the last quarter. The authors conclude that this study documents a birthdate phenomenon in relation to hockey success. In light of the results obtained, the authors felt that a number of potentially talented hockey players were

not achieving the level of performance that would accurately reflect their abilities.

Barnsley and Thompson (1988) continued the study of the Relative Age Effect on hockey participation and success with two additional investigations. The first studied birthdate and rate of participation in minor hockey; the second involved the examination of the Relative Age Effect in relation to representative (usually representative of a city or area) or top tier teams. In their first study they hypothesized, as a result of relative age effects, that as the children in minor hockey grow up, those born in the first months of the year tend to remain as participants, whereas those born in the later months of the year tend to drop-out. Their analysis of 7313 minor hockey participants demonstrated this to be the case. A significant difference was found between the observed numbers of participants born in each quarter of the year and an expected even distribution of numbers across the quarters (Chi-squared = 21.77; df = 3; $p<.001$). The reason given for this drop-out is that the younger children in the age group experience a developmental disadvantage relative to the older children in the same age group and hence are eliminated or leave in frustration. The results showed that there was no difference in the participation rates of hockey players born in different quarters of the year in the "Mite F" (eight years and below), "Mite" (nine and ten years of age), and the "Junior"

(nineteen and twenty years of age) categories. However, all the remaining categories showed significantly different distributions of participants across the quarters of the year than would be expected with an even distribution across the quarters. The findings of this study support the hypothesis proposed by Barnsley et al. in the 1985 study. That is, that the relative age differences, based on month of birth, among hockey players creates differing experiences of success and thereby alters the participation rate in minor league play after the "Mite" category. The authors conclude that older players (January-June birthdates) continue to play minor hockey till a later age than do the younger players (July-December birthdates) who tend to drop-out of the sport. The authors explain that the observation of no effect on participation in the junior category was due to the fact that the better junior players participate in leagues outside of the Minor Hockey Association and hence they were not included in this study. The authors had already presented data in their original study (1985) on major junior hockey, in the Western and Ontario Hockey Leagues, wherein the results predictably were in line with the findings on professional hockey players.

The second of Barnsley and Thompson's 1988 studies suggests a further explanation for the relationship between month of birth and long-term success in hockey or the withdrawal from competitive play. The authors feel that the

explanation for the Birthdate Phenomenon in hockey resides in the differential hockey experiences given to players who are chosen for representative ("rep") or "top tier" teams in their leagues as compared to those not so selected. The argument suggests that those players who have a relative age advantage are more likely to be chosen for the higher calibre teams than those players with a relative age disadvantage. Once placed on the higher calibre teams, these players experience advantages such as better coaching, higher level of competition, more ice time and greater prestige. The authors concluded that the analysis of their data revealed a significant relationship between birth quarter and the tier level of minor league hockey participation (Chi-squared = 160.89; df = 6; $p<.001$). Three interrelated patterns emerged from the analysis of these data.

The first pattern was that at each age category, with the exception of "Midget", the lowest tiers demonstrate a significant differences between the observed distribution of births across the quarters of the year and the expected even distribution. However, these results show fewer players with a relative age advantage playing at these lower tier levels. That is, significantly more participants born in the last two quarters are participating at these lower tiers.

The second pattern found significant differences between the observed and the expected numbers in the top tier teams. There was a much higher proportion of players at this

level born in the first half of the year than in the second. This finding supports the hypothesis that selection to a top tier or "rep" team is highly related to the relative age advantage of hockey players.

The third pattern discovered was that in the middle tiers no relationship exists between birthdate and participation rate. This appeared to be the result of the higher proportion of players with a relative age advantage being placed in the higher tier leagues and those disadvantaged placed in the lower tiers.

The results of the investigations by Barnsley et al. (1985) and Barnsley and Thompson (1988) led them to the conclusion that a far larger proportion of hockey players born early in the year are being developed to their potential than is the case of those born later in the year. These studies do not answer whether the development of the early born players has been a long standing outcome of the minor hockey system, or is it a recent development.

There are other data that suggest the relative age effect observed in professional hockey is a relatively recent development. Daniel and Jansen (1987) compiled the birthdates of players in the N.H.L. and observed no evidence of the Birthdate Phenomenon in selected seasons of the 1960's, and as late as the 1975 season. According to their investigations, the effect observed by Barnsley et al. (1985) involved the 1982/83 season and was even more pronounced in

the 1985/86 season. Their explanation for the development of a relative age effect in hockey is related to the international series with the Soviet Union of 1972 and 1974. They suggest that it was at this point that greater emphasis in Canada began to be placed on systematic methods of developing hockey talent. Hence, streaming of players into various levels of proficiency at an early age became widespread (Daniel & Jansen, 1987).

Daniel and Jansen (1987) went on in an attempt to find out if there was any indication of a relative age effect in professional sports other than hockey. Their investigation involved studying participation rates relative to month of birth in the professional sports of football, basketball and baseball. The leagues studied were the Canadian and National football leagues, the National Basketball Association and Major league baseball. Their results showed no clear indication of a relative age effect in any of the three sports at the professional level.

Daniel and Jansen (1987) expressed a belief that the reason that a relative age effect was not observed in football is that competitive play typically begins at a much later age than in hockey and that height and weight as much as, or rather than, age is involved in the separation of participants into categories. Hence, they suggest that the Relative Age Effect is present in professional hockey and not in football as a result of the more pronounced differences in

physical development with a few months of age at the age that organized play begins. They suggest also that the longer playing period over which the Effect may be felt by the participant in activities, such as hockey, may also affect who stays in the sport up to the professional ranks.

With respect to basketball, the structure and organization are closer to football than to hockey. Organized competitive play commences at about the same age as in football and participation occurs mainly through the schools with age groupings not as restrictive (Daniel & Jansen, 1987). This would seem to explain not finding the Birthdate Phenomenon among professional basketball players.

Out of the three sports studied by Daniel & Jansen (1987), baseball would be expected to be most closely related to hockey. Organized play begins at a relatively early age, although not as early as in hockey and players are grouped in two year age categories. In the United States of America, September first is the cut-off date for little league play. Daniel and Jansen's data suggest that the first quarter after September first has the greatest concentration of players births. This finding is not statistically significant, however.

The conclusions of Daniel and Jansen (1987) support the findings of Barnsley et al. (1985) and Barnsley and Thompson (1988). That is, the Birthdate Phenomenon is a product of the current Canadian minor hockey system.

2.3 Summary

The indication of both educational and sport research is that if we continue to group children into grades and categories strictly by chronological age without considering other variables such as maturation or development, mental age, ability level or skill level, we automatically condemn a proportion of the population to disappointment and potentially eventual failure. We cause them to be labelled; we produce frustration and disappointment, and we eventually cause some participants to drop-out of the system.

Each and every individual should have the opportunity to experience self-satisfaction and success in whatever endeavors he or she may choose. Weiss (1962) states that if children are exposed to situations before they are ready or capable of making sufficient progress for self satisfaction, they may develop uncomfortable attitudes to the situation and themselves. Society should be striving to present the opportunity for self-satisfaction for the individual, but instead sometime seems to be limiting this pleasure to a select few based upon their time of birth within the year.

The discovery of relative age effects within the Canadian minor hockey system is startling and disturbing. The existence of the Birthdate Phenomenon in professional and minor hockey is clear. The lack of its existence in professional Football, Basketball and Baseball is

enlightening. However, it does not answer the question of whether it exists in the lower levels in these or other sports played by thousands of people in minor or amateur organizations. The study of the participants of these other sports may lead to some suggestions for ways to overcome this effect in hockey and in any other sports that may be affected.

CHAPTER III

METHODS AND PROCEDURES

In an effort to discover the generality and mechanisms of the Relative Age Effect, specifically the Birthdate Phenomenon, in minor sport, an attempt was made to obtain the necessary data in at least one individual and a variety of team sports with varying organizations, but with grouping systems similar to that of ice hockey. It was decided that a minimum of one thousand participants in each sport would be required to make the analyses across ages at a given time worthwhile. The information which was required in this study was the gender, birthdate and level of competition of each of the participants in each sport. It seemed desirable to obtain the across age data on each sport for one year.

The provincial sport federations of swimming, soccer, team handball and volleyball were contacted for the 1988 year's registration lists containing the necessary information on each participant. The provincial soccer federation did not have a list of all participants due to the large number of them (approximately sixty-five thousand) across Quebec. An affiliated association was then contacted (Montreal-Concordia Soccer Association) for it's registration list. It was thought that the organizational differences and similarities of swimming, soccer, team handball and volleyball would elucidate whether or not there is a relative age effect in sports with varying properties and requirements. These

properties include individual competition and team play, the use of December 31st as a cut-off, and the use of individuals' birthdates as the cut-off dates, varying season starting dates and lengths, and commencement of competitive play at various ages.

3.1 Swimming

Swimming is an individual sport with slightly higher female than male participation. The participants in swimming enter and leave age categories on their birthdates. The sport of swimming is divided into two organizational structures. The first involves the primary three age groupings (8,9 & 10 years of age) each being of one year duration. There are monthly competitions beginning in October and culminating in February. The second structure emerges at the eleven-to-twelve year old age category. From this point on, age groupings are of two and three year durations. The competitive season is more-or-less year-around with major competitions for individual standings in February and team standings in August. At these levels, swimmers are ranked and placed in ability groups (A, B & C levels) and hence compete in different divisions. Placement in a division is determined by achieving established standard times for the various competitive events. A swimmer has to meet the required time standard for his or her division in the previous competition in order to qualify

for the next competitive event. Unhappily, the numbers of participants competing in each division at each age level was not included on the registration lists obtained for this study and subsequently analysis by division could not be carried out.

3.2 Soccer

Soccer, which is a team sport that is extremely popular throughout the world, has approximately sixty-five thousand participants at the minor level in the Province of Quebec. Female participation is far less than male. This sport is also played in the schools, especially in high schools, colleges and universities.

Soccer is primarily a summer sport although it also includes a winter indoor season in Quebec. Its main season begins in May or June and terminates in September or October. Soccer has a grouping and organizational structure similar to that of ice hockey. It employs two year age categories up to the junior level with a December 31st cut-off date. It is a stratified sport with up to three competitive levels at each age category. Competitive play begins at eight years of age. In general there are "A" level teams which represent their associations or organizations in inter-city competition. The "B" level teams compete inter-districtly at a lower level

than the "A" teams, and the "C" level teams generally compete amongst themselves in a "house league" structure.

3.3 Team Handball And Volleyball

Representatives of the Quebec Team Handball and Volleyball Federations expressed a keen interest in this study and readily supplied the necessary information. These sports share a grouping and organizational structure similar to that of hockey and soccer. The age categories encompass a two year age range. Each is a team sport and employs the December 31st cut-off date for inclusion into each age category. Team Handball has approximately the same number of male and female participants. Volleyball has a slightly higher number of female than male participants.

The youngest competitive level is the eleven-to-twelve year old age group and the two year categories continue to the seventeen-to-eighteen age level. After this, team handball has a nineteen-and-over age category. Each sport is stratified into two levels at the sixteen-to-seventeen age category. Again, the information necessary to study this stratification was not provided in the registration lists and therefore, an analyses of its effect if any on participation could not be carried out. Both sports have approximately the same season beginning in October and ending in April.

Unlike the other sports included in this study, team handball and volleyball are both greatly influenced by what occurs in schools. Both are introduced and played extensively in elementary and high schools in Quebec. At the high school and college (CEGEP) levels there are extensive inter-scholastic organizations which compete against the respective sport federations for participants. Some players may compete in their sport in both organizations. Hence, these sports are played extensively in the schools where age categories do not always play as dominant a role as in the minor sport organization. When age categories are used in the education system, they generally are the same as in minor sport and the cut-off date is usually the end of December.

3.4 Subjects

The subjects of this study were all registered male and female participants within the provincial sport federations or an affiliated association within each sport. The total number of subjects in this study was 13,169. The break down of subjects in each sport is as follows; swimming = 4741, soccer = 5625, team handball = 1604 and volleyball = 1199. The age ranges of the subjects differ with the sports concerned, depending upon the youngest and oldest age categories in each sport.

3.5 Data Collection

The data collection procedure of this study involved a written request for a copy of the registration lists of each of the provincial sport federations concerned. The federations which responded to the request were swimming, team handball and volleyball. The soccer federation indicated that it did not have this information. The Soccer Federation suggested contacting a member association for the necessary information. The Montreal-Concordia Soccer Association was then contacted and responded by supplying their registration lists. The registration lists for each sport contained the gender, birthdate and level of competition of each participant.

The provincial technical directors for each sport were contacted and were asked how their respective sports were organized in terms of age categories, stratifications and seasons. Upon completion of the analysis of the data, these same technical directors and other organizers of these sports were presented the findings and asked for their explanations of them in terms of participant groupings and other organizational matters.

3.6 Treatment Of The Data

The data on participants of each sport was treated separately. The birthdates of all participants on the registration list of each sport were divided into the month in which they fell and then totals tallied. These tallies included separate totals by age category, by gender and of the participants of that sport as a whole.

The number of birthdates falling in each month of the year were then grouped by quarter of the year for the total sample, for males and females separately, and for each age category separately. Analyses were then carried out to determine if the observed numbers of participants born in each quarter of the year were significantly different from those which would have been expected with an even distribution of births across the quarters.

3.7 Analysis Of The Data

To test the study's first hypothesis, a Non-parametric Goodness of Fit test in the form of a one sample chi-squared was employed. This test answers the question of whether there is a significant difference between the observed frequencies and the expected frequencies. In this study, the observed referred to the numbers of participants born in each quarter of the year and the expected was a theoretical even

distribution of births across the quarters which assumed a random unbiased distribution of births throughout the year. Barnsley and Thompson (1988) found that the quarterly expected theoretical distribution of male births was virtually the same as the actual quarterly distribution of male live births in Canada in 1966-67. The authors felt that the comparison between the observed and the expected theoretical distribution was appropriate given the large number of births over the years included in a study such as this (1960 through 1980).

In order to test the second hypothesis, the following was done. The observed numbers of birthdates falling in each month of the year were transformed into percentages of the total for the year. Spearman rank order correlations were calculated on the number of participants born each month for each sport. These calculations were carried out by ranking the months from January to December and comparing them to the percentage of players of each sport born in each month. These calculations helped to clarify the nature of the relationship existing between the number of participants born each month and the month of the year.

CHAPTER IV

RESULTS

The data collected for analysis contained the birthdates and the levels of competition of all the participants registered with the Quebec swimming, team handball and volleyball federations. It also included this same data from one soccer region in Quebec. A one sample chi-squared statistical procedure was applied to the data on participants of each sport to discover if the observed numbers were significantly different from the expected numbers. The observed numbers were the frequency of participants whose birthdays fell within each quarter of the year. The expected numbers represented an even distribution of births across the quarters of the year. A Spearman rank order correlation was carried out to determine if a significant relationship existed between month of the year and the percentage of participants born each month.

The chi-squared analyses conducted on each sport involved first, an overall analysis of the total sample. Secondly, analyses of all male participants and all female participants were completed separately. Further analyses involved the same three procedures (the total sample, the male and the female numbers) carried out upon the participants of each age category within each sport.

4.1 Swimming

The results of the chi-squared analyses on swimming participation by quarter of birth for the total sample, the males, the females and for each age category are presented in Table 1.

The total number of female swimmers observed was significantly different from an expected even distribution of births across the year. The distribution of births of the female swimmers decreased more-or-less linearly from the first to the fourth quarter of the year as predicted (see Figure 1, p. 43).

No significant differences between the observed and the expected numbers were found for the combined genders and males for the total sample. For the combined genders of the total sample, the distribution of births across the quarters decreased in general, although the second quarter was slightly higher than the first. No discernable distribution pattern was found in the total sample of male swimmers.

The chi-squared analyses of participants in each of the age categories in swimming revealed some significant differences between the observed numbers born in each quarter of the year and an expected even distribution across the quarters. These significant differences were discovered in the eight, nine, ten and eighteen-and-over age categories.

TABLE 1

Swimming Participants by Quarter of Birth for Each Age Category with Chi-Square Differences From the Expected

		Number of Participants Birth Quarter					Statistics	
Age	Category	Q1	Q2	Q3	Q4	Total	Chi	alpha
8	Combined	105	88	78	48	319	21.1	p=.000
	Male	38	46	39	24	147	7.0	p=.074
	Female	67	42	39	24	172	22.2	p=.000
9	Combined	124	106	96	78	404	10.9	p=.012
	Male	51	49	43	39	182	2.0	p=.572
	Female	73	57	53	39	222	10.6	p=.014
10	Combined	134	169	131	124	558	8.7	p=.034
	Male	57	67	57	61	242	1.1	p=.775
	Female	77	102	74	63	316	10.3	p=.016
11-12	Combined	332	346	353	300	1331	5.0	p=.173
	Male	139	141	145	127	552	1.3	p=.728
	Female	193	205	208	173	779	3.9	p=.274
13-14	Combined	227	241	229	252	949	1.7	p=.636
	Male	90	106	104	109	409	2.1	p=.556
	Female	137	135	125	143	540	1.2	p=.742
15-17	Combined	231	218	210	245	904	3.1	p=.373
	Male	97	110	110	123	440	3.1	p=.381
	Female	134	108	100	122	464	6.0	p=.119
18 +	Combined	54	60	83	79	276	8.7	p=.033
	Male	38	33	50	49	170	5.0	p=.178
	Female	16	27	33	30	106	6.2	p=.101
Total	Combined	1207	1228	1180	1126	4741	4.9	p=.177
	Male	510	552	548	532	2142	2.0	p=.565
	Female	697	676	632	594	2599	9.8	p=.021

Within the eight, nine and ten year age categories, the significant differences were found in the combined genders and female data. For each of these age categories, the distribution of births in each quarter of the year decreased more-or-less from the first to the fourth. The distribution of births of males in each of these categories was not found to be significantly different from what was expected.

The age categories of eleven-to-twelve, thirteen-to-fourteen and fifteen-to-seventeen did not show any significant differences between the observed numbers and those which were expected. The distribution of births across the quarters of the year for the sample as a whole, in these age categories, did not demonstrate any discernable pattern. There did appear, however, a trend for a reversal of the Birthdate Phenomenon among the male participants of these ages.

The observed numbers for the combined genders within the eighteen-and-over age category were significantly different from the expected. The distribution of births across the quarters of the year for the combined genders demonstrate a pattern that is the reverse of that predicted and appears contributed to by both the male and female data. Neither the male nor the female distribution by quarter in this age group was significantly different from what was expected.

The Spearman rank order correlation between month of birth and participation percentages for the total sample of female swimmers showed a significant relationship between

month of the year and the percentages of participants born each month (Spearman Correlation = .62, $p<.015$). Figure 1 depicts swimming participation in percentages by quarter of birth for the total sample, males and females.

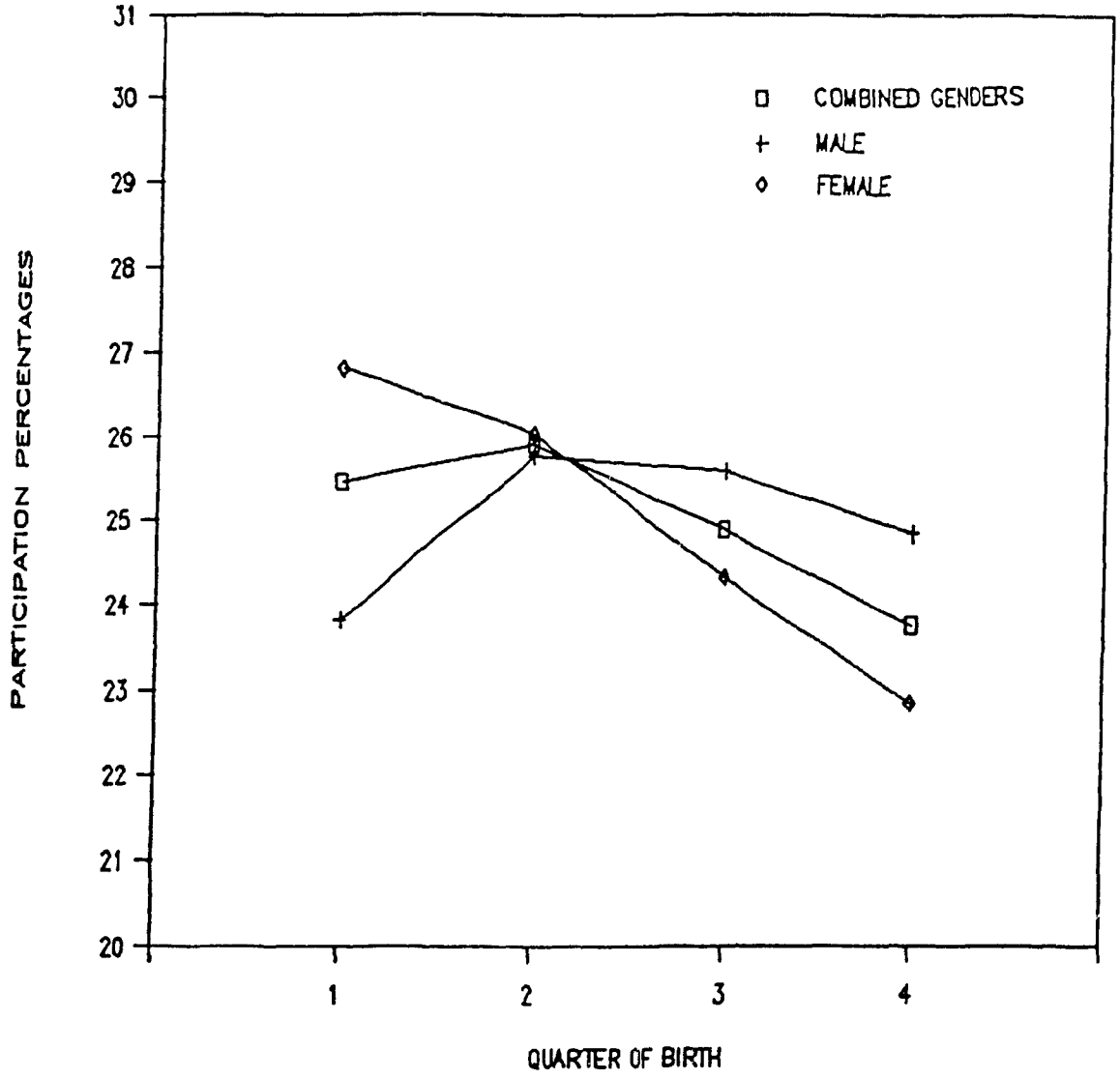

Figure 1: Swimming participation percentages by quarter of birth for the total sample males, females and both combined.

4.2 Soccer

The results of the chi-squared analyses on soccer participation by quarter of birth for the total sample, the males, the females and for each age category are presented in Table 2.

The data on the total sample of soccer players reveal that the distributions of birthdates for the combined genders, males and females were significantly different from that which was expected. The distribution pattern for the females was as predicted, decreasing more-or-less linearly from the first to the fourth quarter of the year. The distribution patterns of the males, and the males and females combined, are similar with the first quarter having the highest and the fourth quarter the lowest percentages, but with the third quarter of the year having a slightly higher percentage than the second (see Figure 2, p. 48).

Significant differences between the observed numbers and the theoretical even distribution across the quarters were found in all age categories except among the fifteen-to-sixteen and the seventeen-to-eighteen year olds. The seven-to-eight and nine-to-ten year old age categories were found to have significant differences from the expected for the combined genders, the males and the females. The distribution patterns of births across the quarters of the year for each

TABLE 2

Soccer Participants by Quarter of Birth for Each Age Category with Chi-Square Differences From the Expected

		Number of Participants Birth Quarter					Statistics	
Age	Category	Q1	Q2	Q3	Q4	Total	Chi	alpha
7-8	Combined	182	183	171	114	650	19.8	p=.000
	Male	154	161	156	111	582	11.1	p=.011
	Female	28	22	15	3	68	20.3	p=.000
9-10	Combined	186	177	132	116	611	22.7	p=.000
	Male	159	158	121	107	545	15.3	p=.002
	Female	27	19	11	9	66	12.3	p=.006
11-12	Combined	195	186	174	158	714	4.3	p=.234
	Male	180	171	161	156	668	2.1	p=.536
	Female	15	15	13	2	46	10.5	p=.015
13-14	Combined	166	132	130	113	541	10.9	p=.012
	Male	151	122	122	113	508	6.5	p=.091
	Female	15	10	8	0	33	2.4	p=.307
15-16	Combined	69	73	74	72	288	0.2	p=.978
	Male	64	69	71	72	176	0.5	p=.908
	Female	5	4	3	0	12	----	p=.---
17-18	Combined	44	51	59	41	195	3.9	p=.266
	Male	38	44	53	41	176	2.8	p=.413
	Female	6	7	6	0	19	0.1	p=.949
19 +	Combined	708	603	696	620	2627	12.8	p=.005
	Male	676	582	676	613	2547	10.4	p=.015
	Female	32	21	20	7	80	15.7	p=.001
Total	Combined	1550	1405	1437	1234	5626	36.5	p=.000
	Male	1422	1307	1360	1213	5302	17.7	p=.001
	Female	128	98	77	21	324	75.5	p=.000

of these was as predicted and decreased more-or-less linearly from the first to the fourth quarter.

The eleven-to-twelve year old female birth pattern was significantly different from the expected even distribution. The combined genders and the males were not. However, in each of these, the distribution pattern of the births by quarter decreased as predicted from the first to the fourth quarter of the year. The thirteen-to-fourteen age category demonstrated a significant difference between the observed numbers born each quarter and the expected for the combined genders, but not for the males or females separately. However, in all incidences, the distribution pattern of births was as predicted, decreasing more-or-less linearly from the first to the fourth quarter of the year.

No significant differences between the observed and expected numbers were found within the fifteen-to-sixteen and seventeen-to-eighteen year old age categories, and no discernable distribution pattern of births across the quarters of the year was observed. A chi-squared analysis was not carried out on the females in the fifteen-to-sixteen age group because the expected value was less than five.

The chi-squared analyses of the nineteen-and-over age category revealed that the combined genders, the males and the females were significantly different from that which was

expected. The distribution patterns for the females was as predicted and decreased more-or-less linearly from the first to the fourth quarter of the year. The distribution patterns of the combined genders and the males described a similar pattern with the first quarter having the highest and the fourth quarter the lowest percentages. In each of these, however, the third quarter of the year had a slightly higher percentage than the second.

Spearman rank order correlations were calculated for the three sets of data of the total soccer population. These analyses demonstrated significant relationships between a rank order on month from January to December and the percentages of participants born in each month. For the combined genders the correlation was .80 ($p<.001$), for the male group the correlation was .58 ($p<.024$), and for the overall female soccer group the correlation was .80 ($p<.001$).

The relationships between percentage of participants and quarter of birth for each of the sub samples and the total sample of soccer participants are illustrated in Figure 2.

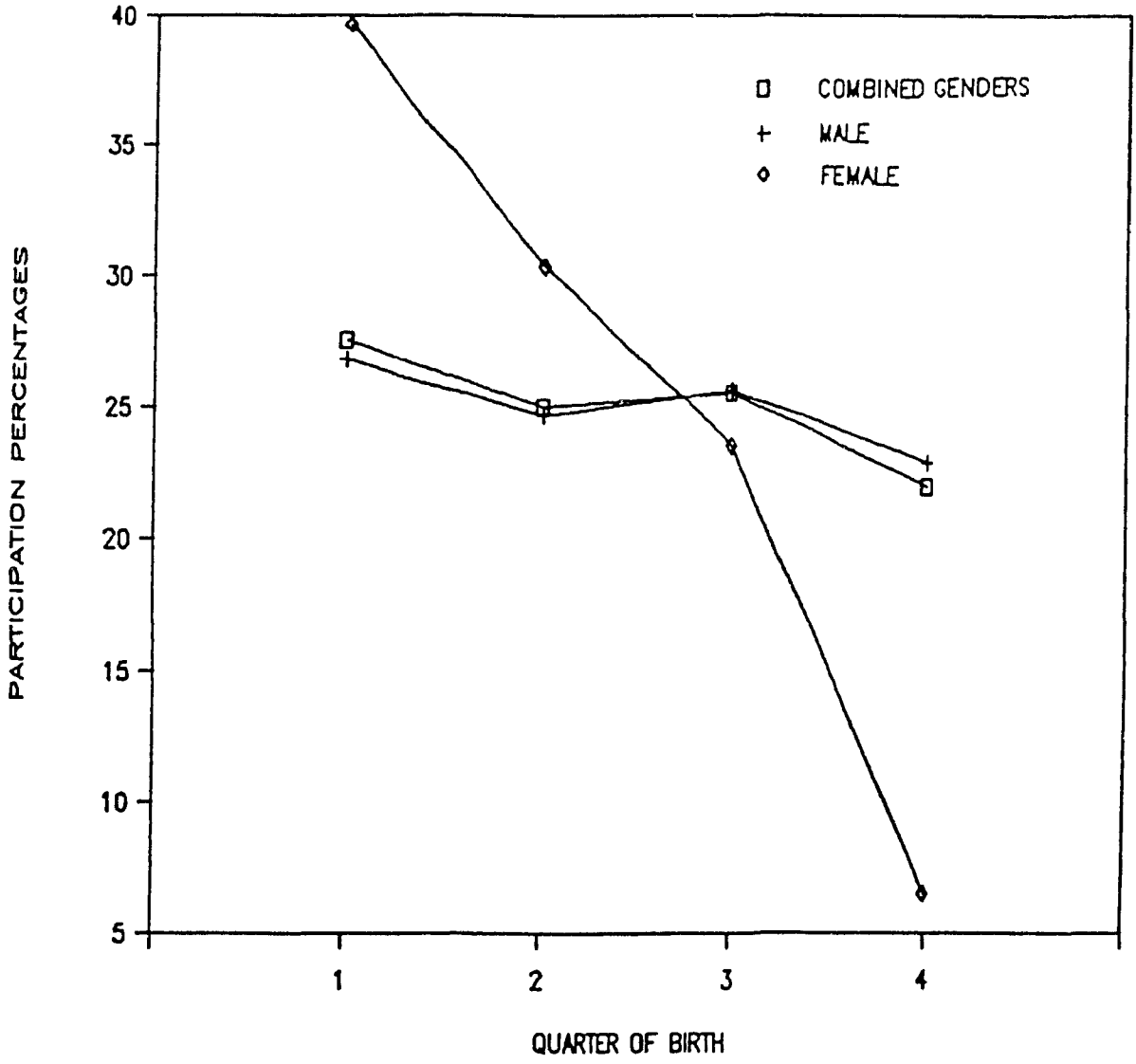

Figure 2: Soccer participation percentages by quarter of birth for the total sample males, females and both combined.

4.3 Team Handball

The results of the chi-squared analyses on the total sample of team handball players and the separate age categories for the combined genders, male and female players are presented in Table 3.

The distribution by quarter of birth of the total sample of team handball players was found to differ significantly from the expected for the combined genders, males and females. In each instance, the distribution of births across the quarters of the year was more-or-less as predicted decreasing from the first to the fourth (see Figure 3, p. 53).

Significant differences between the observed numbers and the expected even distribution across the quarters of the year were found in the total sample and in all the three younger age categories. The distribution over the quarters of the year was not, however, always in the direction predicted.

For the eleven-to-twelve year old age category, the combined genders and the females were significantly different from the expected. The distribution of males by quarter of birth in this group was not significantly different from that which was expected. In this age grouping, the combined genders, males and females each exhibited distribution patterns in line with what was predicted. In each instance, percentages of births decreased from the first to the fourth quarter of the year. Within the thirteen-to-fourteen age

Table 3

Team Handball Participants by Quarter of Birth for Each Age Category with Chi-Square Differences From the Expected

		Number of Participants Birth Quarter					Statistics	
Age	Category	Q1	Q2	Q3	Q4	Total	Chi	alpha
11-12	Combined	124	108	96	51	379	31.1	p=.000
	Male	34	37	25	19	115	7.1	p=.068
	Female	90	71	71	32	264	27.0	p=.000
13-14	Combined	168	137	115	115	535	14.1	p=.003
	Male	100	75	51	55	281	21.5	p=.000
	Female	68	62	64	60	254	0.6	p=.908
15-16	Combined	59	59	53	88	259	11.5	p=.009
	Male	32	35	34	57	158	10.5	p=.015
	Female	27	24	19	31	101	3.0	p=.386
17-18	Combined	58	57	46	45	206	2.8	p=.421
	Male	34	30	27	19	110	4.4	p=.221
	Female	24	27	19	26	96	1.6	p=.663
19 +	Combined	63	56	57	49	225	1.7	p=.625
	Male	49	38	37	31	155	4.4	p=.226
	Female	14	18	20	18	70	1.1	p=.781
Total	Combined	472	417	367	348	1604	23.9	p=.000
	Male	249	215	174	181	819	17.5	p=.001
	Female	223	202	193	167	785	8.1	p=.042

group the combined genders and the males were significantly different from the expected while the females were not. The distribution of births across the quarters of the year decreased for the combine genders and the males.

The fifteen-to-sixteen age category demonstrated significant differences between the observed and the expected numbers for the combined genders and the males, but not for the females. However, no clear pattern of births across the quarters of the year appears in this group except that in each instance the fourth quarter value is greater than for the previous quarters. It should be noted also that the total population in this age category in each group was less than half of what it was at the thirteen-to-fourteen age category.

No significant differences were found between the observed and the expected numbers in the seventeen-to-eighteen and nineteen-and-over age categories. However, in both groups the combined genders and the males exhibited a decreasing pattern of distribution of births across the quarters of the year as predicted. No pattern was observed in the female numbers in these two age groupings.

Significant relationships were found between the rank order of month of the year and the percentages of participants born in each month, for the combined genders (Spearman Correlation = .89, $p<.000$), the males (Spearman Correlation = .76, $p<.002$) and for the females (Spearman

Correlation = .83, p<.000). These significant relationships are evident when the percentage of participants are plotted across the year. Figure 3 represents the relationships between percentages of births and quarter of the year for the combined genders, males and females separately for the total sample.

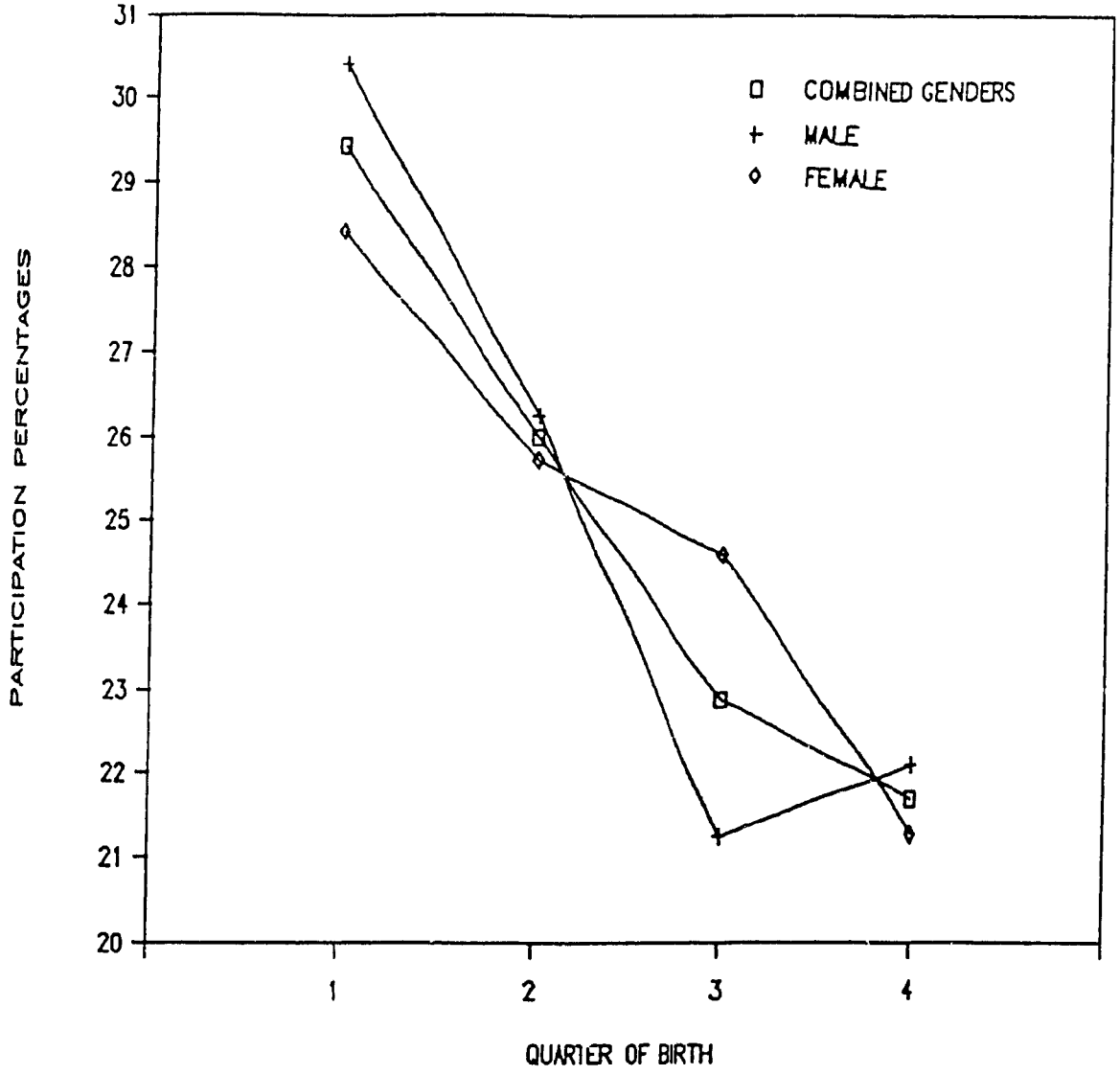

Figure 3: Team Handball participation percentages by quarter of birth for the total sample males, females and both combined.

4.4 Volleyball

The results of the chi-squared analyses on volleyball participation by quarter of birth for the total sample, the males, the females and for each age category are presented in Table 4.

The total sample of volleyball players showed significant differences between the observed and the expected numbers for each quarter of the year for the combined genders and for the males, but not for the females alone. The distribution of births across the quarters for the combined genders, males and the females was in line with what was predicted. The numbers of births decreased more-or-less linearly from the first to the fourth quarter of the year (see Figure 4, p. 57).

The data for the males and females combined in the eleven-to-twelve year old age category was found to be significantly different from what was expected even though the total numbers were relatively small. No significant difference between the observed distribution and the expected even distribution of births across the quarters of the year was found for the females in this age category. No analysis was carried out upon the male data in this age category because the expected value was less than five. The distribution of births across the quarters of the year for the combined genders and females decreased almost linearly from the first to the fourth quarter of the year as predicted.

TABLE 4

Volleyball Participants by Quarter of Birth for Each Age Category with Chi-Square Differences From the Expected

		Number of Participants Birth Quarter					Statistics	
Age	Category	Q1	Q2	Q3	Q4	Total	Chi	alpha
11-12	Combined	11	15	10	3	39	7.7	p=.050
	Male	3	7	3	2	15	----	p=.---
	Female	8	8	7	1	24	5.7	p=.129
13-14	Combined	154	144	104	114	516	13.2	p=.004
	Male	63	58	35	37	193	12.7	p=.005
	Female	91	86	69	77	323	3.5	p=.317
15-16	Combined	136	129	134	127	526	0.4	p=.940
	Male	64	56	49	57	226	2.0	p=.572
	Female	72	73	85	70	300	1.8	p=.606
17-18	Combined	27	34	28	29	118	1.0	p=.805
	Male	17	18	14	13	62	1.1	p=.778
	Female	10	16	14	16	56	1.7	p=.634
Total	Combined	328	322	276	273	1199	8.6	p=.035
	Male	147	139	101	109	496	12.2	p=.007
	Female	181	183	175	164	703	1.3	p=.742

Significant differences between the observed and the expected distribution of births across the quarters of the year were discovered in the combined genders and males, but not in the females for the thirteen-to-fourteen age group. The distribution patterns of births across the quarters of the year for the combined genders, males and females in this age category decreased, more-or-less as predicted, from the first to the fourth. The total numbers of participants in this age category was considerably greater than that in the previous category.

The fifteen-to-sixteen and seventeen-to-eighteen year old age categories showed no significant differences between the observed and the expected numbers across the quarters of the year. No discernable distribution patterns for the births across the quarters was found either. The total numbers of participants was found to decrease dramatically after sixteen years of age.

Spearman rank order correlations revealed that the combined genders (Spearman Correlation = .58, $p<.024$) and the males (Spearman Correlation = .67, $p<.008$) had significant relationships between month of the year and the percentages of participants born in each month. Figure 4 depicts graphically the percentages of participants by quarter of birth for the combined genders, males and females separately for the total sample of volleyball players.

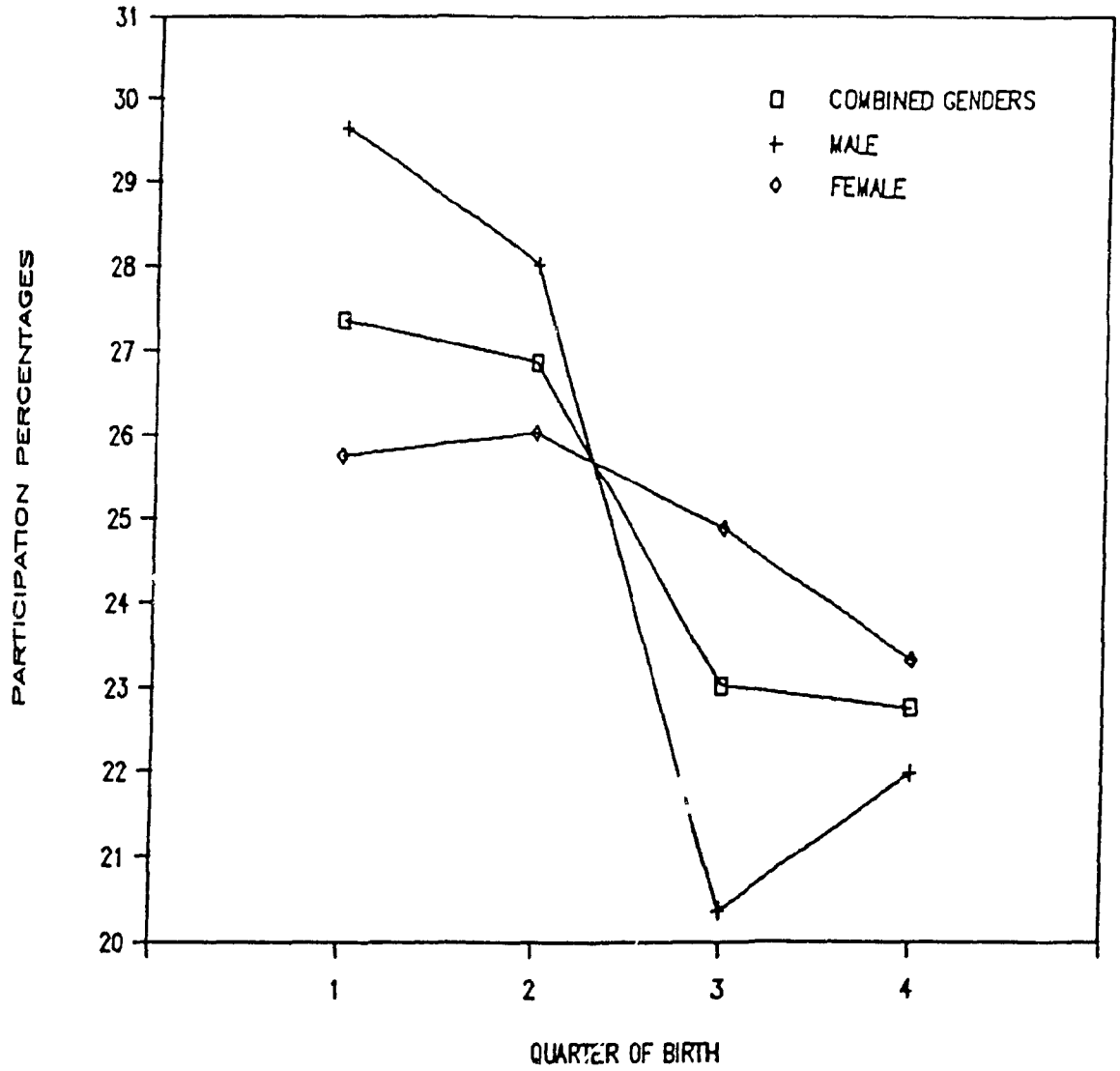

Figure 4: Volleyball participation percentages by quarter of birth for the total sample males, females and both combined.

CHAPTER V

DISCUSSION

The Birthdate Phenomenon was found at least to some degree in each of the sports studied as the chi-square values and distribution by quarter summarized by sport in Table 5 indicate. It is evident from the results of the present investigation that this phenomenon is not isolated in a single sport, but is more general throughout the minor sports studied. The Birthdate Phenomenon was found at various age levels and effecting both males and females in team sports. However, this is not equally true at all age levels.

It was discovered that in swimming only the females showed significant differences between the observed and expected numbers of births across the quarters of the year. The males demonstrated a similar pattern at the young ages, but as their numbers were smaller than the females, significance was not achieved. The results from the total samples for each sport are due to what occurs at the separate age categories. Examination of the separate age categories helps to provide a clearer interpretation of the result obtained.

TABLE 5

Summary of Participants by Quarter of Birth for the Total Sample, Males and Females Separately for Each Sport

		Number of Participants Birth Quarter					Statistics	
Sport	Category	Q1	Q2	Q3	Q4	Total	Chi	alpha
Total Swimming	Combined	1207	1228	1180	1126	4741	4.9	p=.177
	Male	510	552	548	532	2142	2.0	p=.565
	Female	697	676	632	594	2599	9.8	p=.021
Total Soccer	Combined	1550	1405	1436	1234	5625	36.5	p=.000
	Male	1422	1307	1360	1213	5302	17.7	p=.011
	Female	128	98	76	21	323	75.5	p=.000
Total Team Handball	combined	472	417	367	348	1604	23.9	p=.000
	Male	249	215	174	181	819	17.5	p=.001
	Female	223	202	193	167	785	8.1	p=.042
Total Volley-ball	Combined	328	322	276	273	1199	8.6	p=.035
	Male	146	139	101	109	496	12.2	p=.007
	Female	181	183	175	164	703	1.3	p=.742

5.1 Swimming

In spite of the fact that swimmers change age categories on their birthdays, the Birthdate Phenomenon was in evidence in the participation of swimmers. The distribution of births for the total sample of female swimmers was found to be significantly different from what was expected and it demonstrated the pattern of the Birthdate Phenomenon. The significant rank order correlation between percentage of female participants born each month and a rank order of months from January to December helps to verify this. As a result, the pattern of births for the combined male and female swimmers shows the first half of the year to be somewhat higher than the second. In order to understand why the Birthdate Phenomenon is present in the female sample as a whole, an examination of the separate age groupings is required (See Table 1, p. 40).

The sport of swimming is divided into two organizational structures. At the youngest ages the groupings are of one year duration. Eight, nine and ten year olds are each in separate categories. For these swimmers there are no ability groupings, but there are monthly competitions beginning in October and culminating in February. Within these age categories significant differences between the observed and a theoretical even distribution of births, with a pattern of decreasing numbers from the first to the fourth quarter, were found for the combined genders and the females. The males alone in general demonstrate

a similar decreasing pattern of births across the quarters of the year, but with their relatively small numbers, the distribution pattern was not significantly different from the normal expectancy.

At the eleven-to-twelve year old age category the second structure emerges. From this point on age groupings are of two and three years. The competitive season runs throughout the year with major competitions for individual standings in February and team standings in August. At this level swimmers are ability grouped into A, B and C categories. At this level there is also a tremendous influx of participants into the system as the number of swimmers almost triples over that in the proceeding category. A suggested explanation for this dramatic numbers increase is that youth swim lessons end at approximately this age so that individuals who want to continue to swim move from an instructional to a competitive environment.

At this stage there are no significant or extra-ordinary distribution patterns in evidence. In fact, there appears a trend among males at the thirteen-to-fourteen and fifteen-to-seventeen year age categories to a slightly reversed pattern. The results suggest that the change in organizational structure, with the increase in competitive swimming popularity at these levels, eliminates any evidence of the Birthdate Phenomenon.

The one exception is at the eighteen-and-over age level. A significant difference between the observed births across the quarters and the expected is present in this age category. The

numbers are small, however, and there is not a consistent pattern of births across the quarters of the year. Contributing to the peculiar distribution pattern is the fact that over two-thirds of the participants appear to leave federation governed competitive swimming after they reach their eighteenth birthdays. Participants may leave federation competition for other competitive environments at college or university or it may be that competitive swimming is no longer attractive to them after this age.

The change in organizational structure and program offerings seem responsible for the elimination of the Birthdate Phenomenon after age ten. The question which remains is why this phenomenon is present in the one year age groupings and predominantly among female participants. A partial answer to this question may involve the layout of the competitive season relative to the birthdates of participants.

The culmination or peak of the competitive season for youngsters of the one year age groups, according to coaches at this level (Boulis, 1989), is January and February. This is the time at which the swim meets considered most important for the swimmers are held. This allows those individuals who are born about this time in the year to experience the greatest relative age advantage over those born at other times in the year. That is, the individual who is the oldest at the time of the key competitions theoretically should be bigger, stronger, faster and better coordinated and skilled than those who are younger. With

these advantages, it is hypothesized that the older individuals experience greater success and are more likely to continue to participate than those relatively younger. Hence, the Birthdate Phenomenon appears with a decreasing number of participants born across the quarters of the year at these age levels. Why this appears to be more true among female than male swimmers at these ages is not at all clear.

Once the age categories change to two year durations, participants suffer relative age disadvantages as well as advantages by being the youngest when they enter and the oldest when they leave a category. They compete in ability groupings (A, B or C level) within their age categories and thus compete against individuals of roughly the same caliber. In addition, the competitive season runs more-or-less year-around with two competitive peaks. With key individual competitions in February and the team competitions in August, the relative age differences amongst participants at the crucial periods is at least reduced by half.

In summary, the Birthdate Phenomenon is present in the total sample of female swimmers. This phenomenon appears to be a product of the one year age categories with the presence of key competitions in January and February. After age ten, the age grouping system and year-around competitive season seem to successfully eliminate any significant relative age effect.

5.2 Soccer

Significant differences between the observed numbers of births and the expected were discovered for the total sample, and for the males and females separately in soccer. In general the distribution patterns of births across the quarters of the year decreased from the first to the fourth. This is further illustrated by the significant positive rank order correlations between percent of participants in each group whose birthdays occur each of the twelve months of the year. These significant patterns in soccer are a product of what happens at each of the separate age categories (see Table 2, p. 45).

Soccer is divided into two year age categories with a December 31st change over date up to the nineteen-and-over level. Within each of the age groupings up to the fifteen-to-sixteen age category, significant differences were found between the observed distribution of births and the expected. The distribution of births across the quarters of the year decreased more-or-less linearly from the first to the fourth. Within these age categories where significance was not achieved, the decreasing distribution pattern of births across the quarters of the year remained.

At the fifteen-to-sixteen and seventeen-to-eighteen year old age groupings no significance differences were found. An explanation for the loss of the phenomenon in these categories may be the relatively large drop-off in participation at these

ages. The numbers participating drop almost in half between the thirteen-to-fourteen age group and the fifteen to-sixteen group and then drop by another third from this group to the seventeen-to-eighteen age level. It is suggested that at these age levels participants leave the sport due to social, economic and other pressures. Education, part-time work and social pressures to do other things appear to play an increasing role about these ages. Barnsley and Thompson (1988) found a similar drop in participation at these levels and the disappearance of the Birthdate Phenomenon. They suggested that participants were leaving federation governed play for other competitive environments such as college and university. In the process, more participants with relative age advantages as compared to disadvantages leave federation play and hence there is a leveling off of participation rates across the quarters of the year. This appears to be a reasonable explanation for the loss of the phenomenon in soccer as well.

At the nineteen-and-over age level a tremendous influx of participants is observed and the Birthdate Pheromenon reappears. It would seem that those individuals who experienced relative age advantages and hence success during their years of minor play return to the sport in greater numbers than those not so advantaged so that the Birthdate Phenomenon is observed again.

In summary the Birthdate Phenomenon is present in the total sample of soccer players both females and males. This phenomenon appears to be the result of the two year age groupings with a

December 31st cut-off date employed at each of the age categories. This cut-off date and age grouping system creates relative age advantages for those born early in the year. With this grouping system, the individuals born in the first quarter of the year are as much as twenty-four months older than those born in the fourth quarter. As a result, those participants born in the first quarter should be bigger, stronger, faster and better coordinated and hence should experience greater success. The individuals experiencing the relative age advantages continue throughout their minor soccer careers to experience greater success than the later born. The present evidence suggests that as a result, the early born participate longer and in greater numbers than those experiencing disadvantages (those born later in the year). The result of these conditions is a distribution pattern of births across the year that in general, decreases from the first quarter of the year to the last. The presence of the Birthdate Phenomenon appears to be strongest at the ages when the soccer federation is the chief organization providing soccer competition. It is less evident among federation players at levels where the numbers are smaller and when high school, college and university organizations provide viable alternatives for soccer play. Whether the phenomenon exists or not among soccer participants of these other environments has yet to be examined.

5.3 Team Handball

Evidence of the Birthdate Phenomenon was discovered in the total sample of team handball players. Significant differences between the observed numbers of births and an expected even number of participants born each quarter of the year were found for the males and females combined, as well as, for the samples of males and females when analyzed separately. The distribution pattern of births across the quarters of the year decreased from the first to the fourth quarter for each of these groups. These findings are supported by significant positive relationships found between the percentage of participants born each month and a rank order of months from January to December. These overall outcomes are a reflection of the findings in the separate age categories (see Table 3, p. 50).

Examination of the separate age categories reveals that a situation similar to that observed in soccer exists. In soccer the Birthdate Phenomenon was present up until and including the thirteen-to-fourteen age category; it disappeared at the fifteen-to-sixteen age level and then returned at the nineteen-and-over category. In team handball, the first two age categories (eleven-to-twelve and thirteen-to-fourteen) showed significant differences between the observed and the expected numbers of births across the quarters of the year. The numbers of births across the quarters of the year also decreased from the

first to the fourth. The distribution patterns found at the fifteen-to-sixteen year age category among the males and combined group were significantly different from the expected pattern, but were not in the direction hypothesized. These findings as well as the lack of a significantly different distribution pattern at the seventeen-to-eighteen age category may have an explanation similar to that of soccer.

First, as was concluded with the sport of soccer, the two year age categories with the December 31st cut-off date create relative age advantages for those born early in the year. The advantages of size, speed and strength of the early born allow them to experience greater success and more positive experiences which draw them to and keep them in an organized and competitive form of the sport. The participation patterns across quarters of the year up to fifteen years of age seem to reflect this.

A second mechanism involved in the development of the Birthdate Phenomenon may be related to the coinciding of the critical period of the season and participants' birthdays. The peak in the season of team handball is approximately March and April. With a peak season so early in the calender year, participants born after the December 31st cut-off date will have the greatest relative age advantage at this crucial period. These advantaged participants should experience greater success and thus have a higher motivation to continue to participate.

The unusual distribution pattern of births across the quarters of the year at the fifteen-to-sixteen age category begs

explanation. The reduction by half in participation at this level from the previous level seems important. Possible social factors such as need for employment, higher education and change in social environments may partially explain the high drop-out rates at this age. The data also indicate that a higher proportion of participants born early in the year leave federation governed competition compared to those born later in the year. The suggestion by Barnsley and Thompson (1988) that individuals experiencing relative age advantages leave the system for other competitive environments, such as college and university, at a higher rate than those suffering disadvantages seems quite plausible. Team handball is said to be one of the most popular sports in schools within the province of Quebec, especially within the french schools. The school teams may be better organized, more convenient for the participants and provide more social reinforcements than the federation teams. Thus the school teams may attract the better players (those experiencing relative age advantages). However, this remains to be demonstrated. An examination of the birth pattern of participants of competitive team handball in school may help to clarify this suggestion.

The reappearance of a decreasing pattern of births across the quarters of the year is noted at the seventeen-to-eighteen and nineteen-and-over age categories. The numbers of births across the quarters of the year decreased more-or-less linearly from the first to the fourth, although the distribution was not

statistically significantly different from expected. This may be a result of those participants who have experienced relative age advantages during their minor careers remaining or returning to the sport as appears to be the case in soccer.

In summary it was concluded that the two year age grouping system using a December 31st cut-off date provides a relative age advantage for those born early in the year. The coinciding of the peak or crucial period in the season and participants' birthdates allows for the highest relative age advantage at the important period in the season. Also, it is concluded that where the federation is the dominant competitive environment the phenomenon is strongest. When compromised by the availability of alternative competitive handball environments such as in the education system, the phenomenon diminishes.

5.4 Volleyball

Volleyball has the same organizational structure as soccer and team handball. That is, they all use a two year age categorization with a December 31st cut-off date. In volleyball a decreasing distribution of births across the quarters of the year was observed for the total sample of players and the males in particular. These patterns of births across the quarters of the year were significantly different from what was expected. A significant positive relationship between percentages of participants born each month and a rank order of months from

January to December for the sample as a whole and the males separately help to substantiate these results. The total number of female participants in volleyball decreased across the quarters of the year from more-or-less the beginning to the end. However, this pattern was not significantly different from the expected. In order to understand why these patterns are observed, the separate age categories must be examined (see Table 4, p. 54.)

The first two age categories in volleyball demonstrated significant differences between the observed and the expected numbers of births across the quarters of the year for some groups. In the cases where significance was not attained, the general pattern of decreasing numbers of births across the quarters of the year remained. Within the eleven-to-twelve age category the number of participants was very small. There was a tremendous increase in participation between this age level and the thirteen-to-fourteen category. The increase in volleyball participation at the thirteen-to-fourteen age level may be due to a relationship between volleyball play in the schools and the competitive play of the federation. Typically in the school environment, the sport of volleyball is not introduced until the upper elementary grades. Once introduced to the sport, participants may seek out competitive play with the provincial sport federation.

The Birthdate phenomenon observed in these two age categories appears to be a product of the relative age

differences created by the grouping procedure. The individuals born early in the year in the age category should be taller, stronger, faster and better coordinated than those born later in the year. These relative age advantages may provide greater success and thus a higher motivation to continue to participate.

Volleyball shares the same approximate time of peak season as does team handball. This peak occurs relatively early in the year, generally between March and April. Hence, individuals born early in the year have the highest relative age advantage during the crucial period. Logically, it seems that if individuals are reaching the highest relative age advantage at the crucial time, they will experience greater success than those suffering the greatest disadvantage. Individuals born early in the year and succeeding during the peak of the season would seem to be most likely to be highly motivated to continue while those youngest at the peak would suffer and potentially leave the sport.

At the fifteen-to-sixteen age category, there is still a slight increase in the numbers of participants from the previous age level. However, no significant differences exist between the observed distribution of births across the quarters and the expected. At this level, the combined males and females and the males separately had slightly higher numbers of births in the first half of the year as compared to the second. The leveling of participation rates across the quarters may be attributed to the suggestion (Barnsley & Thompson, 1988) that a higher proportion of participants leave federation governed competition

for other competitive environments. As in team handball, there appears to be an increased attractiveness of school volleyball. College and university volleyball provides a high level of competition that is more convenient for students who are able to attend classes, practice and compete in the same location.

A dramatic drop-off in participation was seen as in the previous two team sports, but it did not occur in volleyball until the seventeen-to-eighteen age category. This change in timing of the greatest drop-out may be due in part to the popularity and availability of other competitive environments. Volleyball may not be as readily available in other competitive environments, or the federation system may be stronger and hence more attractive at the fifteen-to-sixteen age level than it is for soccer or team handball.

No data were available on the nineteen-and-over category in volleyball. Thus, it is not known whether the phenomenon returns at this age level as was witnessed in soccer and team handball. As was concluded in team handball, the grouping system used in this sport creates relative age advantages and disadvantages depending upon participants' birthdates. This appears to affect the participation rates. The relationship between the peak or crucial period of the season and players birthdates is also believed to influence the participation rates. It was evident, as in the other sports studied, that where the federation offers the chief competitive environment, the Birthdate Phenomenon is strongest.

5.5 Summary Of Explanations For The Observed Results

The systematic drop-off of participants according to quarter of birth is evident in all four sports studied. The Birthdate Phenomenon appears to be widespread within minor sport. It appears that factors other than the two year age categories and December 31st cut-off date may be involved in the development of the phenomenon in some sports. The study of swimming verifies this in that although a single cut-off date is not used in this sport, the phenomenon was still found to exist at certain levels.

The mechanism which has been identified in this study for the development of the Birthdate Phenomenon in swimming is the coincidental timing of peak or crucial time of the competitive season and participants' birthdates. It is suggested that those individuals who are the oldest and hence experiencing the highest relative age advantage at the peak in the season achieve the greatest levels of success and therefore are the most likely to continue to participate. The individuals who are born in the first quarter of the year are potentially twelve months older than those born in the last quarter and yet are competing together in February at the culmination of the competitive season. This effect appears to be satisfactorily eliminated with ability groupings in two and three year age categories with competitions the year-round.

The two year age separations with a December 31st cut-off date are widely used in minor sport. With this organizational

structure, individuals born early in the year will continually be the oldest in each age category and thus experience relative age advantages throughout their careers. This bias in the system appears to cause a systematic increase in drop-out of participants from the first quarter of the year to the last. The three team sports of this study employ the two year age groupings with the December 31st cut-off date. The results of this study support the hypotheses of Barnsley et al. (1985) and Barnsley and Thompson (1988), but also indicate that other factors may be involved which have not been identified in previous research.

If the peak in the season is involved in the development of the Birthdate Phenomenon in swimming, it seems logical that the coinciding of peak season and birthdates could affect participation in team sports as well. The sports of team handball and volleyball have a peak in the season at approximately March and April. At this time in the season those individuals born immediately after the December 31st cut-off (in the first quarter of the year) will have potentially twenty-four months relative age difference from those born just before the 31st cut-off (in the two year age category). If, at the crucial time, the older individuals out perform the younger then they should have a higher motivation and reinforcement to continue the following season. The sport of minor hockey also has its season's peak about the same time as team handball and volleyball. The relative age differences among participants at the peak in the season may be another factor in the development

of the Birthdate Phenomenon in sport that needs further study.

Another mechanism discussed in the literature to explain the development of the Birthdate Phenomenon in sport involves the age at which competitive play begins and the duration of the season (Barnsley et al., 1985; Barnsley & Thompson, 1988; Daniels & Jansen, 1987). Daniels and Jansen (1987) suggest that the more pronounced developmental differences at the young age organized play begins (approximately six years of age) in ice hockey, and the longer season over which the effect may be felt by the participants in hockey are some of the reasons why the Birthdate Phenomenon was found in ice hockey but not in other professional sports. Team handball and volleyball both begin competitive play at eleven years of age with a season which is a little shorter, but more-or-less comparable to that of ice hockey yet, the Birthdate Phenomenon was observed. The sport of soccer has a slightly shorter season than hockey and again the phenomenon was found. The results of this study do not agree with the conclusions of Daniels and Jansen (1987). The age at which competitive play begins did not seem to have an effect on the Birthdate Phenomenon.

5.6 Conclusion

It is apparent from the results of this study that the minor sport system is biased in creating advantages or disadvantages for its' participants related to the time of their births in the

year. The four sports studied provided insight into the generality and mechanisms of the Birthdate Phenomenon in minor sport. The activities studied clarify the extent of influence relative age effects may have on participation in sports with varying properties and organizations.

The Birthdate Phenomenon was observed at least to some degree in each of the sports studied. The phenomenon observed in the total samples is due directly to the results and significant differences between the observed numbers and the expected at the separate age categories. A critical conclusion which can be made from these result is that when the provincial sport federation is providing the dominant competitive environment in its sport the phenomenon is strongest. When other organizations such as high schools, colleges and universities compete for participants within a sport, the phenomenon disappears or is lessened among federation participants.

In swimming the phenomenon was only observed in the organizational structure involving the one year age groupings. The team sports of soccer, team handball and volleyball revealed several similarities in the pattern of results. In each of the team sports the phenomenon is present at the younger ages. Two or three years later at approximately the same age in each sport there is a drastic drop-off in participation. This drop out of participants eliminates or reverses the phenomenon. A possible explanation for the dampening of this effect was proposed by Barnsley and Thompson (1988). They believe a higher proportion

of advantaged individuals (those born earlier in the year) leave for other competitive environments thus causing a leveling of participation rates across the quarters. In the cases where the data were available, evidence of the phenomenon reappears at the nineteen-and-over age category demonstrating that those individuals born early in the year are returning or continuing to participate in greater numbers as compared to those born later in the year.

It is suggested that the relationship between peak or crucial times in the competitive season and one's date of birth may play a role in the development of the Birthdate Phenomenon. Individuals experiencing the greatest relative age advantages during the crucial time in the season should experience greater success and as a result have higher motivation to continue to participate within a sport. It is suggested that this relationship is the prime reason why the phenomenon was observed in the one year age categories in swimming and may also be in part responsible for the phenomenon in the team sports of team handball, volleyball and possibly hockey.

The discovery of the extent of this phenomenon in minor sport is shocking and disturbing. It seems highly desirable that processes, procedures and methods to reduce the Birthdate Phenomenon in sport be discovered, tested and implemented in order to make minor sport fair for all individuals regardless of their dates of birth.

CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Children are often grouped into grades and categories in accordance with the year in which they were born. When this procedure of grouping individuals together is used there appear physical, intellectual, behavioral and maturational differences between the children. The effects of relative age differences between students has been studied in great depth. It has been discovered that the younger children suffer disadvantages in academic achievement, social and emotional adjustment when compared to older students within the same grade (Beattie, 1970; Halliwell, 1966).

Barnsley et al. (1985) and Barnsley and Thompson (1988) conducted pioneering investigations that involved studying the relative age effects in ice hockey. These investigations were concerned with the procedure of grouping children into two year age categories with a fixed cut-off date and its' effects on participation and success at the minor, elite and professional levels. It was hypothesized that because of the grouping procedure the older individuals (those born early in the year) would achieve more success, receive greater rewards and continue to participate longer than those born late in the year. The authors concluded that there was an extremely strong relationship between month of birth and hockey participation and success.

The relative age effects on sport participation has been termed the Birthdate Phenomenon and is evident where the numbers of participants drops-off systematically according to month of birth from January to December. Evidence of the Birthdate Phenomenon was found in the Canadian minor hockey system. No other research in regard to the relative age effects on minor sport participation has been found. Most minor sports use a grouping system similar to that of ice hockey.

The purpose of this study was to examine the generality and mechanisms of the Birthdate Phenomenon on a variety of minor sports with varying properties and requirements. The differences between sports include individual competition and team play, the use of December 31st as a cut-off date and the use of individual's birthdates as the cut-off dates, varying season starting dates and lengths and commencement of competitive play at various ages.

As a result of the grouping procedures used in minor sport, it was hypothesized that the relative age differences between participants would cause varying participation rates for those born at different times in the year. More specifically, significant differences would exist between the observed distribution of births across the quarters of the year and a theoretical even distribution of births across the quarters. These significant differences were expected to be found in the overall participation rates for the males and females

separately, and for the combined genders as well as at each age category within each sport.

6.1 Procedures

It seemed desirable to obtain the across age data on each sport for one year. The Quebec provincial sport federations of swimming, soccer, team handball and volleyball were contacted for their 1988 year's registration lists which contained the gender, date of birth and level of competition of each participant registered with them. The Quebec Soccer Federation did not have a list of all participants due to the large number of players (approximately sixty-five thousand) across Quebec. The Montreal Concordia Soccer Association was then contacted for it's registration lists.

The sports included in the study had varying properties and requirements. The sport of swimming is an individual sport which begins at a relatively young age and is essentially an activity engaged in the year-around. Swimmers enter and leave age categories on their birthdates. Soccer is a very popular sport which uses two year age categories with a December 31st cut-off date. Soccer play generally begins at a young age and goes on predominantly from early summer to fall. Team handball and volleyball each use a two year age category system with a December 31st cut-off date. Competition in these two sports under federation organization begins at a later age than

swimming or soccer. These two sports also share roughly the same season which runs from late fall to early spring.

The subjects of this study were all registered male and female participants within the provincial sport federations or an affiliated association within a sport. The data on a total of 13,169 athletes were involved in the study. This total is made up of 4741 swimmers, 5625 soccer players, 1604 team handball participants and 1199 volleyball players.

The data on participants of each sport were treated separately. The birthdates of all participants on the registration list of each sport were divided into the month in which they fell and then totals tallied. These tallies included separate totals by age category, by gender and of the participants of that sport as a whole. The numbers of birthdates falling in each month were then grouped by quarter of the year for the total sample, males and females separately for each sport.

The observed distribution of births across the quarters of the year were compared to a theoretical even distribution of births across the year. Chi-Squared analyses were used to determine if the observed distributions were significantly different from the expected. Further analyses involved transforming the observed numbers of births in each month of the year for the total sample, males and females in each sport into percentages. Spearman rank order correlations were carried out to clarify the nature of the relationship existing

between the percentage of births in each month and the rank order of months from January to December.

6.2 Results And Discussion

The Birthdate Phenomenon was found at least to some degree in each of the sports studied. The Phenomenon affected the total population, males and females separately and was also observed in certain age categories, but not to the same extent in every sport.

The distribution of births for the total number of female swimmers across the quarters of the year was found to be significantly different from an expected even distribution across the quarters. This was verified with the significant positive relationship between the percentage of participants born in each month, and a rank order of months from January to December. The total sample of males and females separately, and combined males and females were also found to be significantly different from the expected for soccer and team handball. The combined genders and the males for the total number of volleyball players were found to be significantly different from the expected. The results observed in the total populations in each of the sports was a reflection of what is observed in the separate age categories.

Swimming has two grouping and organizational structures. In both structures competitors change age category on their

birthdays. The first is divided into one year age separations (8, 9 & 10 years of age). There are no ability groupings within these categories and the season runs essentially from October to February. The second structure is divided into two and three year age groupings; swimmers are ranked into A, B & C ability levels and competition goes on more-or-less year-round. The culmination or peak in the competitive season for the first structure is in February. This is the time at which swim meets which are considered most important for the swimmers are held. This allows those individuals who are born at about this time to experience the greatest relative age advantage over those born later in the year as they are oldest at the time of the competitions. It is hypothesized that these older swimmers experience greater success and are more likely to continue to participate. In this first organizational structure it was found that the combined genders and females demonstrated a significant difference in distribution of births across the quarters from that expected. The pattern was that of decreasing numbers from the first to the fourth quarter of the year. The males in these age categories also generally demonstrated a decreasing pattern of births across the quarters of the year, but with their relatively small numbers the distribution patterns were not significantly different from the normal expectancy.

From the first to the second organizational structure there is a tremendous influx in the number of participants.

This is believed to be the result of the termination of youth swim lessons at this age and subsequent change over of swimmers from an educational to competitive environment. The results show that in the second organizational structure there are no significant or extra-ordinary distribution patterns in evidence except at the eighteen-and-over age category. At this level there is a significant difference between the observed and expected distribution of births across the quarters of the year. There is, however, no consistent pattern of births in evidence. This is attributed to the large drop in participation between this and the previous age category.

In summary, the Birthdate Phenomenon is present in the total sample of female swimmers. This phenomenon appears to be a product of the first organizational structure at the lowest age categories with the presence of key competitions in February. The age grouping structure and year-around competitive season in the second organizational structure seem to have successfully eliminated any further significant relative age effects in competitive swimming participation.

The team sports of soccer, team handball and volleyball use a two year age category system with a December 31st cut-off date. This grouping procedure allows those individual born early in the year to have a relative age advantage by being bigger, stronger and faster than those born later in the year. It is believed that these relative age advantages allow those older individuals to experience more success and as a result

they participate in greater numbers and longer than the later born. The differences between these sports are; soccer is essentially a summer sport while the others are winter activities. Soccer competition begins at the relatively young age of approximately eight years while the other two begin at about eleven years of age.

The total number of participants of each team sport were found to have significant differences between the observed and expected distributions of births across the quarters of the year. These significant differences were observed in the combined genders, males and females separately in soccer and team handball, and in the combined genders and males in volleyball. These findings are verified by significant rank order correlations between the percentages of participants born each month of the year and a rank order of months from January to December.

The Birthdate Phenomenon is observed in the initial age categories in each sport. This phenomenon affects both males and females, but to different degrees in each sport. At approximately the same age range, fifteen-to-sixteen in soccer and team handball, seventeen-to-eighteen in volleyball and eighteen-and-over in swimming there is a tremendous drop in participation. This drop is attributed to social, economic and other pressures. The Birthdate Phenomenon also disappears or reverses at approximately this age in the team sports. It is believed that individuals who have been experiencing relative

age advantages within the sport leave for other competitive environments such as high school, college and university or other things in higher proportions than those disadvantaged individuals, thus, levelling or even reversing participation rates across the quarters of the year. These same results were observed by Barnsley and Thompson (1988) in minor ice hockey.

At the nineteen-and-over age categories in soccer and team handball there is an indication that those individuals who have experienced relative age advantages throughout their minor careers continue or return to participate in their sport. In this open category the number of participants is relatively high and the Birthdate Phenomenon again is evident. In soccer the picture is clear and significant while in team handball, with smaller numbers, although the pattern is evident significance was not attained. No data were available in volleyball for this age category.

The coinciding of peak or crucial period in the season with the greatest relative age differences between participants may also be involved in the development of the Birthdate Phenomenon. Team handball and volleyball each have a peak in approximately March. The timing of this crucial period in regards to the December 31st cut-off date allows those individuals born in the first quarter of the year to have the greatest relative age advantages at the most important point in the season. It is interesting to note that in minor hockey

where the Birthdate Phenomenon was also in evidence, the season peaked about this same time.

A key observation in all the sports studied involves the high drop-out in participation. When the numbers in federation play are reduced, the Phenomenon is eliminated or in certain cases reversed. This dampening of the Phenomenon may be due in part to the availability of other competitive environments. When the minor sport federation provides the main competitive program the Birthdate Phenomenon is most prominent, when other organizations are providing alternate competitive play, evidence of the Birthdate Phenomenon is reduced or eliminated.

6.3 Conclusions

The Birthdate Phenomenon exists in all sports studied. That is, there is a relative age effect that appears to dramatically affect participation in the sports of swimming, soccer, team handball and volleyball.

Each of the sports in this study is affected differently at various levels according to the specific grouping procedure, the organization of it's competitive season and the role played by the provincial federation in governing competition in that activity.

The results indicate that the most dramatic effect appears when the grouping cut-off date approximates the peak competitive time of the year and at the levels where the

federation governed competition is the predominant offering in that activity. The relative age effect on sport participation appears to diminish where other competitive environments become available to the participants and is not always evident when participant numbers are small.

The discovery of the extent of the Birthdate Phenomenon in minor sport is shocking and disturbing. It seems highly desirable that processes, procedures and methods to reduce this phenomenon in sport be of prime concern to sport organizers and administrators.

6.4 Implications Of The Research

The findings of this study make it evident that the Quebec (and possibly the Canadian) minor sport system creates relative age advantages or disadvantages for its participants depending on their months of birth. This would seem highly undesirable. Solutions for the problem of the relative age differences must be easily applied and administered across minor sports.

Swimming does not have a fixed cut-off date, therefore other factors appear to be creating relative age differences between participants resulting in the Birthdate Phenomenon. This phenomenon is observed only among the youngest participants in the first organizational structure. One is thus lead to believe that this structure somehow leads to the

existence of the Phenomenon. The obvious solution to removal of the Birthdate Phenomenon in swimming is to create one uniform organizational structure similar to the second because within it the Phenomenon is not observed. Somehow the grouping procedure and other organization of this structure controls for the effects of relative age on participants.

A suggestion to reduce the relative age differences in team sports would be to modify the strict age restrictions on participants. This could involve the testing of participants' sport specific skills and assessing social maturity at each age level and if individuals are not able to perform up to set standards, they could be allowed to continue to participate at a lower level in spite of their age. That is, if a eleven year old is judged to be performing at the nine-to-ten age level in skill and possibly social maturity, he should remain in that age category and experience competition at his ability and readiness level.

Ability standards and testing for minor sports would take considerable cooperation and coordination among provincial, regional and local sport organizers, administrators and coaches. This type of solution would be costly, time consuming and would require strict supervision in order to ensure that all organizations treat participants fairly. This may be a long term solution. However, it is believed that coaches and sport administrators should be given partial responsibility in placing individuals in categories where they have a chance to succeed.

A second suggestion to reduce the relative age differences between participants would be to change the cut-off or change-over date. Taking into consideration the layout of the season, it would seem logical that the most important time for individuals to perform at their optimum would be during the peak of the season. The peak in the season of most team sports is just prior to and during the play-offs. Thus, those reaching the highest relative age advantage during the peak season have the greatest opportunity for success.

The sports of team handball and volleyball have approximately the same season. Each of these sports has a season which ends in March or April. If this time is taken as the peak, then, those individuals born in the first quarter of the year have in the present system up to twenty-four months relative age advantage (in a two year age category) at this important time. Theoretically if the cut-off date was changed to August 30th, then in March, during the peak season, the highest relative age difference between participants would be twelve rather than twenty-four months.

A combination of measures such as ability and maturity groupings and reduction of the relative age differences at crucial times in the season, by moving the cut-off or change-over date, should contribute to the reduction if not the elimination of the Birthdate Phenomenon. The elimination of this phenomenon and subsequent equal opportunity for all

participants one would hope would be a prime concern of all sport organizers and administrators.

6.5 Recommendations For Further Research

The extent of existence of the Birthdate Phenomenon in minor sport has not yet been completely examined nor have the physical, social and emotional mechanisms that bring it about been clearly identified. For instance, are the early born participants succeeding because they are bigger, stronger and faster as suggested, or are there other mechanisms at work ? Are intellectual variables involved ? Exactly how is their reinforcement different then that received by the later born children ? Will changing the cut-off date influence participants' experiences ? In what other ways can the relative age differences between participants be reduced ?

The results of this study indicate that this Birthdate Phenomenon is influencing thousands of minor sport participants and that the Phenomenon has the potential to be widespread throughout minor sport. There is a great deal more that must be examined in order to eliminate this bias in minor sport. The following are research recommendations and questions which need to be addressed in order to understand and reduce the Birthdate Phenomenon in sport.

Research Recommendations:

1. Examine further minor and professional sports with varying organizations and properties to ascertain the extent of the phenomenon.
2. Take actual physical measures of minor participants to determine the extent of differences in an age category.
3. Determine which physical and other measures are critical to success in each sport.
4. Continue to survey the drop-outs of minor sport to determine what factors caused them to leave.
5. Survey participants within minor sports to determine why they continue to remain in their sport from one age category to another.
6. Investigations of the relative age effects on participation in school sport programs is required to determine if this sport environment is biased as well. This should help to determine whether school sport participation fosters or dampens the effect in minor sport.
7. Does a combination of criteria for sport participation such as age and sport specific skills and social maturity reduce the Birthdate Phenomenon ?
8. When is the most crucial time in the season for each sport ?

9. Are those individuals experiencing the greatest relative age advantages those excelling in their sports ?

10. Would the cut-off date being placed six months from the season affect the Birthdate Phenomenon ?

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APPENDICES

APPENDIX A

Swimming Raw Data

AGE	MONTH	GENDER					
		COMBINED		MALE		FEMALE	
		#	%	#	%	#	%
8 Yrs	1	38	11.91	14	9.53	24	13.94
	2	37	11.6	12	8.16	25	14.54
	3	30	9.4	12	8.16	18	10.47
	4	30	9.4	17	11.56	13	7.56
	5	28	8.78	14	9.53	14	8.14
	6	30	9.41	15	10.21	15	8.72
	7	32	10.03	19	12.93	13	7.56
	8	24	7.52	9	6.12	15	8.72
	9	22	6.91	11	7.48	11	6.4
	10	10	3.13	5	3.4	5	2.91
	11	17	5.33	7	4.76	10	5.81
	12	21	6.58	12	8.16	9	5.23
		319	100	147	100	172	100
9 Yrs	1	44	10.88	16	8.79	28	12.61
	2	36	8.91	19	10.44	17	7.66
	3	44	10.89	16	8.79	28	12.61
	4	40	9.9	17	9.34	23	10.36
	5	34	8.42	15	8.24	19	8.56
	6	32	7.92	17	9.34	15	6.76
	7	30	7.43	15	8.24	15	6.76
	8	33	8.17	13	7.14	20	9.01
	9	33	8.17	15	8.24	18	8.11
	10	33	8.17	19	10.44	14	6.31
	11	27	6.68	11	6.04	16	7.2
	12	18	4.46	9	4.96	9	4.05
		404	100	182	100	222	100
10 Yrs	1	42	7.53	16	6.61	26	8.23
	2	38	6.81	17	7.03	21	6.65
	3	54	9.68	24	9.92	30	9.49
	4	53	9.5	19	7.85	34	10.76
	5	74	13.26	31	12.81	43	13.61
	6	42	7.53	17	7.03	25	7.91
	7	50	8.96	20	8.26	30	9.49
	8	46	8.24	19	7.85	27	8.54
	9	35	6.27	18	7.44	17	5.38
	10	29	5.2	19	7.85	10	3.17
	11	45	8.06	22	9.09	23	7.28
	12	50	8.96	20	8.26	30	9.49
		558	100	242	100	316	100

11-12 Yrs	1	116	8.71	45	8.15	71	9.11
	2	90	6.76	35	6.34	55	7.06
	3	126	9.47	59	10.69	67	8.6
	4	121	9.09	48	8.7	73	9.37
	5	113	8.49	42	7.61	71	9.11
	6	112	8.45	51	9.24	61	7.83
	7	116	8.71	47	8.51	69	8.86
	8	106	7.96	41	7.43	65	8.34
	9	131	9.83	57	10.33	74	9.5
	10	101	7.59	41	7.43	60	7.7
	11	109	8.18	41	7.43	68	8.74
	12	90	6.76	45	8.14	45	5.78
		1331	100	552	100	779	100
13-14 Yrs	1	72	7.58	34	8.32	38	7.04
	2	72	7.58	29	7.09	43	7.96
	3	83	8.75	27	6.6	56	10.37
	4	83	8.75	33	8.07	50	9.26
	5	84	8.85	34	8.32	50	9.26
	6	74	7.8	39	9.54	35	6.48
	7	78	8.23	36	8.8	42	7.78
	8	76	8.01	32	7.82	44	8.15
	9	75	7.9	36	8.8	39	7.22
	10	95	10.01	45	11	50	9.26
	11	89	9.38	38	9.29	51	9.44
	12	68	7.16	26	6.36	42	7.78
		949	100	409	100	540	100
15-17 Yrs	1	78	8.63	29	6.59	49	10.56
	2	73	8.07	29	6.59	44	9.48
	3	80	8.85	39	8.86	41	9.32
	4	60	6.64	29	6.59	31	6.68
	5	84	9.29	43	9.77	41	9.32
	6	74	8.19	38	8.64	36	7.76
	7	65	7.19	34	7.73	31	6.68
	8	75	8.3	42	9.55	33	7.11
	9	70	7.74	34	7.73	36	7.76
	10	81	8.96	40	9.09	41	8.84
	11	76	8.41	37	8.41	39	8.41
	12	88	9.73	46	10.45	42	9.05
		904	100	440	100	464	100

18 + Yrs	1	18	6.52	12	7.06	6	5.66
	2	14	5.07	12	7.06	2	1.89
	3	22	7.97	14	8.23	8	7.55
	4	17	6.16	14	8.23	3	2.83
	5	22	7.97	11	6.47	11	10.38
	6	21	7.25	8	4.71	13	12.26
	7	31	11.23	23	13.53	8	7.55
	8	24	8.7	11	6.47	13	12.26
	9	28	10.14	16	9.41	12	11.32
	10	27	9.78	17	10	10	9.43
	11	21	7.25	12	7.06	9	8.49
	12	31	11.23	20	11.76	11	10.38
		276	100	170	100	106	100
OVERALL	1	408	8.61	166	7.75	242	9.31
	2	360	7.59	153	7.14	207	7.96
	3	439	9.26	191	8.92	248	9.54
	4	404	8.52	177	8.26	227	8.73
	5	439	9.26	190	8.87	249	9.58
	6	385	8.12	185	8.64	200	7.7
	7	402	8.48	194	9.06	208	8
	8	384	8.1	167	7.8	217	8.35
	9	394	8.31	187	8.73	207	7.96
	10	376	7.93	186	8.68	190	7.31
	11	384	8.1	168	7.84	216	8.31
	12	366	7.72	178	8.31	188	7.23
		4741	100	2142	100	2599	100

APPENDIX B

Soccer Raw Data

AGE	MONTH	GENDER					
		COMBINED		MALE		FEMALE	
		#	%	#	%	#	%
7-8 Yrs	1	53	8.15	45	7.73	8	11.76
	2	66	10.15	55	9.45	11	16.18
	3	63	9.69	54	9.28	9	13.23
	4	65	10	59	10.14	6	8.82
	5	67	10.31	57	9.79	10	14.7
	6	51	7.85	45	7.73	6	8.82
	7	63	9.69	59	10.14	4	5.88
	8	55	8.46	51	8.76	4	5.88
	9	53	8.15	46	7.9	7	10.29
	10	41	6.31	41	7.04	0	0
	11	31	4.77	29	4.98	2	2.94
	12	42	6.46	41	7.04	1	1.47
		650	100	582	100	68	100
9-10 Yrs	1	69	11.29	59	10.83	10	15.15
	2	63	10.31	53	9.72	10	15.15
	3	54	8.84	47	8.62	7	10.61
	4	65	10.64	61	11.19	4	6.06
	5	65	10.64	57	10.46	8	12.12
	6	47	7.69	40	7.34	7	10.61
	7	38	6.22	34	6.24	4	6.06
	8	45	7.36	41	7.53	4	6.06
	9	49	8.02	46	8.44	3	4.54
	10	43	7.04	39	7.15	4	6.06
	11	38	6.22	34	6.24	4	6.06
	12	35	5.73	34	6.24	1	1.51
		611	100	545	100	66	100
11-12 Yrs	1	72	10.08	68	10.18	4	8.7
	2	61	8.54	53	7.93	8	17.39
	3	62	8.68	59	8.83	3	6.52
	4	66	9.24	63	9.43	3	6.52
	5	52	7.28	47	7.04	5	10.87
	6	68	9.52	61	9.13	7	15.22
	7	56	7.84	52	7.78	4	8.7
	8	57	7.98	53	7.93	4	8.7
	9	62	8.68	56	8.38	6	13.03
	10	68	9.52	67	10.03	1	2.17
	11	42	5.88	41	6.14	1	2.17
	12	48	6.72	48	7.18	0	0
		714	100	668	100	46	100

13-14 Yrs	1	55	10.17	49	9.65	6	18.18
	2	59	10.9	54	10.63	5	15.15
	3	52	9.61	48	9.45	4	12.12
	4	49	9.06	47	9.25	2	6.06
	5	42	7.76	39	7.68	3	9.09
	6	41	7.58	36	7.09	5	15.15
	7	45	8.32	41	8.07	4	12.12
	8	37	6.84	36	7.09	1	3.03
	9	48	8.87	45	8.86	3	9.09
	10	40	7.39	40	7.87	0	0
	11	31	5.73	31	6.1	0	0
	12	42	7.76	42	8.27	0	0
		541	100	508	100	33	100
15-16 Yrs	1	20	6.94	19	6.88	1	8.33
	2	18	6.25	15	5.43	3	25
	3	31	10.76	30	10.87	1	8.33
	4	23	7.99	22	7.97	1	8.33
	5	22	7.64	22	7.97	0	0
	6	28	9.72	25	9.06	3	25
	7	31	10.76	30	10.87	1	8.33
	8	20	6.94	19	6.88	1	8.33
	9	23	7.99	22	7.97	1	8.33
	10	36	12.5	36	13.04	0	
	11	19	6.6	19	6.88	0	
	12	17	5.9	17	6.16	0	
		288	100	276	100	12	100
17-18 Yrs	1	11	5.64	10	5.68	1	5.26
	2	18	9.23	16	9.09	2	10.53
	3	15	7.69	12	6.82	3	15.79
	4	22	11.28	19	10.79	3	15.79
	5	13	6.67	12	6.82	1	5.26
	6	16	8.2	13	7.39	3	15.79
	7	16	8.2	15	8.52	1	5.26
	8	20	10.26	20	11.36	0	0
	9	23	11.79	18	10.23	5	26.31
	10	13	6.67	13	7.39	0	0
	11	17	8.72	17	9.66	0	0
	12	11	5.64	11	6.25	0	0
		195	100	176	100	19	100

19 + Yrs	1	254	9.69	242	9.5	12	15
	2	203	7.73	193	7.58	10	12.5
	3	251	9.55	241	9.46	10	12.5
	4	202	7.69	198	7.77	4	5
	5	190	7.23	186	7.3	4	5
	6	211	8.03	198	7.77	13	16.25
	7	226	8.6	218	8.56	8	10
	8	256	9.74	246	9.66	10	12.5
	9	214	8.15	212	8.32	2	2.5
	10	201	7.65	199	7.8	2	2.5
	11	180	6.85	178	6.99	2	2.5
	12	239	9.09	236	9.26	3	3.75
		2627	100	2547	100	80	100
OVERALL	1	534	9.49	492	9.28	42	13
	2	488	8.67	439	8.28	49	15.17
	3	528	9.39	491	9.26	37	11.45
	4	492	8.75	469	8.84	23	7.12
	5	451	8.02	420	7.92	31	9.6
	6	461	8.19	418	7.88	43	13.31
	7	475	8.44	449	8.47	26	8.05
	8	490	8.71	466	8.79	24	7.43
	9	472	8.39	445	8.39	27	8.36
	10	442	7.86	435	8.2	7	2.17
	11	358	6.36	349	6.58	9	2.79
	12	434	7.71	429	8.09	5	1.55
		5625	100	5302	100	323	100

APPENDIX C

Team Handball Raw Data

AGE	MONTH	GENDER					
		COMBINED		MALE		FEMALE	
		#	%	#	%	#	%
11-12 Yrs	1	38	10.03	10	8.7	28	10.61
	2	40	10.55	10	8.7	30	11.36
	3	46	12.14	14	12.17	32	12.12
	4	40	10.55	10	8.7	30	11.36
	5	35	9.23	12	10.43	23	8.71
	6	33	8.71	15	13.04	18	6.82
	7	38	10.03	10	8.7	28	10.61
	8	28	7.39	8	7	20	7.58
	9	30	7.92	7	6.09	23	8.71
	10	21	5.54	7	6.09	14	5.3
	11	17	4.48	7	6.09	10	3.79
	12	13	3.43	5	4.35	8	3.03
		379	100	115	100	264	100
13-14 Yrs	1	60	11.21	30	10.68	30	11.81
	2	54	10.09	35	12.46	19	7.48
	3	54	10.09	35	12.46	19	7.48
	4	46	8.6	29	10.32	17	6.69
	5	40	7.48	24	8.54	16	6.3
	6	51	9.53	22	7.83	29	11.42
	7	38	7.1	21	7.47	17	6.69
	8	34	6.36	12	4.26	22	8.66
	9	43	8.04	18	6.41	25	9.84
	10	47	8.79	22	7.83	25	9.84
	11	37	6.92	16	5.69	21	8.27
	12	31	5.79	17	6.05	14	5.51
		535	100	281	100	254	100
15-16 Yrs	1	20	7.72	11	6.96	9	8.91
	2	25	9.65	15	9.49	10	9.9
	3	14	5.41	6	3.8	8	7.92
	4	19	7.34	12	7.59	7	6.93
	5	21	8.11	16	10.13	5	4.95
	6	19	7.48	7	4.43	12	11.88
	7	21	8.11	11	6.96	10	9.9
	8	14	5.41	11	6.96	3	2.97
	9	18	6.95	12	7.59	6	5.94
	10	41	15.83	28	17.72	13	12.87
	11	23	9.06	14	8.86	9	8.91
	12	24	9.27	15	9.49	9	8.91
		259	100	158	100	101	100

17-18 Yrs	1	18	8.74	9	8.18	9	9.38
	2	21	10.19	13	11.81	8	8.33
	3	19	9.22	12	10.91	7	7.29
	4	21	10.19	11	10	10	10.42
	5	15	7.28	8	7.27	7	7.29
	6	21	10.19	11	10	10	10.42
	7	14	6.8	8	7.27	6	6.25
	8	15	7.28	8	7.27	7	7.29
	9	17	8.25	11	10	6	6.25
	10	12	5.82	6	5.45	6	6.25
	11	13	6.31	6	5.45	7	7.29
	12	20	9.71	7	6.36	13	13.54
		206	100	110	100	96	100
19 + Yrs	1	21	9.33	17	10.97	4	5.71
	2	20	8.89	15	9.68	5	7.14
	3	22	9.78	17	10.97	5	7.14
	4	19	8.44	12	7.74	7	10
	5	16	7.11	10	6.45	6	8.57
	6	21	9.33	16	10.32	5	7.14
	7	23	10.22	15	9.68	8	11.43
	8	17	7.56	7	4.52	10	14.29
	9	17	7.56	15	9.68	2	2.86
	10	16	7.11	13	8.39	3	4.29
	11	14	6.22	8	5.16	6	8.57
	12	19	8.44	10	6.45	9	12.86
		225	100	155	100	70	100
OVERALL	1	157	9.79	77	9.4	80	10.19
	2	160	9.98	88	10.74	72	9.17
	3	155	9.66	84	10.26	71	9.04
	4	145	9.04	74	9.04	71	9.04
	5	127	7.92	70	8.55	57	7.26
	6	145	9.04	71	8.67	74	9.43
	7	134	8.35	65	7.94	69	8.79
	8	108	6.73	46	5.62	62	7.9
	9	125	7.79	63	7.69	62	7.9
	10	137	8.54	76	9.28	61	7.77
	11	104	6.48	51	6.23	53	6.75
	12	107	6.67	54	6.59	53	6.75
		1604	100	819	100	785	100

APPENDIX D

Volleyball Raw Data

AGE	MONTH	GENDER					
		COMBINED		MALE		FEMALE	
		#	%	#	%	#	%
11-12 Yrs	1	5	12.82	1	6.67	4	16.67
	2	1	2.56	0	0	1	4.17
	3	5	12.82	2	13.33	3	12.5
	4	7	17.96	4	26.67	3	12.5
	5	5	12.82	0	0	5	20.83
	6	3	7.69	3	20	0	0
	7	3	7.69	1	6.67	2	8.33
	8	4	10.27	1	6.67	3	12.5
	9	3	7.69	1	6.67	2	8.33
	10	1	2.56	0	0	1	4.17
	11	1	2.56	1	6.67	0	0
	12	1	2.56	1	6.67	0	0
		39	100	15	100	24	100
13-14 Yrs	1	49	9.5	19	9.85	30	9.29
	2	44	8.53	16	8.29	28	8.67
	3	61	11.82	28	14.51	33	10.22
	4	40	7.75	18	9.33	22	6.81
	5	62	12.01	23	11.92	39	12.07
	6	42	8.14	17	8.81	25	7.74
	7	35	6.78	10	5.18	25	7.74
	8	30	5.81	13	6.74	17	5.26
	9	39	7.56	12	6.22	27	8.36
	10	31	6.01	11	5.7	20	6.19
	11	44	8.53	15	7.77	29	8.98
	12	39	7.56	11	5.7	28	8.66
		516	100	193	100	323	100
15-16 Yrs	1	41	7.79	16	7.08	25	8.33
	2	47	8.94	18	7.96	29	9.67
	3	48	9.12	30	13.27	18	6
	4	39	7.41	16	7.8	23	7.67
	5	43	8.18	19	8.41	24	8
	6	47	8.94	21	9.29	26	8.67
	7	41	7.79	19	8.41	22	7.33
	8	42	7.98	17	7.52	25	8.33
	9	51	9.7	13	5.75	38	12.67
	10	45	8.55	25	11.06	20	6.67
	11	42	7.98	16	7.08	26	8.67
	12	40	7.6	16	7.08	24	8
		526	100	226	100	300	100

17-18 Yrs	1	9	7.63	5	8.06	4	7.14
	2	5	4.24	5	8.06	0	0
	3	13	11.02	7	11.29	6	10.71
	4	12	10.17	8	12.9	4	7.41
	5	8	6.78	5	8.06	3	5.36
	6	14	11.86	5	8.06	9	16.07
	7	11	9.32	6	9.68	5	8.93
	8	6	5.08	3	4.84	3	5.36
	9	11	9.32	5	8.06	6	10.71
	10	6	5.08	5	8.06	1	1.79
	11	10	8.47	4	6.45	6	10.71
	12	13	11.02	4	6 45	9	16.07
		118	100	62	100	56	100
OVERALL	1	104	8.67	41	8.27	63	8.96
	2	97	8.09	39	7.86	58	8.25
	3	127	10.59	67	13.51	60	8.53
	4	98	8.17	46	9.27	52	7.4
	5	118	9.84	47	9.48	71	10.1
	6	106	8.84	46	9.27	60	8.53
	7	90	7.51	36	7.26	54	7.68
	8	82	6.84	34	6.85	48	6.83
	9	104	8.67	31	6.25	73	10.38
	10	83	6.92	41	8.27	42	5.97
	11	97	8.09	36	7.26	61	8.68
	12	93	7.76	32	6.45	61	8.68
		1199	100	496	100	703	100