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Long-Term Effects of Peer Victimization on Social Outcomes through the Fourth Decade of Life in Individuals Born at Normal or Extremely Low Birth Weight

Kimberly L. Day, Ph.D.^{a,1}, Ryan J. Van Lieshout, M.D., Ph.D., F.R.C.P.(C)^a, Tracy Vaillancourt, Ph.D.^b, Saroj Saigal, M.D., F.R.C.P.(C)^c, Michael H. Boyle, Ph.D.^a, and Louis A. Schmidt, Ph.D.^d

^aDepartment of Psychiatry and Behavioural Neurosciences, McMaster University

^bFaculty of Education and School of Psychology, Faculty of Social Sciences, University of Ottawa

^cDepartment of Pediatrics, McMaster University

^dDepartment of Psychology, Neuroscience, & Behaviour, McMaster University

Abstract

Exposure to early adversity is known to have deleterious effects on brain-behavior relations across the lifespan and across a range of domains. Here we tested a cumulative risk hypothesis of adult social functioning and health outcomes in the fourth decade of life, using the oldest known longitudinally followed cohort of survivors of extremely low birth weight (ELBW; <1000 grams). We investigated the additional impact of peer victimization in youth on social outcomes at age 29–36 years in ELBW survivors and matched normal birth weight (NBW; >2500 grams) participants. In the combined sample, peer victimization was associated with lower likelihood of having children and household income, poorer family functioning and self-esteem, more loneliness and chronic health conditions, less social support, and increased likelihood for contact with police. Moderation analyses indicated that among ELBW survivors, compared to their NBW counterparts, victimization was more strongly associated with being convicted of a crime and with having chronic health conditions. These findings highlight the negative long-term impact of peer victimization on all children and that some outcomes may be differentially affected by prenatal and early postnatal environments.

Keywords

Peer victimization; Bullying; Extremely Low Birth Weight; Youth; Social outcomes

Although there is substantial evidence that cumulative exposure to adversity negatively shapes brain-behavior relations (see Pressman, Klebanov, & Brooks-Gunn, 2012, for a review), there have been few studies that have prospectively examined the long-term effects of multiple adversities across different developmental domains into adulthood. The *theory of*

Correspondence concerning this article should be addressed to Kimberly L. Day, Ph.D., Department of Psychology, University of West Florida, 11000 University Parkway, Pensacola, Florida 32514. Tel.: (850) 474-2689, kday@uwf.edu.

¹Present position: Department of Psychology, University of West Florida

cumulative risk proposes that it is the accumulation of adversities that has the strongest impact on developmental outcomes across the lifespan (Sameroff, Bartko, Baldwin, & Seifer, 1998), and empirical research supporting associations between cumulative risks and cognitive test scores and behavioral outcomes in childhood and adolescence has been replicated and is well accepted (see Pressman et al., 2012).

One example of early adversity in humans is exposure to suboptimal prenatal and early postnatal environments. One important model of this is preterm birth. Children born preterm have higher rates of exposure to perinatal adversities that can lead to a host of characteristic neuroanatomical abnormalities which can affect specific and more general domains of emotional and behavioral functioning (Volpe, 2009). Indeed, being born preterm is an adversity that leads to biological changes that can impact development across the lifespan. Those born ELBW are the tiniest and most at-risk babies. However, advances in neonatal medical care have now enabled the first generation of survivors to reach adulthood (Saigal & Doyle, 2008). These survivors are known to be at risk for a number of adverse outcomes in adulthood including lower educational attainment and income, a decreased likelihood of being married or cohabitating, and higher levels of psychopathology (Saigal, 2014; Saigal et al., 2016; Van Lieshout et al., 2015).

A second significant type of early adversity is the experience of peer victimization (i.e., bullying). Peer victimization is common in childhood and adolescence, with approximately one-third of children reporting current or previous exposure (Molcho et al., 2009). Peer victimization is intentional, aggressive behavior that is repetitive in nature and occurs between people of unequal power status (Olweus, 1999). The effects of peer victimization can be severe, and its impact extends well into adult life (see McDougall & Vaillancourt, 2015). The experience of peer victimization adversely affects adult health, wealth, and social outcomes, including higher rates of illness and poverty, less education and job security, and poorer social relationships (Lereya, Copeland, Costello, & Wolke, 2015; Sigurdson, Wallander, & Sund, 2014; Wolke, Copeland, Angold, & Costello, 2013). Exposure to peer victimization in childhood and adolescence is also associated with more than twice the risk of developing clinically significant anxiety and depressive disorders up to 36 years later (Copeland, Wolke, Angold, & Costello, 2013; Ttofi, Farrington, Lösel, & Loeber, 2011), highlighting its status as an environmental adversity that jeopardizes development across multiple domains. The experience of peer victimization may affect children biologically by leading to increased *allostatic load*, the poor physiological consequences of chronic exposure to stress hormones as the body attempts to regulate elevated levels of stress hormones over an extended period of time (McEwen, 2000). In addition, peer victimization has been associated with hypothalamic-pituitary-adrenal (HPA) axis dysregulation (Ouellette-Morin et al., 2011), and the improper secretion of cortisol by the HPA axis which can negatively affect physiological and behavioral adaptation. Lastly, peer victimization can also impair social cognition which can have its own long-term adverse effects (van Dam et al., 2012).

The impact of peer victimization on ELBW survivors' social functioning in adulthood is an important topic of inquiry as children born ELBW have been found to be at increased risk for experiencing peer victimization (Day et al., 2015a; Day et al., 2015b; Yau et al., 2013). They may be at elevated risk because they manifest many of the characteristics that put

children born at term at risk for peer victimization, including poorer motor functioning (Evensen et al., 2004; Saigal, Szatmari, Rosenbaum, Campbell, & King, 1991), lower IQ (Hack et al., 2009; Saigal et al., 1991), and more symptoms of anxiety and depression (Hack et al., 2009).

Despite strong theoretical support from the model of cumulative risk (Sameroff, 1998) that those born ELBW may be at an increased risk for negative social outcomes in adulthood as a result of the cumulative risks of being born at ELBW and experiencing peer victimization, no research is known to have empirically investigated this. We build upon research by Wolke, Baumann, Strauss, Johnson, and Marlow (2015) in that they found that the cumulative risk of being born preterm and very low birthweight (VLBW; < 1500g) did not predict emotional problems to age 11–13, but that peer victimization was the most important predictor. In this study, we built upon the health disparity family of models (Linder & Sexton, 2011), since being born ELBW is a proxy for a number of negative biological, social, and contextual conditions, including greater risk for having chronic health conditions (Saigal et al., 2016), an overprotective parent (Jaekel, Wolke, & Chernova, 2012) and having poorer mathematical and verbal skills (Hack et al., 2005), among others.

Here we used the oldest, prospective, longitudinally-followed sample of ELBW survivors and matched NBW participants to examine the additional impact of the experience of peer victimization on social outcomes to age 29–36 years within the two groups. As ELBW survivors have already been found to have adverse outcomes into the fourth decade of life in comparison to NBW participants (Saigal et al., 2016), we investigated two hypotheses. First, child victimization would predict adverse outcomes in adulthood in both the ELBW and NBW groups in terms of poorer social functioning, lower socio-economic status, higher criminal activity, and poorer health. Second, we predicted that childhood victimization would have more adverse effects on these social outcomes in ELBW survivors than NBW participants.

Method

Sample Overview

ELBW survivors born between 1977 and 1982 ($n = 179$) were matched on age, sex, and familial socio-economic status (SES) with a group of control children born NBW ($n = 145$) and who were recruited at age 8 years. For a detailed description on the recruitment of both samples, please refer to Saigal et al. (1991). The participants were predominately Caucasian, and both samples were followed to adulthood. For this study, we focused on data collected at ages 8, 22–26, and 29–36.

This study complied with APA ethical standards in the treatment of the sample. Written informed consent was obtained from parents (age 8) and participants (age 22–26 and 29–36). Approval for the use of human participants for this study was obtained through the McMaster University's and Hamilton Health Sciences' ethics committees.

Predictor Measure

Peer victimization—Participants retrospectively reported at age 22–26 on their experiences with physical and verbal peer victimization before the age of 16 using the Childhood Exposure to Violence Questionnaire (Walsh, MacMillan, Trocmé, Jamieson, & Boyle, 2008). On a 5-point scale (1 = never, 5 = more than 10 times), participants rated their experiences with verbal bullying (“Sometimes kids get hassled or picked on by other kids who say hurtful or mean things to them. How many times did this happen to you before age 16?”) and with physical bullying (“Sometimes kids get pushed around, hit or beaten up by other kids or a group of kids. How many times did this happen to you before age 16?”). The two questions were moderately correlated, $r = .41$, $p < .001$, and summed to create a 10-point composite measure of peer victimization.

Outcome Measures at Age 29–36 Years

Outcomes were self-reported at age 29–36 years and comprised four broad domains of functioning. *Social functioning* included romantic relationships, number of children, current family functioning, loneliness, social support, and self-esteem. *Socio-economic status* included measures of education, employment, and income. *Criminal activity* was assessed via self-reports of contact with police and criminal convictions. *Health* was measured using a count of chronic health conditions. These outcomes were chosen as they assess both objective and subjective measures of well-being and are believed to be sensitive to a broad range of aspects of happiness and life quality (Diener, Oishi, & Lucas, 2015).

Social functioning—Within the Ontario Child Health Study (OCHS) questionnaire, participants reported whether they currently had a partner and how many children they had. Those currently in a relationship completed the Relationship Assessment Scale (RAS; Hendrick, 1988) to assess satisfaction with their partner. The scale includes 7 items, each one rated on a 5-point scale. Responses to these items were summed to create a measure of relationship satisfaction with higher scores corresponding to poorer relationships ($\alpha = .84$).

Family function was measured using the General Functioning subscale of the McMaster Family Assessment Device (Byles, Byrne, Boyle, & Offord, 1988), which includes 12 items that describe core elements of the family (e.g., acceptance, support, communication). Participants were asked to report on those family members living with them. If participants were not currently living with other people, they did not have data for this outcome. Its items are measured on a 4-point scale (1 = Strongly agree, 4 = Strongly disagree) and summed to yield a scale with higher scores corresponding to better family functioning ($\alpha = .91$).

Loneliness was measured by the Revised UCLA Loneliness Scale (R-UCLA; Russell, Peplau, & Cutrona, 1980). Questions measured if participants feel close to people, if they have people to turn to, and if they have people who understand them. Its 20 questions are measured on a 4-point scale (1 = Never, 4 = Always) and were summed to create a measure of loneliness with higher scores corresponding to more loneliness ($\alpha = .93$).

The presence of social support was measured by the Young Adult Social Support Index (YASSI; McCubbin, Patterson, & Grochowski, 1996). This questionnaire measures

perceived support from twelve sources including parents, friends, and co-workers (1 = No, 2 = Yes, 3 = Yes a lot). The questions were summed to create a measure of social support with higher scores corresponding to more social support ($\alpha = .96$).

Finally, self-esteem was measured by the Coopersmith Self-Esteem Inventory (Coopersmith, 1981). Twenty-five questions were rated on a 2-point scale (0 = Unlike me, 1 = Like me). The summed scale was used in analyses with higher scores corresponding to poorer self-esteem ($\alpha = .90$).

Socio-economic status—At age 29–36, participants completed the OCHS self-administered questionnaire (Boyle et al., 1987), which measured their years of education, whether they completed high school and college, whether they were employed in the past year, and their total household income.

Criminal activity—From the Young Adult Self-Report questionnaire (YASR; Achenbach, 1997), participants answered one question as to whether they ever had contact with the police (0 = No, 1 = Yes) and one that asked if they had ever been convicted of a crime (0 = No, 1 = Yes).

Health—The presence or absence of 24 chronic health conditions was measured using the OCHS questionnaire. Possible conditions included high blood pressure, cardiovascular disease, cancer, and arthritis. In addition to these forced response options, participants could also write in any other long term health condition not explicitly listed. A count of total chronic health conditions was used in analyses.

Birth Variables

Participants' sex, birth weight, and gestational age were measured at birth and collected from their medical charts for ELBW participants. For the NBW group, these characteristics were reported at age 8 by participants' mothers.

Childhood Variables at Age 8

Variables included familial socio-economic status (SES), family function, and childhood psychopathology. These variables were included because they can account for changes in social outcomes later in life and are those most controlled for in previous research examining the long term impact of peer victimization (e.g., Copeland et al., 2013; Takizawa, Maughan, & Arseneault, 2014; Wolke et al., 2013).

Familial SES was measured with education and occupational prestige with Hollingshead (1969) two-factor index of social position.

Parents completed the general functioning subscale of the McMaster Family Assessment Device (Byles et al., 1988) to measure the functioning of participants' family of origin ($\alpha = .91$).

Childhood psychopathology was rated by parents, who completed the Child Behavior Checklist for Ages 4–18 (CBCL; Achenbach, 1991). The CBCL is a widely-used and

validated measure of the presence and severity of emotional and behavioral problems. The total problems scale was used in analyses, which is a summed composite of all CBCL variables, excluding asthma and allergy items ($\alpha = .93$). A score of 46 for boys and 45 for girls, which equates to a T-score of 64, was used as a cut-off for having behavior problems (Achenbach, 1991). This cut-off corresponds to the 91st percentile and is consistent with clinically significant levels of emotional and behavior problems. Children with clinically significant levels of total (T score = 64) problems were given a value of 1, and those who did not exceed this threshold were given a value of 0.

Participant Attrition

Differences between participants and non-participants at age 29–36 were investigated within the ELBW and NBW samples because attrition could affect the validity of the analyses (see Table 1). Of the original 179 ELBW participants who survived to discharge from the hospital, 100 (67%) were able to be contacted and were willing to participate at the age 29–36 year visit. Within the ELBW sample, those who participated at the birth visit and 29–36 year visit ($n = 100/179$) were more likely to be female, $X^2(2, N = 179) = 6.62, p = .010$, than those who only participated at the birth visit. They did not differ by birth weight or gestational age from non-participants. Those who participated at both the 8 year and age 29–36 year visit ($n = 100/156$) had higher familial SES, $t(154) = 3.49, p = .001$, than those who only participated at 8 years. They did not differ by family functioning or clinical level of total problems. In addition, there were no differences on these variables between those who participated at the age 22–26 year visit (when peer victimization was assessed) and the age 29–36 year visit ($n = 100/142$).

Of the 145 NBW participants who were originally recruited at age 8, 89 (61%) were able to be contacted and were willing to participate at the age 29–36 year visit. NBW participants who provided data at the 8 and age 29–36 year visits ($n = 89/145$) were more likely to be female, $X^2(2, N = 145) = 6.62, p = .010$, than those who participated only at the 8 year visit. There were no differences in any other variables. There was also no difference between NBW participants at the 22–26 year visit and the 29–36 follow-up ($n = 89/133$).

Data Analysis

Analyses were performed using IBM SPSS Statistics 22 (IBM SPSS Statistics, IBM Corporation). For our adjusted models, missing data for the predictor and covariates were imputed using the fully conditional model specification. Among the sample included in this study, 180 (95%) were not missing any information, 4 (2%) were missing data for one variable, and 5 (3%) were missing data for two variables. The results from the 10 pooled data sets were used in our statistical analyses.

To investigate our first hypothesis, that childhood victimization would predict adverse outcomes in adulthood in both ELBW survivors and NBW participants, we used ordinary least squares (OLS) regression (Evans, Li, & Whipple, 2013) to examine the effect of a single risk factor (peer victimization) in the combined sample while also controlling for birth weight status. To investigate our second hypothesis, that childhood victimization would have more adverse effects on ELBW survivors than NBW participants, we investigated

moderation by birth weight status. The moderating effect of preterm birth on associations between peer victimization and social outcomes was investigated by creating an interaction term by multiplying centered peer victimization by birth weight status (as recommended by Aiken & West, 1991). When statistical moderation was not significant, we separated the two birthweight groups in order to investigate the impact of peer victimization in those born ELBW, whose birth is a proxy for many adverse biological, social, and contextual risk factors. We performed the same analyses in the NBW group separately in order to preserve power and be able to examine the patterns of effects in the two groups. Unadjusted logistic regressions were used to predict dichotomous outcomes, such as whether a participant had a partner or graduated high school, and linear regressions were used to predict continuous outcomes, such as family functioning and self-esteem. Our predictor was the 10-point peer victimization subscale of the CEVQ. We then performed the same analyses but adjusted for possible covariates collected at birth and age 8 including familial SES, family functioning, and the presence of clinical levels of childhood emotional and behavioral problems. In addition to controlling for these variables, we also adjusted for participant sex in order to exclude the possible impact of our predictors of attrition.

Results

Demographic characteristics of the samples born ELBW and NBW can be found in Table 1. The group born ELBW reported higher levels of peer victimization than the group born NBW, $t(186) = 2.17, p = .031$. They did not differ by participant sex or presence of clinical childhood behavior problems. All continuous variables were normally distributed with a skew less than ± 1.6 for both groups born ELBW and NBW.

The two groups did differ on outcomes at age 29–36 years (see Table 2). In terms of social functioning, fewer participants born ELBW currently had a partner, $X^2(2, N = 189) = 4.25, p = .039$, or had children, $X^2(2, N = 189) = 3.88, p = .049$, than participants born NBW. In addition, participants born ELBW reported being more lonely, $t(187) = 2.16, p = .032$, and having poorer self-esteem than their counterparts born NBW, $t(187) = 2.65, p = .009$. In terms of SES, fewer participants born ELBW were employed in the last year, $X^2(2, N = 182) = 4.77, p = .029$, and participants born ELBW had a lower total household income than NBW participants, $t(170) = -3.74, p < .001$. The two groups did not differ in terms of criminal activity. Participants born ELBW also reported a greater number of chronic health conditions than NBW participants, $t(187) = 4.19, p < .001$.

Peer Victimization and Social Outcomes

Combined sample—At age 29–36, increases in the 10-point CEVQ peer victimization scale were associated with lower likelihood of having children, $OR = .80, 95\%CI, .66-.96$, poorer family functioning, $b = -.69, p = .008$, more loneliness, $b = 1.39, p = .001$, less social support, $b = -2.20, p = .020$, poorer self-esteem, $b = .62, p = .003$, less household income, $b = -4578.16, p = .005$, increased likelihood for contact with police, $OR = 1.37, 95\%CI, 1.04-1.81$, and higher levels of chronic health conditions, $b = .36, p < .001$, after adjustment for covariates (see Table 3).

Moderation analyses—After including the interaction term in the analyses, there were two significant interactions by birth weight status for being convicted of a crime, $OR = .32$, 95% CI, .18–.54, and chronic health conditions, $b = -.36$, $p = .040$. The interactions were probed as described in Aiken and West (1991). For ELBW survivors, there was significant association between peer victimization and being convicted of a crime, $OR = 3.24$, 95% CI, 2.00–5.27, and having more chronic health conditions, $b = .55$, $p < .001$. For NBW participants, peer victimization was not associated with being convicted of a crime, $OR = 1.02$, 95% CI, .82–1.28, or chronic health conditions, $b = .18$, $p = .155$.

ELBW sample—At age 29–36, increases in the 10-point CEVQ peer victimization scale were associated with more loneliness, $b = 1.42$, $p = .021$, and chronic health problems, $b = .55$, $p = .001$, after adjustment for covariates (see Table 3).

NBW sample—Increases in the 10-point CEVQ peer victimization scale were associated with poorer family function, $b = -1.06$, $p = .002$, more loneliness, $b = 1.49$, $p = .006$, and poorer self-esteem, $b = 0.83$, $p = .002$, in NBW controls after adjustment for covariates. In addition, among participants born NBW, each one-point increase in peer victimization score was associated with lower household income after adjustment $b = -\$5,162.39$, $p = .025$ (see Table 3).

Discussion

Our study supported our first hypothesis that child victimization would predict adverse social outcomes in adulthood in both the ELBW and NBW. Specifically, we found that peer victimization predicted a lower likelihood of having children, poorer family functioning, more loneliness, less social support, poorer self-esteem, lower household income, increased likelihood for contact with police, and higher levels of chronic health conditions even after adjustment for covariates, including birth weight status. We partially supported our second hypothesis that childhood victimization would have more adverse effects on these social outcomes in ELBW survivors than NBW participants. While we only found significant moderation by birth weight status for being convicted of a crime and chronic health conditions, the pattern of results suggests that ELBW and NBW participants may be differentially affected in some domains by peer victimization. Our findings extend previous research (Sigurdson et al., 2014; Wolke et al., 2013; Wolke et al., 2015) by reporting significant negative effects of peer victimization in general population, preterm, and very low birth weight (VLBW; $< 1500g$) survivors through their mid-30s and by showing that it also significantly impacts the lives of ELBW survivors. Perhaps most strikingly, participants born NBW who experienced peer victimization were found to earn \$5,162.39 (CAN\$) less for each one-point increase in reported peer victimization, even after adjustment for childhood environmental variables, including their rearing family's SES status. Although not statistically significant, participants born ELBW who experienced peer victimization were also found to earn \$4,457.81 less for each one-point increase in the peer victimization scale. Considering the mean income for participants born NBW and ELBW was \$78,148.15 and \$54,450.55, respectively, and the median household income in Ontario during data collection (age 29–36 years) was approximately \$73,240 (Statistics Canada, 2014), this is a meaningful effect. This finding aligns with previous research (Wolke et al., 2013) that suggested that

those who experienced peer victimization were more likely to live in poverty than those who had not, controlling for known correlates of poverty. Therefore, early peer victimization appears to have strong, negative, impacts on the earning potential of its victims, even into the early to mid-30s.

Although we hypothesized that the cumulative risks of being born ELBW and exposed to peer victimization would lead to poorer outcomes, this hypothesis was only partially supported as there was only statistical significant moderation by birth weight status for being convicted of a crime and chronic health conditions. ELBW survivors who experienced peer victimization were at greater risk for a criminal conviction and higher levels of chronic health conditions, while the associations were not significant for NBW participants. It may be that ELBW survivors may be more likely to react in an antisocial fashion in adulthood after experiencing peer victimization. Furthermore, as ELBW survivors are more at risk for chronic health conditions, they may be more susceptible to health problems than NBW participants as a result of peer victimization. Our lack of significant moderation for the other outcomes may have been because of reduced power as a result of attrition that is inherent in following a sample of participants into their mid-30s.

However, this lack of significant moderation also highlights the detrimental effect peer victimization has on all individuals. Our findings mirror research on the impact of peer victimization in other at risk samples. Specifically, Lereya and colleagues (2015) that there was not cumulative risk for child maltreatment and peer victimization predicting mental health problems into the mid-20s, and Wolke and colleagues (2015) that found that peer victimization, and not preterm/VLBW status, was the most important predictor of emotional problems in two cohorts of very preterm and VLBW survivors to age 11–13.

There were more significant associations between peer victimization and adverse social outcomes for NBW participants than ELBW participants. While this pattern should be interpreted with caution, it may be that being born ELBW may be such a strong predictor of maladjustment that the additional factor of peer victimization does not predict all of these adverse social outcomes above and beyond ELBW status. More research is needed in this area with larger samples to see if this pattern is statistically supported in the future.

The experience of peer victimization may lead to poorer outcomes in adulthood because peer victimization interferes with a person's fundamental need to belong (Baumeister & Leary, 1995; McDougall & Vaillancourt, 2015). Peer victimization also impacts youth physiologically (e.g., changes to the HPA axis; Ouellette-Morin et al., 2011), which in turn, may place them at a disadvantage when it comes to dealing with other forms of psychosocial stressors (see [BLINDED], for a review). Peer victimization is also believed to lead to impaired social cognition and change how victims react cognitively to threatening stimuli (van Dam et al., 2012), and negatively affect school performance (Rueger & Jenkins, 2014).

Limitations

As with any study that follows participants into the fourth decade of life, there was participant loss, though we attempted to minimize this as much as possible by adjusting for predictors of attrition. However, the resulting reduction in statistical power may have

contributed to a decrease in the number of statistically significant associations observed between peer victimization and social outcomes in adulthood. Although more significant associations between peer victimization and social outcomes were found in the sample born NBW, more research with larger sample sizes is needed to provide enough power to examine the possibility that birth weight status statistically moderates associations in order to more fully examine the cumulative risks of being born ELBW and experiencing peer victimization.

It is also important to note that we used a measure of peer victimization that was retrospectively self-reported when participants were in their 20s so there is a threat of recall bias. However, retrospective reports of victimization and victim status have been found to be valid (Olweus, 1993; Rivers, 2001), and peer victimization, although retrospectively measured, was separated in time from the outcomes by about 10 years. As peer victimization and the social outcomes were both self-reported there is a potential of bias due to shared method variance. In addition to utilizing multiple reporters, future research needs to assess all forms of peer victimization including relational and cyber peer victimization in order to have a comprehensive perspective on the experience of peer victimization. In addition, since our participants were born in the late 1970s to early 1980s, and given that neonatal care has improved over time, these findings should be replicated in more recent cohorts of ELBW survivors. Lastly, it is important to note that the sample was primarily Caucasian and came from a country with universal health care, so there is greater access to health care. Accommodations in homes, schools, and workplaces for those with disabilities are also provided by law through the social services available in Canada. As a result, the participants in this study may have better long term outcomes in comparison to those living in areas without these supports.

Conclusions

This study replicates and extends previous findings that children born NBW and ELBW may be at greater risk for poorer social outcomes in adulthood as a result of experiencing peer victimization as youth (Wolke et al., 2013) to the fourth decade of life. Furthermore, ELBW survivors who experience peer victimization may be more likely to be convicted of a crime and have more chronic health conditions than their NBW counterparts. However, considering the relative lack of statistical moderation by birth weight status, this study also highlights the importance of intervening when peer victimization occurs in both youth perceived to be more at risk, as well as children born at term.

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Table 1

Demographic Characteristics of Participants and Nonparticipants at Age 29–36 years

Characteristic	Participants		Nonparticipants	
	ELBW	NBW	ELBW	NBW
Number participated	100	89	79	56
Gender, male (%)	39 (39)	33 (37)	45 (60) [*]	33 (59) [*]
Birth weight, <i>M</i> (<i>SD</i>) grams	834.90 (132.74)	3388.12 (465.63)	840.51 (110.09)	3348.46 (526.52)
Gestational age, <i>M</i> (<i>SD</i>) wks	27.13 (2.42)	40 (0)	26.82 (2.02)	40 (0)
Familial SES, <i>M</i>	3	3	4 [*]	3
Family functioning, <i>M</i> (<i>SD</i>)	19.99 (4.89)	19.65 (5.08)	20.33 (4.54)	20.31 (4.79)
Total problems, clinical level, (%)	37 (39)	29 (33)	28 (51)	17 (31)
Peer victimization, <i>M</i> (<i>SD</i>)	5.17 (1.94)	4.49 (2.02)	4.82 (1.93)	4.93 (2.08)

Notes. ELBW = extremely low birth weight, NBW = normal birth weight.

^{*} $p < .05$ difference between participants and non-participants.

Table 2

Characteristics of Participants at Age 29–36 years

ELBW $n = 100$		NBW $n = 89$		
		Respondents	Respondents	
Social functioning				
Have a partner, n (%)	60 (60) *	100	66 (74.16)	89
Relationship quality, M (SD)	13.10 (5.04)	60	12.59 (4.73)	66
Have children, n (%)	20 (20) *	100	29 (32.58)	89
Family functioning, M (SD)	40.44 (6.76)	82	41.13 (6.11)	75
Loneliness, M (SD)	34.59 (11.61) *	100	31.11 (10.43)	89
Social support index, M (SD)	102.03 (24.90)	100	108.64 (24.43)	89
Self-esteem, M (SD)	7.29 (6.11) *	100	5.11 (5.08)	89
Socio-economic status				
Years of education, M (SD)	16.00 (2.76)	97	16.67 (3.17)	88
High school graduate, n (%)	93 (94.90)	98	83 (94.32)	88
College graduate, n (%)	56 (57.14)	98	56 (63.64)	88
Employed in last year, n (%)	78 (80.41) *	97	78 (91.76)	85
Total household income, M (SD), CAD	54,450.55 (41,004.41) *	91	78,148.15 (41,985.45)	81
Criminal activity				
Contact with police, (%)	7 (7)	100	9 (10.23)	88
Convicted of a crime, n (%)	4 (4.04)	99	7 (7.95)	88
Health				
Chronic health conditions, M (SD)	3.29 (3.12) *	100	1.71 (1.83)	89

Notes. ELBW = extremely low birth weight, NBW = normal birth weight.

* $p < .05$ differed between samples. Higher scores indicate poorer relationship with partner, better family functioning, higher loneliness, more social support, and poorer self-esteem.

Table 3

Associations Between Experiencing Peer Victimization and Adult Outcomes

Outcome	ELBW		NBW		ELBW + NBW	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	OR (95% CI) or b (SE)	OR (95% CI) or b (SE)	OR (95% CI) or b (SE)	OR (95% CI) or b (SE)	OR (95% CI) or b (SE)	OR (95% CI) or b (SE)
Social Functioning						
Have a partner	1.01 (.82–1.24)	1.03 (.82–1.29)	1.08 (.85–1.38)	1.15 (1.00–1.31)	1.05 (.89–1.23)	1.09 (.82–1.29)
Relationship with partner	.42 (.342)	.39 (.344)	.41 (.277)	.46 (.290)	.41 (.22)	.40 (.22)
Have children	.77 (.59–1.00)	.77 (.58–1.01)	.80 (.63–1.02)	.80 (.62–1.05)	.79 (.66–.94)*	.80 (.66–.96)*
Family function	-.30 (.376)	-.35 (.393)	-1.15 (.337)*	-1.06 (.341)*	-.72 (.26)*	-.69 (.26)*
Loneliness	1.46 (.585)*	1.42 (.616)*	1.61 (.525)*	1.49 (.545)*	1.54 (.40)*	1.39 (.41)*
Social support	-.99 (1.30)	-1.78 (1.34)	-2.72 (1.26)*	-2.50 (1.33)	-1.91 (.91)*	-2.20 (.95)*
Self-esteem	.47 (.314)	.44 (.332)	.80 (.255)*	.83 (.260)*	.63 (.21)*	.62 (.21)*
Socio-Economic Status						
Years of education	.08 (.148)	.10 (.147)	-.14 (.168)	-.21 (.169)	-.02 (.11)	-.07 (.11)
High school graduate	.89 (.56–1.43)	.85 (.46–1.56)	.92 (.60–1.42)	.85 (.64–1.12)	.91 (.66–1.24)	.88 (.61–1.29)
College graduate	1.07 (.86–1.32)	1.11 (.87–1.41)	.98 (.79–1.21)	.95 (.76–1.19)	1.03 (.88–1.20)	1.03 (.87–1.21)
Employed in last year	.97 (.75–1.26)	.92 (.70–1.22)	.92 (.63–1.33)	.87 (.59–1.27)	.95 (.77–1.18)	.90 (.72–1.13)
Total household income	-3452.91 (2213.06)	-4457.81 (2351.65)	-5057.34 (2218.97)*	-5162.39 (2298.57)*	-4183.14 (1570.98)*	-4578.16 (1621.23)*
Criminal Activity						
Contact with police	1.61 (1.03–2.49)*	1.55 (.91–2.64)	1.36 (.98–1.89)	1.32 (1.11–1.57)	1.45 (1.12–1.89)*	1.37 (1.04–1.81)*
Convicted of a crime	2.06 (1.10–3.87)*	3.03 (.99–9.24)	1.14 (.79–1.64)	1.07 (.67–1.71)	2.47 (.68–8.98)	1.38 (0.96–1.99) ^a
Health						
Chronic health conditions	.56 (.153)*	.55 (.160)*	.21 (.094)*	.18 (.095)	.38 (.09)*	.36 (.09) ^a

Notes. ELBW = extremely low birth weight. NBW = normal birth weight.

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* $d < .05$ or odds ratio did not include 1.

^aThere was significant moderation by birth weight status. For those born ELBW, those who experienced more peer victimization were more likely to be convicted of a crime ($OR = 3.24, 95\%CI\ 2.00-5.27$) and more likely to have chronic health conditions ($b = .55, p < .001$) than those born NBW (convicted of crime $OR = 1.02, 95\%CI, 0.82-1.28$, chronic health conditions $b = .18, p = .155$). Higher scores indicate poorer relationship with partner, better family functioning, higher loneliness, more social support, and poorer self-esteem. Adjusted analyses included the covariates of participant sex, familial SES, family functioning, and childhood emotional and behavioral problems.