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Patterns of Multisystem Involvement in Adolescence: Implications for Health, Education and Social Services in the Northern Territory of Australia

Vincent Y. F. He[1] | Bernard Leckning[1,2] | Tamika Williams[1] | Gary Robinson[1] | Steven Guthridge[1]

[1]Centre for Child Development and Education, Menzies School of Health Research, Charles Darwin University, Casuarina, Northern Territory, Australia | [2]Discipline of Psychiatry and Mental Health, Faculty of Medicine and Health, UNSW Sydney, Sydney, New South Wales, Australia

Correspondence: Bernard Leckning (bernard.leckning@menzies.edu.au)

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ABSTRACT

Dual-system young people who crossover between child protection and youth justice systems experience a range of health and educational issues. However, very little research has examined the health and education needs of these young people, especially in Indigenous populations. A retrospective cohort study was established using individual-level linked records to examine the child protection, youth justice, health, and education (multisystem) involvement of young Aboriginal and non-Aboriginal people in the Northern Territory (NT) of Australia. Latent class analysis (LCA) was used to identify different groups within the study cohort of 2584 young people with shared patterns and levels of health, education, and social service system involvement from 10 to 17 years of age, inclusive. Three groups of young people were identified, with patterns of higher, more intensive levels of multisystem involvement being associated with a descending social gradient and increasing proportion of health and social service use across the population. A culturally responsive, trauma-informed approach to multiagency collaboration is needed to better support the most vulnerable young people in the NT based on shared priorities targeting educational engagement, strengthening families, and unmet mental health needs.

1 | Introduction

There has been greater focus in recent years on approaches to better meeting the needs and improving outcomes of young people involved in both child protection and youth justice systems, often referred to as dual-system (Herz et al. 2019) or crossover (Baidawi and Sheehan 2019) youth. Although much of the work in this area has focused on improving collaboration across child protection and youth justice systems, there is increasing evidence of a range of influences and adverse outcomes that dual-system involved young people are experiencing in other domains. Mental health, substance misuse and other psychosocial risks have been highlighted as a particular concern among dual-system involved young people (Leckning et al. 2022; Malvaso et al. 2019). A high prevalence of neurodisability has also been reported (Baidawi and Piquero 2021). Educational risk, as measured by poor school attendance, progress, achievement and behaviour, has also been found to be quite prevalent among dual-system involved young people (Hirsch et al. 2018). This growing evidence base of complex interconnected issues outside

Vincent Y. F. He and Bernard Leckning contributed equally to the overall development of the manuscript.

of the primary concern of child protection and youth justice systems points to the need to expand the scope of work to help these young people beyond a focus on dual-system involvement.

In the Northern Territory (NT), a vast jurisdiction of approximately 233,000 residents occupying the central tropical and arid regions of Australia (ABS, 2022), a Royal Commission was established in 2016 in response to reported mistreatment of young people in detention and their overrepresentation in the child protection system (Royal Commission and Board of Inquiry into the Protection and Detention of Children in the Northern Territory 2017). Particular attention was given to young Aboriginal and Torres Strait Islander people (hereafter, respectfully referred to as Aboriginal), the original inhabitants of Australia prior to European colonisation and settlement who currently represent 26% of the NT population (compared to other jurisdictions where Aboriginal and Torres Strait Islander people at most represent 3% of the resident population) (ABS, 2022). The dispossession and cultural dislocation caused by European settlement and subsequent discriminatory policies, such as the forced removal of Aboriginal children from their families often referred to as the Stolen Generations (Cunneen and Libesman 2000), have led to the intergenerational transmission of disadvantage and trauma that has contributed to the over-representation of Aboriginal people in both child protection and youth justice systems (Menzies 2019). Based on reports submitted to the hearings and evidence from research highlighting the cumulative effect of increasing levels and timing of child protection involvement on the risk of youth offending (He, Leckning, et al. 2021), the Royal Commission recommended the adoption of a public health approach which included culturally responsive early intervention and prevention to reduce numbers of young people at risk of entry into both systems. Therapeutic, trauma-informed approaches were to replace coercive or punitive practices in the management of young people within those systems, especially in detention and out-of-home care (OOHC). Based on reports of the unmet mental health needs among dual system young people, the Royal Commission made recommendations for mental healthcare that were limited to clinical services and assessments for high-risk youth. However, the extent to which dual system young people may be experiencing broader health, educational and psychosocial risks was not thoroughly canvassed and, therefore, the multiagency responses to meet all the needs of these vulnerable young people remain unknown.

Multisystem-involved young people are children and adolescents who are concurrently involved in two or more child- and family-serving systems, with the focus typically on child protection, youth justice and behavioural service systems (Vidal et al. 2019). Research into multisystem-involved young people is critical to the planning, development, and allocation of resources to effective prevention and intervention strategies, as well as for informing the best models for multiagency collaboration to improve outcomes. However, in Australia, there is very little research to inform policy in this area. A Western Australia (WA) study explored the patterns of service use of multiple agencies (child protection, mental health, courts and corrections) by children from birth to 18 years of age and reported that a small proportion of the general population (1.5%) had contact with three or more agencies but accounted for a disproportionately high level (31%) of service use or contact with these agencies (Sims et al. 2017). More importantly, they noted the over-representation of Aboriginal and Torres Strait Islander young people, especially males, among those with multisystem involvement (Sims et al. 2017). Another Australian study highlighted the challenges of meeting the educational needs of young people crossing over between residential care and the youth justice system (Baidawi and Ball 2023). However, the authors of this study also noted there is a need for more research to better understand the unique system factors influencing the over-representation of and outcomes for young Aboriginal and Torres Strait Islander people with multisystem involvement (Baidawi and Ball 2023).

1.1 | Research Aims

The existing evidence points to some of the most vulnerable young people in society having high levels of dual system involvement, that is, involvement with both child protection and youth justice systems. Further research has shown these young people have more complex needs that not only require access to a range of health services but pose risks to participation in education. In framing an optimal service delivery model for vulnerable adolescents in the NT, there is a need to expand the existing evidence base on dual system involvement to also investigate patterns of involvement with education and health service systems. More importantly, there is a need to address the gaps in the evidence concerning vulnerable young Aboriginal people. To address these gaps and examine the implications for service delivery across multiple systems, a whole-of-population data linkage study was designed to identify the scope and nature of multisystem involvement of young people in the NT. This study aimed to: (a) identify different groups of young people with shared patterns of service system involvement in the NT from 10 to 17 years of age, inclusive; (b) determine demographic characteristics associated with each group and (c) estimate the proportion of all services used by each group.

2 | Methods

2.1 | Study Design and Study Population

This was a retrospective population-based cohort study of young people who were enrolled in NT government schools when they turned 10 years of age between 1/1/2011 and 31/12/2011 (and so turned 18 before 31/12/2019).

The study population and data were drawn from an extensive repository of de-identified, individual-level, linked administrative datasets established by the Child and Youth Development Research Partnership. The data repository and its linkage process have been described elsewhere (He et al. 2019).

The *NT government school enrolment dataset* contains records of annual enrolments to every government school in the NT. The study cohort was first defined as all young people with records of enrolment at age 10 in 2011. Individuals meeting any one of the following criteria were then excluded: missing demographic data; died between 10 and 17 years of age, inclusive (as indicated by linkage to *NT Mortality dataset*); subsequent enrolment records

indicating interstate migration. A similar proportion of Aboriginal ($n = 316$; 18.9%) and non-Aboriginal children ($n = 360$; 22.7%) were excluded for having moved interstate; however, it was noted that Aboriginal children who moved to interstate schools had higher median school attendance rates (74 days vs. 69 days) and were more likely to attend urban schools (35.1% vs. 25.5%) than Aboriginal children selected into the study cohort (Table S1). See Figure 1 below for the flowchart describing the application of inclusion and exclusion criteria to establish the study cohort.

2.2 | Data Sources and Measures

Linked records from thirteen datasets were used in this study to define the cohort and establish variables used for analysis. The latent class modelling used the following indicators describing levels of involvement within a service system (see Table 1 for full list of indicators and labels):

1. *School Attendance at 10 Years of Age*: The *NT Government School Attendance Dataset*, which contains daily records of attendance for every government school student, was used to calculate the number of days of school attendance at age 10 (i.e., in the Year 2011) as a percentage of all school days expected to attend. To indicate the level of educational participation, school attendance was modelled as a proportion of attendance for the year.
2. *Academic Achievement in Years 7 and 9*: The *NT National Assessment Program for Literacy and Numeracy* (*NAPLAN*) *Dataset* Contains Records of the results of compulsory standardised academic tests administered to students in both government and non-government schools across Australia in Years 3, 5, 7 and 9. *NAPLAN Years 7 and 9 reading test results were used* as indicators of academic achievement and were categorised into the following levels (Highest to Lowest): Standardised Test Score at or above the national minimum standard (NMS), standardised test score below the NMS, expected to take the test but marked as absent, no record of NAPLAN Assessment.
3. *Emergency Department* (*ED*) *Presentation*: The need for emergency medical care was measured using records from the *NT Emergency Department Activity Dataset*. It was used to flag young people with at least one presentation to any NT hospital emergency departments from 10 to 17 years of age, inclusive.
4. *Hospitalisation Indicators*: The *NT Inpatient Activity Dataset* contains records of hospital admissions to all NT public hospitals. The *any hospitalisation indicator was used* to flag whether a young person was admitted to hospital from 10 to 17 years of age, inclusive, for any condition. Diagnosis codes of inpatient records were consulted to develop additional indicators of more serious hospitalisations suggestive of adversity in adolescence: *mental health-related hospitalisation* (ICD-10-AM F Codes), *assault-related hospitalisation* (ICD-10-AM X85-Y09), *self-harm-related hospitalisation* (X60-X84).
5. *Mental Health Service Use*: Many serious mental health and behavioural issues in the community and in hospital are referred to or require the care of the ambulatory mental health services run by the NT Government. The *NT Mental Health Activity Dataset* was used to identify young people with records of any contact with these services from 10 to 17 years of age, inclusive.
6. *Child Protection Involvement*: The *NT Child Protection Dataset* was used to derive three binary variables stating the following levels of involvement with the Child Protection System from 10 to 17 years of age, inclusive: at least one notification (Report) of possible maltreatment or neglect, at least one record of substantiated maltreatment or neglect, and at least one OOHC Placement.
7. *Police Report of DV/FV Exposure*: The *NT Police* or *Police Realtime Online Management Information System* (*PROMIS*) dataset contains data relating to reported incidents and offences recorded by police officers. It was used to identify young people who were flagged in police reports as having direct (i.e., victim) or indirect (i.e., witness) exposure to domestic/family violence (DV/FV) from 14 to 17 years of age, inclusive (complete data only available from 2015 to 2019).
8. *Youth Justice Involvement*: In this study, the Youth Justice System is defined as law enforcement or police, the judicial system of courts, and correctional facilities or youth detention. The order in which each aspect of the system

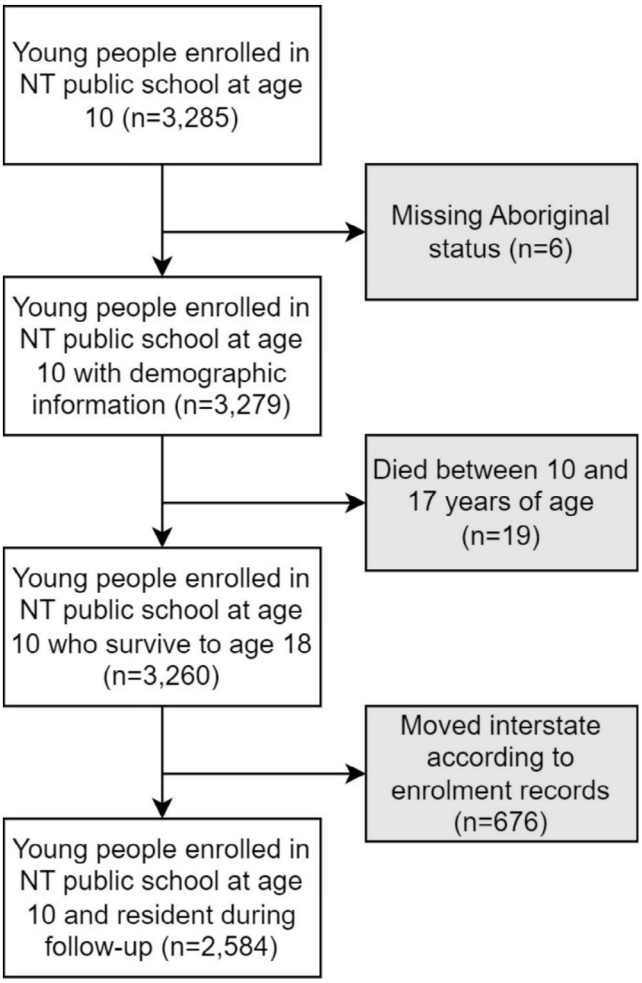

FIGURE 1 | Flowchart of study cohort selection.

TABLE 1 | Indicators and labels used for levels of multisystem involvement in adolescence.

Indicator	Label
School attendance at age 10	
I1	80%–100%
I2	50%–79%
I3	< 50%
NAPLAN Year 7 reading	
I4	At/Above NMS
I5	Below NMS
I6	Not participating
I7	Not found in NT NAPLAN data
NAPLAN Year 9 reading	
I8	At/Above NMS
I9	Below NMS
I10	Not participating
I11	Not found in NT NAPLAN data
Health (age 10–17)	
I12	Mental health service use
I13	ED presentation
I14	Any hospitalisation
I15	Mental health-related hospitalisation
I16	Assault-related hospitalisation
I17	Self-harm-related hospitalisation
Child protection (age 10–17)	
I18	≥ 1 notification(s)
I19	≥ 1 substantiation(s)
I20	≥ 1 OOHC placement(s)
I21	Police report of DV/FV exposure (age 14–17)
Youth justice	
I22	Police contact for criminal incident
I23	Charged with an offence (age 10–13)
I24	Youth justice supervision (age 10–16)
I25	Detention order (age 10–16)

is presented describes increasing levels of youth justice involvements, starting with police contacts and potentially ending with a legal order to serve detention. The *NT Police* or *Police Realtime Online Management Information System* (*PROMIS*) dataset described above was used to flag young people with Police Contact for a criminal incident from 14 to 17 years of age, inclusive (Complete data only available from 2015 to 2019). The *NT Integrated Justice Information System* (*IJIS*) dataset was used to identify young people (a) Charged with an offence and/or (b) Sentenced to detention following a court appearance for an offence from 10 to 16 years of age, inclusive (data only available until April 2019). The *NT Integrated Offender Management System* (*IOMS*) dataset was used to identify young people under youth justice supervision from 10 to 16 years of age, inclusive (data only available until April 2019). This includes young people under remand, serving a community corrections supervision order, or a custodial order in a detention facility.

Socio-demographic characteristics were used as covariates to the latent class analysis to determine the extent to which different population groups were associated with different latent classes.

Sex, Indigenous status, and residence at age 10 were obtained from records in the *NT Government School Student Information dataset*. Place of birth was established by attempting to link all individuals in the study cohort to records of birth in the *NT Perinatal Trends dataset*, drawn from the NT Perinatal Register, a statutory collection of information about all births in the NT. Individuals with a record of birth in the *NT Perinatal Trends dataset* were recognised as NT-born and those without were defined as born interstate/overseas.

2.3 | Analysis

Three analyses were conducted to meet each of the three aims of this study. Firstly, latent class analysis (LCA) was used to derive groups or classes of young people (referred to as 'classes' or 'latent classes') who share patterns of multisystem involvement. LCA models use associations between a set of empirically observed indicators to measure an unobserved or latent variable. In this study we are using involvement with education, health, and child protection, and youth justice systems as described above as the indicators to identify unobserved groups or latent classes in the adolescent population of the NT. Correlations between all indicators were first examined to identify highly correlated variables that may impact the modelling process (see Table S2 for full correlation matrix). Eight latent class models were developed, each designed to test how well the data potentially described one to eight classes or groups of multisystem involvement. Each of these models were developed using a maximum likelihood estimator with robust standard errors and a large number of random starts (500) to better ensure global maxima and avoid local solutions. For each model, the following statistics were obtained (using Mplus output options) to aid with selection of the best fitting solution: log likelihood (LL), Bayesian Information Criteria (BIC), Akaike Information Criteria (AIC), Sample-size-adjusted BIC (SABIC), Voung-Lo–Mendell Rubin adjusted likelihood ratio test (VLMR-LRT), Entropy, and Bootstrap Likelihood Ratio Test (BLRT) and entropy. The following fit statistics were calculated manually using information from Mplus outputs that were also used to aid with model selection: Approximate Weight of Evidence (AWE) (Banfield and Raferty, 1993), Bayes Factors (BF) (Wagenmakers 2007), Approximate Correct Model Probability (cMP) (Schwarz 1978). Although these statistics suggested an eight-class solution optimally fit the data (see Table S3), the three-class solution was selected for this study for the following reasons: (a) the fit statistics for the three-class solution were all in acceptable ranges; (b) a plot of SABIC values for each model (see Figure S1) indicated model fit did not substantially improve after the three class solution, and; (c) the interpretability of the three-class solution was found to be optimal in terms of separability and coherence (Collins and Lanza 2010, pp. 29–34). Latent class membership for each individual was defined as the most likely class determined by the highest predicted probability of membership estimated from the selected latent class model (Asparouhov and Muthén 2014).

A regression analysis was undertaken after the final model was selected to determine demographic differences in latent class membership. In this analysis, demographic characteristics were included as covariates using the 3-step approach (Asparouhov and Muthén 2014; Vermunt 2010) to determine if they were associated with latent class membership. Adjusted Odds Ratios (aOR) were used to express the association between demographic characteristics and membership of latent classes.

The third component of the analysis determined the proportion of total service use across each group. This analysis involved calculating the proportion of service events in the hospital, child protection, and youth justice systems by latent class membership.

Data management and descriptive analyses were conducted using Stata for Windows, Version 17. Latent class analysis was conducted using Mplus Version 8.8.

2.4 | Ethical Approval and Aboriginal Oversight

The study was approved by the NHMRC-registered Human Research Ethics Committee of the NT Department of Health and the Menzies School of Health Research (EC00153), including review and approval by the Aboriginal sub-ethics committee (HREC-2018-3261). The need for informed consent was waived by the NT Department of Health and the Menzies School of Health Research Human Research Ethics Committee because the study used de-identified data from administrative, statutory and service delivery data sources and the retrospective nature of the study. The study design and protocol, initial findings and implications were reviewed and endorsed by the CYDRP First Nations Advisory Group, which includes independent Aboriginal community members.

3 | Results

3.1 | Characteristics of Study Cohort

A total of 3285 children aged 10 years were found with a record of enrolment in NT government schools in the year 2011 (Figure 1). After applying exclusion criteria, the study cohort consisted of 2584 young people, with similar proportions of Aboriginal (52.6%) and non-Aboriginal children (47.4%). The demographic characteristics and levels of multisystem involvement are presented in Table 2 for the study cohort overall and by Indigenous status.

3.2 | Groups of Young People According to Patterns of System Involvement

The conditional probabilities for each indicator in our chosen three-class solution are illustrated in Figure 2. Highly correlated variables were retained for their explanatory value after sensitivity analyses determined their inclusion did not affect model convergence or alter the magnitude and pattern of estimated probabilities of latent class membership (see results for restricted model in Table S4).

Group 1, 'high level of multisystem involvement and educational risk' (19.6% of cohort), consisted of young people with the highest probability of any group to have a record of emergency department presentation, all levels of child protection contacts, all

TABLE 2 | Demographic characteristics and levels of multisystem involvement between 10 and 17 years of age (unless otherwise noted) for the study cohort overall and by Indigenous status.

	Aboriginal		Non-Aboriginal		Total	
	n	Col %	*n*	Col %	*n*	Col %
Total	1358	100.0%	1226	100.0%	2584	100.0%
Sex						
Female	576	42.4%	595	48.5%	1171	45.3%
Male	782	57.6%	631	51.5%	1413	54.7%
Birthplace						
NT	1180	86.9%	699	57.0%	1879	72.7%
Interstate/overseas	178	13.1%	527	43.0%	705	27.3%
Residence at age 10						
Urban	346	25.5%	1171	95.5%	1517	58.7%
Remote	n.p.	n.p.	n.p.	n.p.	913	35.3%
Both urban and remote	n.p.	n.p.	n.p.	n.p.	154	6.0%
Education						
School attendance at age 10						
80%–100%	464	34.3%	1137	92.9%	1601	62.1%
50%–79%	n.p.	n.p.	n.p.	n.p.	594	23.1%
< 50%	n.p.	n.p.	n.p.	n.p.	382	14.8%
NAPLAN Year 7 reading						
At/Above NMS	292	21.5%	969	79.0%	1261	48.8%
Below NMS	503	37.0%	87	7.1%	590	22.8%
Not participating	311	22.9%	36	2.9%	347	13.4%
Not found in NT NAPLAN data	252	18.6%	134	10.9%	386	14.9%
NAPLAN Year 9 reading						
At/Above NMS	167	12.3%	846	69.0%	1013	39.2%
Below NMS	376	27.7%	60	4.9%	436	16.9%
Not participating	403	29.7%	62	5.1%	465	18.0%
Not found in NT NAPLAN data	412	30.3%	258	21.0%	670	25.9%
Health						
Mental health service event						
No	1180	86.9%	1090	88.9%	2270	87.8%
Yes	178	13.1%	136	11.1%	314	12.2%
ED presentation						
No	452	33.3%	442	36.1%	894	34.6%
Yes	906	66.7%	784	63.9%	1690	65.4%
Any hospitalisation						
No	643	47.3%	908	74.1%	1551	60.0%
Yes	715	52.7%	318	25.9%	1033	40.0%

(Continues)

TABLE 2 | (Continued)

	Aboriginal		Non-Aboriginal		Total	
	n	**Col %**	***n***	**Col %**	***n***	**Col %**
Mental health-related hospitalisation						
No	1265	93.2%	1187	96.8%	2452	94.9%
Yes	93	6.8%	39	3.2%	132	5.1%
Assault-related hospitalisation						
No	1344	99.0%	1211	98.8%	2555	98.9%
Yes	14	1.0%	15	1.2%	29	1.1%
Self-harm-related hospitalisation						
No	n.p.	n.p.	n.p.	n.p.	2524	97.7%
Yes	n.p.	n.p.	n.p.	n.p.	60	2.3%
Child protection						
Notification						
No	460	33.9%	958	78.1%	1418	54.9%
Yes	898	66.1%	268	21.9%	1166	45.1%
Substantiation						
No	1106	81.4%	1188	96.9%	2294	88.8%
Yes	252	18.6%	38	3.1%	290	11.2%
OOHC placement						
No	n.p.	n.p.	n.p.	n.p.	2534	98.1%
Yes	n.p.	n.p.	n.p.	n.p.	50	1.9%
Police report of DV exposure (age 14–17)						
No	762	56.1%	1035	84.4%	1797	69.5%
Yes	596	43.9%	191	15.6%	787	30.5%
Youth justice						
Police contact for criminal incident (age 14–17)						
No	879	64.7%	1137	92.7%	2016	78.0%
Yes	479	35.3%	89	7.3%	568	22.0%
Charged with an offence (age 10–13)						
No	n.p.	n.p.	n.p.	n.p.	2465	95.4%
Yes	n.p.	n.p.	n.p.	n.p.	119	4.6%
Youth justice supervision (age 10–16)						
No	n.p.	n.p.	n.p.	n.p.	2518	97.4%
Yes	n.p.	n.p.	n.p.	n.p.	66	2.6%
Detention order (age 10–16)						
No	n.p.	n.p.	n.p.	n.p.	2469	95.5%
Yes	n.p.	n.p.	n.p.	n.p.	115	4.5%

Note: n.p, results not presented to avoid reporting cell counts < 10.

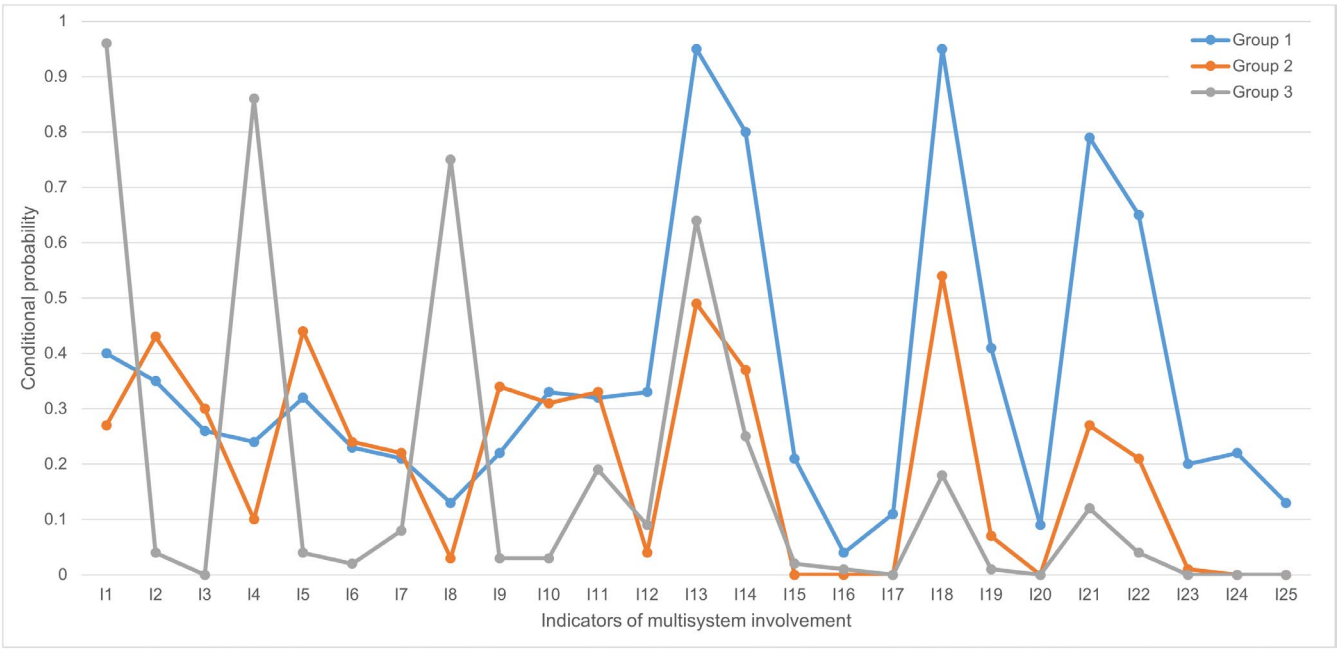

FIGURE 2 | Conditional probability for each indicator (see Table 1) of multisystem involvement in adolescence by latent class.

levels of youth justice contacts, mental health service utilisation, and serious hospitalisation from 10 to 17 years of age, inclusive (see Figure 2 and Table S4). This group of young people is also characterised by high educational risk: they have a 60% probability of attending less than 80% of school days in 2011 and just over 40% and 60% probability of not participating in or having a record of Year 7 and Year 9 NAPLAN test results, respectively.

Group 2 has been labelled the 'moderate level of multisystem involvement and high educational risk' (32.5% of cohort) group. The most prominent features of this group are ED presentations, hospital admissions, child protection notifications, and police reports of exposure to DV/FV and incidents of crime. This group of young people is also characterised by high levels of educational risk: they have the highest probability of any group of attending less than 80% of school days in 2011 and not participating in or having a record of Year 7 and Year 9 NAPLAN test results (see Figure 2 and Table S4). Group 2 had the second highest probability after Group 1 of hospital admission, child protection notification, police report of exposure to DV/FV, and having a police report for an alleged crime incident. Also notable is the low probability of higher levels of dual-system involvement, such as substantiated child protection reports, placements in OOHC, being charged and/or sentenced with a criminal offence and being under youth justice supervision.

Group 3 is referred to as the 'low level of multisystem involvement and low educational risk' (47.9% of cohort) group of young people. This group comprises the class with the largest membership and was characterised by having the highest probability of greater than 80% school attendance in 2011, highest NAPLAN participation rates and highest NAPLAN scores at Year 7 and Year 9, and relatively low probability of contact with child protection and youth justice systems. Whilst this group had the second highest probability of presentation to ED, it also had the lowest level of hospital admission of any group. Although having an 18% probability of a child protection report, Group 3 had almost no probability of higher levels of child protection involvement. Youth justice involvement was mostly limited to the relatively low probability of appearing in police records of exposure to DF/FV and crime incidents, with almost no probability of higher levels of youth justice involvement. Notably there is an increasing probability of young people in Group 3 not being found in NAPLAN records between Year 7 (8%) and 9 (19%). Given that students normally participated in Year 9 NAPLAN test at age 14 or 15, it could be hypothesized that there were two different groups of young people in Group 3 without Year 9 NAPLAN records in the NT: young people who remained in the NT but were not attending school; and young people who moved interstate without this being reflected in NT government school enrolment data. Most of the young people without Year 9 NAPLAN had a record of school attendance of 80% or greater at age 10 and it is therefore expected that most belonged to the group who moved interstate.

3.3 | Demographic Differences in Latent Class Membership

Young people had greater odds of being Aboriginal in Groups 1 (OR: 21.51; 95% CI: 15.65–29.57) and 2 (OR: 33.84; 95% CI: 18.26–62.72) compared to Group 3. Compared to Group 3, males had greater odds of membership in Group 1 (OR: 1.50; 95% CI: 1.11–2.03) and there was no strong evidence of any sex differences in the membership of Group 2 compared to Group 3. Remote residence at age 10 was also more strongly associated with membership in Groups 1 (OR: 4.10; 95% CI: 3.00–5.61) and 2 (OR: 21.78; 95% CI: 14.71–32.23) compared to Group 3. Young people in Groups 1 (OR: 14.57; 95% CI: 8.05–26.38) and 2 (OR: 23.38; 95% CI: 12.15–45.01) also had much higher odds of having both urban and remote residence across the school year at age 10 compared to Group 3. Young people in Group 1 also had lower

TABLE 3 | Distribution of demographic characteristics across latent classes and their association (aOR) with Groups 1 and 2 compared to Group 3.

	Group 1			Group 2			Group 3
	Col %	aOR	95% CI	Col %	aOR	95% CI	Col %
Indigenous status							
Non-Aboriginal	14.6	1		11.4	1		85.4
Aboriginal	85.4	33.84***	(16.23–70.58)	88.6	21.514***	(14.73–31.43)	14.6
Sex							
Female	38.5	1		43.9	1		49.1
Male	61.5	1.10*	(0.74–1.63)	56.1	1.502	(1.05–2.15)	50.9
Birthplace							
NT-born	87.2	1		81.7	1		60.7
Interstate/overseas	12.8	1.34	(0.80–2.27)	18.3	0.656	(0.41–1.04)	39.3
Residence at age 10							
Urban	40.4	1	—	20.6	1		92.1
Remote	44.8	21.78***	(13.65–34.75)	71	4.101***	(2.83–5.95)	7.3
Urban & Remote	14.8	23.38***	(10.71–51.02)	8.5	14.57***	(7.18–29.55)	0.6

*$p < 0.05$.
***$p < 0.001$.

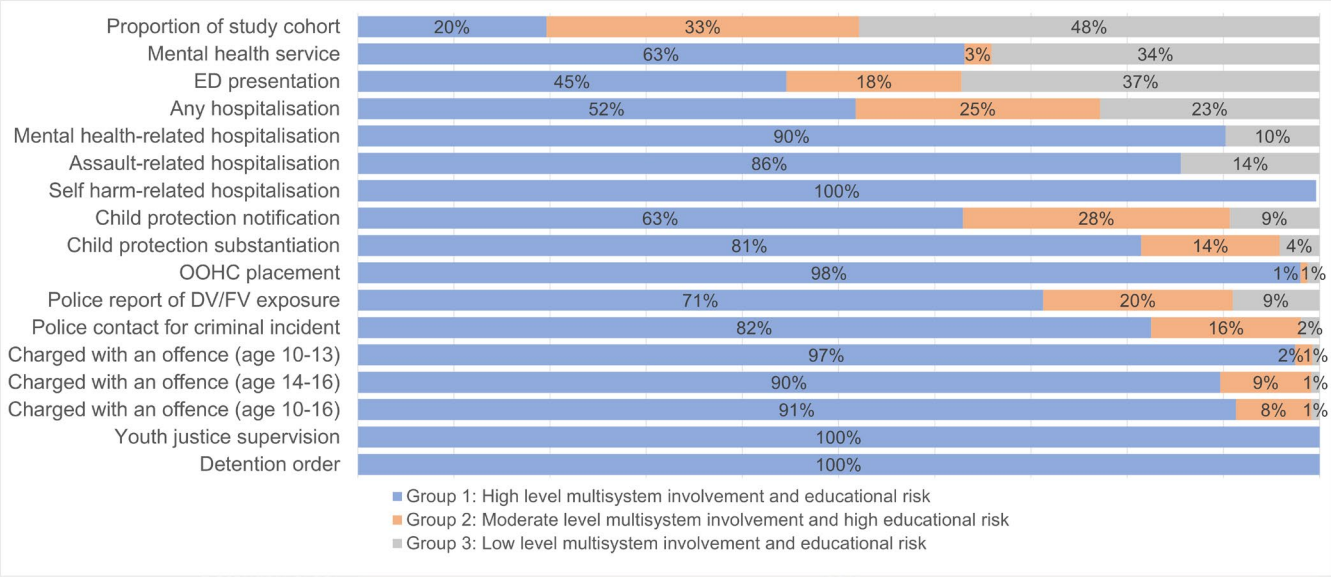

FIGURE 3 | Level of service use by individuals in each latent class expressed as a proportion of total service events across health, child protection, and youth justice systems.

odds (OR: 0.66; 95% CI: 0.45–0.96) of being born interstate/overseas compared to Group 3. Table 3 shows the distribution of demographic characteristics and their association with each latent class.

3.4 | Level of Service Use From 10 to 17 Years of Age, Inclusive, by Group Membership

Figure 3 illustrates the proportion of the overall number of service events in the health, child protection, and youth justice systems by each group (see Table S6 and Figure S2 for person counts). Although Group 1 comprised almost one-fifth of the study cohort, it accounted for the highest level of health, child protection, and youth justice service use of any group.

In the health system, Group 1 accounted for almost half of ED presentations and most hospital admissions in the study cohort. Notably, they comprised almost all of the serious hospitalisations (i.e., mental-health, self-harm and assault-related hospitalisations) in the study cohort and almost two-thirds of ambulatory mental health service events. Group 2

had relatively lower levels of mental health service and ED use compared to Groups 1 and 3. But Groups 2 and 3 had similar levels of hospital admissions.

In the child protection system, Group 1 accounted for most events, especially at the highest level of involvement where almost all OOHC episodes in the child protection system involved young people from Group 1. Young people in Group 2 made up the next largest proportion of child protection service events, followed by Group 3.

Group 1 accounted for a substantial proportion of youth justice events in the study cohort, with all events at the highest levels of contact (i.e., sentenced to detention and youth justice supervision) being recorded by young people in this group. The young people in Group 2 had the highest levels of the youth justice events albeit with lower levels of the system, with young people in Group 3 having very little contact with the youth justice system at all.

4 | Discussion

This study expands the research on multisystem-involved young people by differentiating between levels of involvement across systems and including measures of educational participation and achievement. It is also one of a small number of studies to explore differences according to Indigenous status. The results fill a critically important gap in the evidence base to inform service planning and delivery for young people and their families in the NT. The findings especially point to the needs of those young people in Groups 1 and 2 who have high and moderate levels of multisystem involvement, respectively, and high levels of educational risk. These two groups use the most services and are most vulnerable to poorer outcomes compared to young people in Group 3 who display characteristics of service involvement associated with more optimal developmental trajectories through adolescence (Black et al. 2017). More importantly, the demographic characteristics associated with each latent class point to a social gradient of risk and vulnerability requiring particular attention.

The lower probability of mental health service use, serious hospitalisations, child protection, or youth justice involvement that characterises Group 3 would appear to signify a common pattern of development for most urban adolescents in the NT. Despite the low risk of serious mental or physical ill-health indicated by the latent class analysis, Group 3 made relatively heavier use of mental health and emergency department services. This may reflect how adolescence is typically the time of psychological and emotional development when most mental health issues and some risky behaviours emerge (Patton et al. 2016). It likely also reflects that this predominantly urban group has better access to and makes use of services able to provide needed care and support. A higher probability of regular school attendance and NAPLAN results at or above the NMS suggest these issues are not having a substantial impact overall on this group, and it is likely their needs are largely being met by their families, support networks and available services. Notably, almost one-fifth of young people in Group 3 were likely to have moved interstate after a period of time in the NT, suggestive of a group marked by higher levels of social mobility compared to young people in Groups 1 and 2.

By contrast, young people in Group 1 were observed with high levels of educational risk and had the greatest probability of requiring the highest level of involvement with the youth justice, child protection and health service systems. Although comprising one-fifth of the study cohort, Group 1 had the greatest level of service use of any group, comprising almost all of the episodes at the highest level of the child protection system (i.e., OOHC) and all of the episodes recorded at the highest level of youth justice involvement (i.e., sentenced to detention and/or under youth justice supervision). Taken together, these patterns of service involvement reflect family and living circumstances of high stress and significant adversity (indicated by DV/FV exposures and child protection involvements) underpinning high levels of harmful behaviours towards self and others (indicated by self-harm and antisocial/criminal behaviour associated with youth justice involvements) and unmet mental health needs (indicated by self-harm, mental health service use and mental health-related hospitalisations). Moreover, the associated demographic characteristics point to high-risk population groups that typically have limited access to appropriate services—young Aboriginal people, especially males and those living in remote areas. Given the high level of service use observed for Group 1, the findings from this study raise questions about the efficiency and effectiveness of these service systems in addressing the needs and improving outcomes for this most vulnerable group of young people (Ellem et al. 2019).

Much like Group 1, the young people of Group 2 had high levels of educational risk and were involved with multiple systems, but at lower levels by comparison—they had low to no probability of serious hospitalisations, substantiated reports of maltreatment, OOHC placement, DV/FV exposure, and being sentenced to or having served a period of detention for a crime. However, the relatively high probability of police reports of DV/FV exposure and child protection notifications suggests the presence of some level of stress, adversity and/or unmet needs, but not to the extent that met the threshold of statutory intervention by the child protection system and enforcement by police and the judicial system. Whilst Group 2 do not feature as prominently as Group 1 in some of the indicators of individual-level adversity, such as serious hospitalisations and mental health service use, they have been observed with a relatively higher probability of police reports of exposure to DV/FV and crime compared to Group 3. Furthermore, based on the associated demographic characteristics (identifying as Aboriginal and remote residence), the higher probability of ED presentation and inpatient admission may not only point to the potentially poorer physical health of this group (Zhao et al. 2004) but it may be a consequence of this group's poorer access to high quality, well-resourced, and culturally safe primary healthcare where they live (Zhao et al. 2013). Overall, the findings for Group 2 point to potential gaps in services and their delivery for issues that are below statutory or clinical thresholds for intervention, but that may have adverse impacts on young people if neglected.

4.1 | Policy and Practice Implications

4.1.1 | Improving Information-Sharing to Support Multi-Agency Collaboration

The importance of multi-agency collaboration has been emphasised in numerous inquiries and literature relating to child and youth services (Brennen et al. 2019; Vidal et al. 2019). This can be supported by improved information-sharing between agencies, which was recommended by the NT Royal Commission into the dual-system involvement of young people (Royal Commission and Board of Inquiry into the Protection and Detention of Children in the Northern Territory 2017). However, legal regulations, differing capacities of agencies and a lack of alignment in operational goals between agencies have limited information-sharing and have been implicated as impediments to effective multiagency collaboration (Ross 2009; Vidal et al. 2019). Among services for children, data systems are often isolated and cannot be viewed in real-time. However, the findings presented here clearly illustrate the extent to which a small group of young people with high levels of multisystem involvement have high levels of service use in the study cohort. It is, therefore, important for policymakers to consider an integrated data-platform that combines information across agencies to enhance planning and delivery of services by identifying the extent of 'common clients' and overlapping service utilisation. It is possible that many of the activities of different agencies overlap, so that the frequent service use observed in the higher risk groups may reflect duplication and the need for better coordination across common activities, such as screening and assessment, case management, and the offering of developmentally appropriate social supports (Vidal et al. 2019). It may also reflect contradictory service delivery, where different philosophies and goals between agencies may lead to the provision of services that may reflect different, even conflicting perceptions of the developmental goals of the young people they serve (Vidal et al. 2019). It is important that information with diagnostic value be shared between agencies within a framework of common goals and aims for improving the outcomes of young people to better ensure the proper coordination of services through earlier referrals for intervention and support. Therefore, it is important that overarching legal and governance frameworks and individual agency policies regarding privacy and information sharing be reviewed to ensure that any expansion of data sharing is both informative and preserves the privacy of individuals involved.

4.1.2 | Identifying Shared Priorities—School Engagement, Strengthening Families and Unmet Mental Health Needs

A framework of common priorities and goals is not only required to improve information-sharing, but to inform effective and appropriate multiagency collaboration during adolescence. Two groups of young people in this study (Groups 1 and 2) were observed with similar patterns of multisystem involvement indicative of consistency with evidence on dual-system young people from other jurisdictions with similar demographic profiles and who share common underlying adversities and complex unmet needs (White et al. 2024). Addressing family dysfunction (indicated by child protection involvement and police reports of exposure to DV/FV), low school engagement, and unmet mental health needs could be three critical aspects for a shared response to improve outcomes for these groups of young people who make up most of the service use in this study. Providing training in culturally relevant trauma-informed practice relevant to different child- and family-serving systems is an important first step to improving the recognition of issues facing the most vulnerable young people and their families (Ko et al. 2008) and to ensuring a common language and framework needed for safe and effective practice and collaboration that also minimises the risk of re-traumatisation common to many of these systems (Donisch et al. 2016). Multidisciplinary child and adolescent mental health teams have demonstrated effectiveness in primary mental healthcare and across schools (McGorry et al. 2022). However, the more serious mental health and behavioural concerns observed in the most vulnerable groups in this study illustrate the need for more targeted approaches, such as specialist multi-disciplinary teams offering culturally responsive and intensive management and support of complex mental health and other issues across different service systems (Assan et al. 2008).

Our study has also highlighted the issue of high educational risk among the two most vulnerable groups of young people. In recent years, policy agendas have typically focused efforts on the contribution of attendance and early literacy and numeracy to academic outcomes in the early years and longer term. However, disengagement has increased despite substantial investments in school truancy programmes and policies of income management that link family welfare payments to school attendance (Guenther et al. 2022; Prout Quicke and Biddle 2017). The assumption underpinning these programmes and policies has overlooked the distinct characteristics of the NT and the complexity of remote school education in which poor school engagement is a consequence of a combination of factors rather than a single dominant factor (Guenther et al. 2022; Prout Quicke and Biddle 2017). To improve school engagement, it is important to consider a range of issues including stability of teaching staff (Hall 2012), student safety at school (Jadambaa et al. 2019) and cultural safety including the role of bilingual education (Devlin 2011) in addition to broader responses to socio-demographic and early life health factors that affect school engagement (He et al. 2018; He, Nutton, et al. 2021; Robinson and Tyler 2020; Roper et al. 2023). Doing so would also increase the opportunities to intervene early with young Aboriginal people through trauma-informed, culturally tailored social and emotional learning programmes (Robinson et al. 2020) that seek to proactively identify and address psychosocial issues that negatively impact education, health, and social outcomes.

4.1.3 | The Need for a Life Course Perspective on Early Intervention and Prevention

An ecological approach to prevention and intervention that recognises the role of social determinants would appear to be warranted given the range of individual (e.g., mental health issues, self-harm), family (e.g., DV/FV, maltreatment) and community and societal influences (e.g., demographic differences) evident in the patterns of system involvement in the two most vulnerable groups of young people identified in this study. However,

the complexity and challenges of addressing issues in adolescence that are likely to have emerged in earlier years have been well documented and so it is also necessary to ensure that a life course perspective is acknowledged (Tomlinson et al. 2021). For example, whilst this study has highlighted the shared patterns of child protection involvement and self-harm in adolescence, there is also strong evidence that the cumulative effects of child protection involvement in both early and middle childhood are associated with the highest risk of self-harm in adolescence (Leckning et al. 2021). Put simply, what this study has observed as the co-presence of multiple issues in adolescence, such as shared patterns of child protection involvement and self-harm in Group 1, may well be the cumulative effects of adversity from childhood. Delays between the recognition of the impact of stress and adversity on developmental needs and access to therapeutic or supportive services to address their potential consequences are common—a study of Western Australia children found that exposure to DV/FV at age 6 was often not accompanied by mental health supports until age 12 (Orr et al. 2022). It is very likely the patterns of service involvement within Groups 1 and 2 in our study are indicative of a similar trajectory of poor outcomes among dual system young people with complex needs—poor or delayed preventive responses to early signs of risk and vulnerability leading to high levels of intervention for acute and potentially chronic issues in adolescence coupled with low levels of school engagement (Baidawi and Sheehan 2019). The findings from this study highlight the need to further investigate and address any gaps in the provision of assertive, therapeutic, trauma-informed follow-up in response to harm or, more importantly, potential harm associated with adverse experiences throughout childhood (Baidawi and Sheehan 2019). Research to inform the proper targeting of early intervention approaches across the life course in health, education, and social service systems would not only help to find ways to reduce levels of service use on systems currently overwhelmed by preventable issues in adolescence but, more importantly, could help to improve the outcomes and trajectories for these children. This would especially be the case for young Aboriginal people from remote settings, who were found to be associated with higher odds of membership in Groups 1 and 2, where such services are known to be absent or poorly resourced.

4.2 | Strengths and Limitations

Our study has several limitations. Firstly, our study cohort is limited to government school students. While this covers more than 70% of all NT children, the future addition of non-government school data will provide more complete records of the population and refine our understanding of all groups of children in the education systems. A second limitation is that this study has excluded one-fifth of NT government school students enrolled in age 10 who moved interstate either permanently or to attend interstate schools. A third limitation is that while the datasets used in this study provide diverse information across key services, there are services for which information is not available. For example, information on primary healthcare service use that are relevant to this study is currently not available for linkage. A fourth limitation of our study is its generalisability. The demographic makeup of the NT is unique in the Australian context (see Table 2) and readers should exercise caution in applying the findings to other jurisdictions and populations. Every effort has been made to provide sufficient information about the NT context to aid with and support the interpretation of the results from this study that will allow for some comparison to other jurisdictions and populations.

5 | Conclusions

This study has explored patterns of service use in adolescence to uncover groups of young people with distinct levels of multisystem involvement indicative of different domains of risk and vulnerability. It has highlighted two groups of young people with similar profiles of multisystem involvement—one with much higher and intensive levels of involvement than the other, but both with high levels of educational risk—that make up the majority of health, child protection and youth justice services provided to young people in the NT. The association of these groups with young Aboriginal people, especially those from remote areas, points to the importance of culturally relevant and/or Aboriginal-led services to meet their needs. The high levels of vulnerability and adversity indicated by the patterns of service use by these two groups provides support for development of a 'multisystem trauma-informed approach' to not only address gaps in service delivery, but to ensure that services are designed to identify and address unmet needs. This approach has the greatest potential to improve outcomes for young people by improving the effectiveness and efficiency of the service systems they rely on for support, care, and intervention. Gains from these kinds of system improvements could then be channelled into important complementary efforts that properly identify and target opportunities for early intervention to further reduce the impact on services and improve outcomes in adolescence. Further research is, therefore, needed into the childhood antecedents of the profiles of multisystem involvement in young people established by this study to inform improved preventive responses in the early years.

Author Contributions

Vincent Y. F. He: conceptualization, methodology, data curation, formal analysis, visualization, writing – original draft, writing – review and editing. **Bernard Leckning:** conceptualization, methodology, writing – original draft, writing – review and editing, formal analysis, visualization. **Tamika Williams:** writing – review and editing. **Gary Robinson:** writing – review and editing. **Steven Guthridge:** conceptualization, methodology, writing – review and editing, supervision, project administration.

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Conflicts of Interest

Vincent He is currently an employee of the Northern Territory Government. His involvement in this study predates that employment, and the views contained herein do not reflect those of the Northern Territory Government. He initiated and completed work on the study during his employment at the Menzies School of Health Research until 14 April 2023; subsequently, he began his employment with the Northern Territory Government on 2 May 2023. All other authors declare no conflicts of interest.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.