Increased risk of alcohol and drug use among children from deployed military families

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ABSTRACT

Aims   To examine the association between military deployment of a parent and use of alcohol and drugs among children of deployed military personnel. **Design**   Observational and cross-sectional study. **Setting**   Data from the USA 2010 Iowa Youth Survey, a statewide survey of 6th, 8th and 11th graders, were analyzed during 2011. **Participants**   Of all 6th-, 8th- and 11th-grade students enrolled in Iowa in 2010, 69% ($n = 78\ 240$) completed the survey. **Measurements**   Ever drink more than a few sips of alcohol and past 30-day: binge drinking, marijuana consumption, other illegal drug use and prescription drug misuse. **Findings**   The rates of alcohol use [risk difference (RD) = 7.85, 99.91% confidence interval (CI) = 4.44–11.26], binge drinking (RD = 8.02, 99.91% CI = 4.91–11.13), marijuana use (RD = 5.30, 99.91% CI = 2.83–7.77), other illegal drug use (RD = 7.10, 99.91% CI = 4.63–9.56) and prescription drug misuse (RD = 8.58, 99.91% CI = 5.64–11.51) are greater for children of currently or recently deployed parents than for children of parents who are not in the military. The magnitude of the effects is consistent across 6th, 8th and 11th grades. Disrupted living arrangements further accentuate increased substance use, with the largest effect seen in children with a deployed parent who was not living with a parent or relative. **Conclusions**   Children of deployed military personnel should be considered at higher risk for substance use than children of non-military citizens.

Keywords   Alcohol use, deployment effect, drug use, Iowa youth survey, military children, military families, substance use.

INTRODUCTION

In 2010, approximately 1.99 million US children had at least 1 parent in active duty [1]. In states such as Iowa, Vermont, Wisconsin, and Minnesota, the largest proportion of military personnel serve with the Reserve or the National Guard (NG) [1]. Citizens in the Reserve and NG live in civilian communities throughout the country, which may not be geographically close to military support services. When the Reserve or NG are called to active duty, their families may face changes in income, child care and medical insurance [2]. Active duty assignments often involve deployment, which is a short-term (i.e. usually ranging from 1 to 15 months) routine, planned or unexpected assignment of military personnel to a combat or non-combat zone.

Since the wars in Iraq and Afghanistan started, researchers have studied the effect of deployment on military families [2–23]. For example, studies of the deployment impact on families found that adolescents and their caregivers have higher levels of stress, and more emotional and behavioral difficulties than adolescents from national samples and of non-deployed parents [4–6,15]. Caregiver mental health and behaviors (e.g. parental distress, avoidant coping) are associated with child well-being (e.g. anxiety levels, conduct and emotional problems, psychosocial morbidity) [13,16,22]. Children have a higher rate of maltreatment during their parent's deployment than non-deployment [14]. Multiple deployments over time can have a significant effect on the mental health of a child leading to increased child depression, externalizing behaviors, maltreatment, lower

achievement scores, increased suicide ideation and lower quality of life [8,16,19,23]. In one study [19], adolescents with deployed parents seemed to be more likely to engage in binge drinking and drug use than adolescents with civilian parents; however, the substance use outcomes were considered only as possible confounders in the association between parental deployment and adolescent well-being, and were not studied in detail.

Some studies show the association between substance use and youth emotional and behavioral difficulties, maltreatment, well-being and school achievement [24–26]. In spite of the suspected association between these deployment effects and increased risks for substance use, Reed's [19] seems to be the only study presenting data that could be used to relate parental deployment and children' substance use behaviors. Thus, the aim of this study was to investigate the association between parental deployment and substance use. Considering the effects of deployment on children and its potential association with increased substance use, this work hypothesized that Iowan children of deployed parents would have higher rates of substance use than children of non-military parents. Possible factors (e.g. age, gender, race/ethnicity and living environment) that could influence this association were also investigated.

METHODS

Participants

The Iowa Youth Survey (IYS) is a statewide survey of 6th-, 8th- and 11th-graders conducted since 1999 by the Iowa Department of Public Health's Division of Behavioral Health in collaboration with other agencies. All public and private middle, junior and high schools in the state are invited to participate in this survey. Once a school accepts to participate in the survey, all 6th-, 8th- and 11th-grade students and their parents receive an informational letter about the survey and instructions for declining participation. Participating students completed an online survey asking about attitudes and experiences about alcohol and drugs, violence, and perceptions about their peers, family, school and communities (http://iconsortium.subst-abuse.uiowa.edu/new_Projects.html #IYS). According to Arndt *et al.* [27], IYS data are reliable with >85% of the community variation due to community differences.

Data from the 2010 IYS were used in this analysis. Of all 6th-, 8th- and 11th-grade students enrolled in the state of Iowa in 2010, 69% (*n* = 78 240) completed a survey. All the schools in the state of Iowa were invited to participate in the survey. Once a school decided to participate, the survey's information was sent to the parents by the school. The participating schools included about 80%

of the total enrollment in Iowa during 2010–11. Thus, the bulk of the non-response (i.e. about 20%) is at the level of the school, while only about 11% of the non-response is attributable to the participants. When only the participating schools are considered, the response rate was 86%. There was no evidence of a difference in grade, gender and race distributions in the sample used in the analysis when compared with all the students in the state of Iowa.

Students were asked to describe if they had a parent in the military and their parent's deployment status using the following item: 'I have a parent in the military who:' with response options of 'Is currently away from home because of military service' (*n* = 775), 'Returned home from military service in the last year' (*n* = 983), 'I do not have a parent in the military' (*n* = 57 637) and 'None of the above' (*n* = 17 097). The 18 233 (23.3%) students that did not answer or answered 'None of the above' to the parental military status question and the 612 (0.8%) students who listed their grade as 'Other' or 'Ungraded' were not included in the analysis. Thus, the analysis included 59 395 students (i.e. 52.4% of the target population). The results did not change when the students who answered 'None of the above' were included in the analysis.

Data

The following categories for military status were created: (i) currently deployed military parent (CD group, *n* = 775, 1.3%); (ii) recently returned military parent (RR group, *n* = 983, 1.7%); and (iii) non-military parent (NM group, *n* = 57 637, 97.0%).

The following main outcomes were considered:

1 *Ever drink alcohol*—students were asked the question 'How old were you (if ever) when you first: Drank (more than a few sips) of alcohol (beer, wine, or liquor)'. Students who reported an age when the student first drank more than a few sips were coded as ever drinkers and those who responded 'Never' were coded as non-drinkers

2 *Past 30-day binge drinking*—binge drinkers were assessed by the student's response to 'During the last 30 days, on how many days did you have 5 or more drinks of alcohol (glasses, bottles or cans of beer; glasses of wine, liquor, mixed drinks) in a row, that is within a couple of hours?'. A response of '0 days' was coded as 'No', and students who reported drinking 1 or more days were coded as 'Yes'

3 *Past 30-day marijuana and illegal drugs use*—a series of questions asked 'In the past 30 days, on how many days have you: (i) 'Used marijuana (pot, grass, hash, bud, weed)', (ii) 'Sniffed glue, breathed the contents of gases or sprays in order to get high', (iii) 'Used

methamphetamines (crank)', (iv) 'Used cocaine [crack, rock, coke (not Coca Cola)]', or (v) 'Used amphetamines other than methamphetamines (like stimulants, uppers, speed)'. Past 30-day marijuana users were classified separately because its frequency of use is higher than for other drugs. Positive responses to the remaining drug-related questions were classified as illegal drug use

4 *Prescription drug misuse*—students who were coded as prescription drug misusers indicated past 30-day use of prescription medications that were not prescribed for the student by a doctor and use of prescription medications (that were prescribed to the student by a doctor) different from the directions.

Additionally, sex, grade, race and ethnic groups, and living arrangement were considered as potential confounders. The participants classified themselves as White, African American, American Indian or Alaska Native, Asian/Pacific Islander, or Hispanic or Latino. Living arrangement was determined from the question 'Where are you now living?' Three categories of living arrangements were created based on all possible response options: (i) with parent(s), (ii) with grandparents or other relatives, and (iii) other which included foster parents, shelter care, residential group or home, and independent living.

Statistical analysis

χ^2 tests and one-way ANOVA were used to compare respondents on demographic and main outcome variables. Given the large sample size, effect sizes and confidence intervals (CI) were reported. For categorical variables, odds ratios (OR) and risk differences (RD) were used as effect size measures. In the case of continuous variables, we reported Cohen's d. For the initial analyses, military deployment status was categorized using the aforementioned three groups (i.e. CD, RR and NM groups). When there were no differences between the CD and RR groups, results were reported using a binary form of military status, that is deployed (i.e. CD and RR groups) versus non-military (i.e. NM group).

Logistic regression models predicted substance use utilizing the deployed and NM groups. Other variables included the grade, sex, living arrangement and race/ethnicity. Second-order interactions of the deployment by these other variables were also studied. Results remained essentially unchanged when school and/or school district were used as clustering variables in the analysis. Thus, simpler analyses not including clustering effects are reported.

Although ORs are presented, the predicted probabilities from the logistic regression analyses are also reported. These probabilities were corrected for the cov-

ariates and derived from the logistic regression by inverting the logit function. The RD derived from these probabilities are robust to the 30-day substance use rates that drastically increase from grade 6 to grade 11. Instead, ORs are sensitive to this expected increase in substance use and vary considerably over the different grades. Thus, RD are better than OR for the interpretation of the difference between the deployed and the NM groups over the different grades.

Because of the large sample size and number of tests, a significance threshold of 0.0009 (i.e. Bonferroni adjustment for all the tests performed) was used in order to reduce the overall type I error rate and to focus on meaningful effect sizes. All statistical analyses were performed using SAS.

RESULTS

Demographic characteristics

There were no differences in the demographic characteristics between the CD and RR groups. Students in the CD or RR groups were slightly younger than students in the NM group (Table 1). There were more 6th-graders and males in the deployed group compared with the NM group (Table 1). Also, there were fewer 11th-graders in the deployed group than in the NM group. Students with deployed parents were less often White than students in the NM group (Table 1). The proportions of African American and American Indian/Alaska native students were approximately doubled in the deployed groups compared with the NM group (Table 1).

Students in the CD group were least frequently living with a parent (84.7%, $n = 653$), followed by students in the RR group (90.7%, $n = 899$), while 96.7% ($n = 55\,671$) of students in the NM group were living with parents [CD group versus NM group: RD = −12.03, 99.91% CI = (−16.41, −7.66); RR group versus NM group: RD = −6.01, 99.91% CI = (−9.14, −2.89)]. Among students not living with a parent, grandparents or other relatives often took the student. However, students in the CD group, more frequently had 'other' living arrangements, with 2.2% ($n = 17$) living in a shelter, 3.0% ($n = 23$) living independently, 1.2% ($n = 9$) living in foster care, 0.5% ($n = 4$) living in a residential group or home and 1.8% ($n = 14$) report a living arrangement not listed as an option. All of these options were under 1% among students in the NM group.

Univariate analysis of substance use outcomes

Substance use was higher in the deployed groups than in the NM group (Table 2). For instance, more than twice as many students in the deployed groups reported using marijuana or misusing prescription drugs in the past 30

Table 1 Basic demographics among the parental groups.

	Deployed group (n = 1758)	Non-military group (n = 57 637)	Effect size[a]	99.91% confidence interval
Age mean (SD)	13.13 (2.01)	13.45 (2.05)	0.16	[0.08, 0.24]
Grade % (n)				
6	43.57 (766)	35.07 (20 215)	8.50	[4.49, 12.51]
8	34.41 (605)	35.94 (20 714)	−1.53	[−5.37, 2.32]
11	22.01 (387)	28.99 (16 708)	−6.98	[−10.34, −3.61]
Sex % male (n)	58.72 (1030)	49.12 (28 250)	9.60	[5.61, 13.60]
Race/ethnic group % (n)				
White	77.12 (1345)	86.71 (49 694)	−9.59	[−12.99, −6.18]
African American	9.92 (173)	4.39 (2 516)	5.53	[3.11, 7.95]
American Indian or Alaska Native	3.50 (61)	1.28 (734)	2.22	[0.72, 3.72]
Asian/Pacific Islander	2.81 (49)	2.02 (1 159)	0.79	[−0.57, 2.15]
Hispanic or Latino	6.65 (116)	5.60 (3 210)	1.05	[−0.99, 3.09]

[a]Cohen's d for age and risk difference for the rest of the variables (difference between the risk of the deployed group and the non-military group).

Table 2 Percentage of substance use among the parental groups.

	Deployed group (n = 1758)	Non-military group (n = 57 637)	Risk difference[a]	99.91% confidence interval
Ever drink alcohol % (n)	36.18 (618)	28.31 (16 103)	7.87	[3.93, 11.81]
Alcohol 30-day use % (n)	22.31 (381)	14.46 (8 197)	7.85	[4.44, 11.26]
Binge (>5 drinks in a sitting) % (n)	17.60 (302)	9.58 (5 432)	8.02	[4.91, 11.13]
Marijuana 30-day use % (n)	10.12 (173)	4.82 (2 733)	5.30	[2.83, 7.77]
Illegal drugs 30-day use % (n)	10.19 (175)	3.09 (1 757)	7.10	[4.63, 9.56]
Prescription drug 30-day misuse % (n)	15.29 (262)	6.71 (3 816)	8.58	[5.64, 11.51]

[a]Difference between the risk of the deployed group and the non-military group.

days compared with students in the NM group. The rate of illegal drug use was three times higher among students in the deployed groups than in the NM group. Analyses using specific contrasts in a logistic regression revealed non-significant differences in substance use between the CD and RR groups (all *P*-values > 0.08; results not shown).

Multivariate analysis of substance use outcomes

For the logistic regression analyses, interactions of parental deployment status with sex and race/ethnicity were not significant. Thus, deployment was not differently associated with substance use outcomes for male, female or any of the racial/ethnic groups. However, deployment affects students differently depending on their grade in school for alcohol use [Wald $\chi^2(2) = 25.13$, $P < 0.0001$], binge drinking [Wald $\chi^2(2) = 39.27$, $P < 0.0001$] and marijuana use [Wald $\chi^2(2) = 26.67$, $P < 0.0001$]. Deployment was also associated differently with binge drinking and marijuana use depending on the children's living arrangements [Wald $\chi^2(2) = 21.91$,
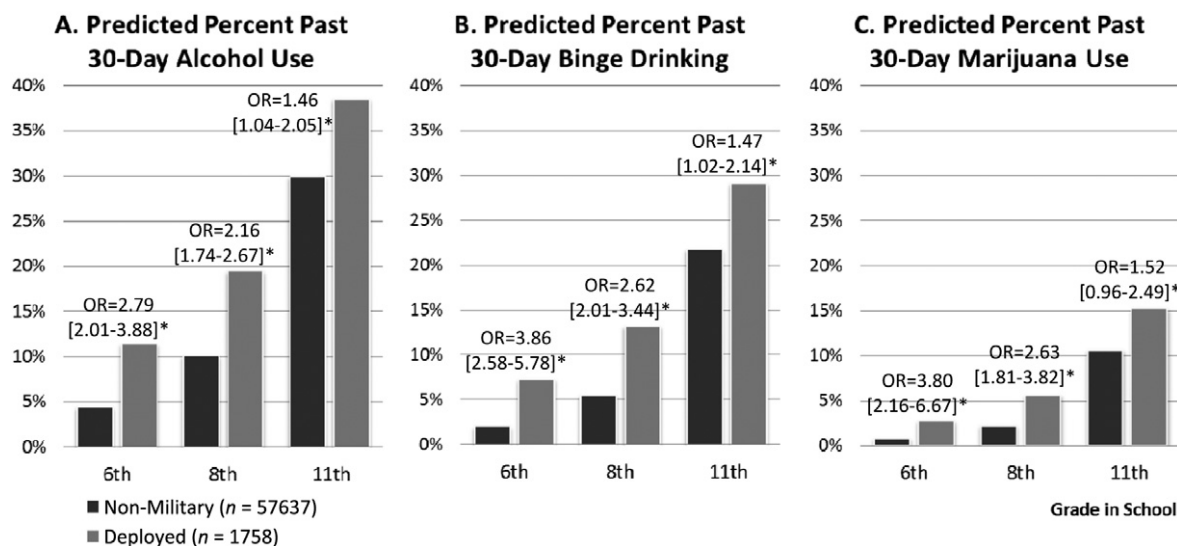
$P < 0.0001$ and Wald $\chi^2(2) = 17.05$, $P = 0.0002$ respectively]. There were no interactions involved with drug use or prescription drug misuse.

In order to understand the interaction effects while using the smallest possible number of models, the logistic regression models were reduced to omit the non-significant interactions, but maintained all of the main effects and significant interactions. Using the reduced models, model-based percentages (probabilities) were constructed and graphed. RDs (deployed versus NM) and ORs for past 30-day substance use were generated to aid interpretation.

The effect associated with deployment status by grade interaction on substance use

Figure 1(a) shows the predicted percentages of alcohol use broken down by grade and deployment status, controlling for sex, race/ethnic group and living arrangement.

The RDs for alcohol use were fairly constant across the grades, 6.97 (99.91% CI = 4.42–9.54), 9.37 (99.91%

A. Predicted Percent Past 30-Day Alcohol Use

B. Predicted Percent Past 30-Day Binge Drinking

C. Predicted Percent Past 30-Day Marijuana Use

Figure 1 Predicted percentages of 30-day (a) alcohol use, (b) binge drinking and (c) marijuana use by grade and military deployment status. Percentages are fixed for a White student living with a parent and evaluated at the model mean for sex. *99.91% confidence interval for odds ratio for deployed group versus non-military (NM) group (see text for more details)

CI = 6.18–12.56) and 8.52 (99.91% CI = 4.60–12.47), for 6th, 8th and 11th grades respectively. This suggests that there was a 7–9 percentage point increase in children's drinking attributable to deployment across all grades. As the base rate of drinking increases over grade level, the ORs differed, with the effect associated with deployment decreasing over the grades, 2.79 (99.91% CI = 2.00–3.88), 2.16 (99.91% CI = 1.74–2.67) and 1.46 (99.91% CI = 1.04–2.05). The relatively constant effect in terms of the RD and the increasing incidence with grade level produced the interaction effect between grade and deployment.

The effect associated with deployment on binge drinking over grades is shown in Fig. 1(b). Again, the RDs across the grades were fairly consistent (6th grade: RD = 5.26, 99.91% CI = 3.15–7.33; 8th grade: RD = 7.71, 99.91% CI = 4.97–10.41; 11th grade: RD = 7.32, 99.91% CI = 3.66–11.00); however, the ORs varied considerably (6th grade: OR = 3.86, 99.91% CI = 2.58–5.78; 8th grade: OR = 2.62, 99.91% CI = 2.01–3.44; 11th grade: OR = 1.47, 99.91% CI = 1.02–2.14). Based on the RDs, there was an approximate 5–8 percentage point increase associated with deployment for binge drinking.

Use of marijuana was also associated with a military by grade interaction. These predicted probabilities are shown in Fig. 1(c). With marijuana, both the RDs and ORs varied over the grades. For 6th-graders the risk of marijuana increased by 1.98 (99.91% CI = 0.68–3.33) percentage points with an OR = 3.80 (99.91%CI = 2.16–6.67). For 8th-graders the RD = 3.36 (99.91% CI = 1.49–5.19) and OR = 2.63 (99.91%CI = 1.81–3.82). For 11th-graders, the RD = 4.65 (99.91% CI = 1.72–7.53) and OR = 1.52

(99.91% CI = 0.96–2.39). Thus, the total percentage of students affected by deployment more than doubles, 2.0–4.6 percentage points, between 6th and 11th grade.

The effect associated with deployment status by living arrangement interaction on substance use

Living arrangement modified the effects associated with deployment for binge drinking (Fig. 2a) and marijuana use (Fig. 2b). After adjusting for grade, gender and race among students not living with a parent or other relative, those with a deployed parent had a risk for 30-day binge drinking 42 percentage points higher than students with NM parents (99.91% CI = 38.21–46.21). They also had almost 9 times the odds of recent binge drinking (OR = 8.70, 99.91% CI = 3.86–19.61). For students living with their parents, the adjusted RD was 7.71 (99.91% CI = 4.97–10.41) (Fig. 2a).

After adjusting for grade, gender and race among students not living with a parent or other relative, those with a deployed parent had a risk for 30-day marijuana use 25 percentage points higher than students with NM parents (99.91% CI = 20.97–28.35). They also had more than 7 times the odds of recent marijuana use (OR = 7.14, 99.91% CI = 3.08–13.70). For students living with their parents, the adjusted RD was 3.36 (99.91% CI = 1.49–5.19) (Fig. 2b).

DISCUSSION

This research suggests that deployment of a parent may be a risk factor for current drinking, binge drinking, use of
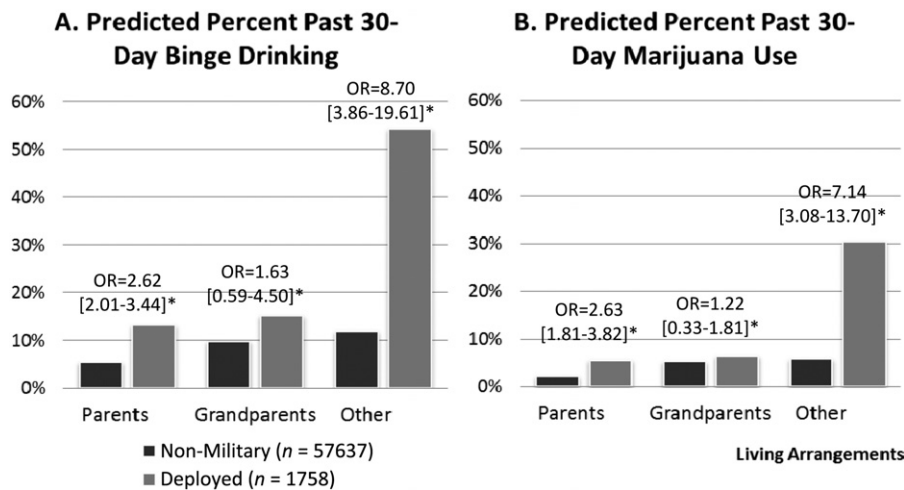
Figure 2 Predicted percentages of 30-day (a) binge drinking and (b) marijuana use by student's living arrangements and parental military deployment status. Percentages are fixed for a White student in the 8th grade and evaluated at the model mean for sex. *99.91% confidence interval for odds ratio for deployed group versus non-military (NM) group (see text for more details)

marijuana and other illegal drugs, and prescription drug misuse. These effects were seen consistently across all of the grades, both in univariate and multivariate analyses. The binge drinking and drug use rates found are somewhat similar to those reported by Reed *et al.* [19]. However, caution must be applied in comparing these results to Reed *et al.*'s owing to the differences between the characteristics of the targeted populations and those between the questions in the Washington State Healthy Youth Survey and the Iowa Youth Survey.

Deployment was related to the child living with someone other than their parents. Univariate analyses show that children whose parent was currently deployed often were not living with immediate relatives. Thus, deployment posed a risk factor for disruption of the child's living arrangement. The increased substance use was accentuated by the disrupted living arrangements, with the largest effect seen in children with a deployed parent who were not living with a parent or relative. These findings agree with previous studies showing that not living with relatives is a risk factor for substance use in children [24,28]. IYS data did not capture information on which parent was deployed (e.g. mother, father or both) or on the changes in support systems encountered when living arrangements were modified. The complexity of this relationship is worth further exploration.

These findings should be interpreted in the context of the Iowan military community. Most of the parents of Iowan children in the deployed groups were in the Reserve or NG [1]. Thus, these results may reflect that Iowan children of deployed parents live in quickly changing home environments, especially when a military parent is suddenly called to duty and deployed overseas. Also, these children may not have experienced prolonged

separations in the past and may have reduced access to support services during the periods of deployment. These circumstances may serve as family stressors that increase the risk of substance use.

The observational, cross-sectional and population-based nature of the data in this study resulted in several limitations. For instance, the IYS collects no data to further describe the sample socio-economic status, the family member characteristics (e.g. parental marital status, number of siblings, family history of substance use), deployment aspects (e.g. length of deployment, number of deployments), or in-depth psychological and mental health characteristics of the children and their caregivers. Thus, the NM group we used as the referent does not allow us to conclude if the increase in substance use among CD/RD children is due to recent deployment of a parent or because of a relative disadvantaged social situation. Also, even though the large sample size of this study helped unveil potential effect modifiers and confounders that impacted the effect of deployment on the children substance use behaviors, there are several other confounders that remain to be studied.

In addition, we are unable to discern whether the increase in substance use in CD/RD children was owing to one parent being deployed or simply a result of being part of a military family. The IYS does not identify children of military parents who were not recently deployed. Presumably, children of military parents not recently deployed were part of the group that marked 'None of the above' as the answer to the IYS question asking to describe their parental military status. Identifying this group of children is needed to know if the findings reported here are due to deployment as opposed to the effect of simply having a parent in the military.

Based on these findings and those relating to suicidal ideation [19], children of deployed military personnel should be considered at higher risk for substance use than children of NM citizens. The literature about substance use in children of military parents is scarce with the body of research focused on secondary data from school-based cross-sectional surveys. To better understand the results found here, future research on child substance use might be designed to focus on children of military families. Future studies could investigate the factors that help protect or increase the risk of children with deployed parents (e.g. substance use and mental health family history, deployment characteristics, living environment characteristics). Nevertheless, these findings indicate key points for intervention. Military deployment is a critical time for intervention with military children who likely experience reduced parental support and increased stressful home environments. Schools and primary health-care providers may serve important roles for children who are most vulnerable during times of deployment. For example, adults in schools and health-care settings could facilitate access to support services by providing early screening for substance use and triage through referrals.

Declaration of interest

Acknowledgements

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