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Keeping children healthy at summer camp: A study of medications administered in the camp setting

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ABSTRACT

Summer campers often require access to medications. However, little is known about the types of medications administered in camps. We used a data set from a camp-specific electronic records system that contained all campers' medications. We developed a coding book and classified medications based on drug type, mechanism, and indication. Data were available on 163,853 medications from 75,072 campers. Health care providers need to be aware of the vast quantity and wide spectrum of medications dispensed in summer camps and should find opportunities to advocate for the adoption of best-practice safety guidelines to ensure the safety and well-being of campers.

Background

Over fourteen million children, accounting for one in five school-aged children, attend summer camps annually in the United States (U.S.) (Kaufman, Holland, Weinberg, & Rosenbloom, 2016). With an estimated 20–30% of school-aged children in the U.S. requiring a daily prescription medication and ~10% requiring two or more prescription medications daily, a substantial number of children may need access to their medications at summer camps for maintenance of their chronic medical, behavioral or mental health disorders (Hales, Kit, Gu, & Ogden, 2018; Martin, Hales, Gu, & Ogden, 2019; Qato, Alexander, Guadamuz, & Lindau, 2018). Across the U.S., the prevalence of chronic medication usage among the pediatric population has continued to increase for certain categories of medications (e.g., asthma medications, behavioral health disorder medications) (Hales et al., 2018). Prior research studies have also demonstrated that parents and caregivers exhibit significant anxiety associated with their campers' medical needs, with one of the most frequent

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questions posed to camp staff centered on medication administration (Garst, Gagnon, Olsen, & Owens, 2020). The American Camp Association (ACA) has designated camper health and safety as the number one emerging issue facing camp providers, including prioritizing medication safety and mental, emotional, and social health (MESH) (2017ACA Camp Emerging Issues Survey Summary Report, 2017).

A substantial proportion of summer camps care for children with chronic medical conditions, including children with food allergies (83% of camps), asthma (66% of camps), and diabetes mellitus (58% of camps), many of whom may require emergency rescue medications for their medical condition (Chang et al., 2017). The use of epinephrine, for example, appears to be common at summer camps settings, with a study of food allergic events in summer camps finding that within a two-year period, almost a quarter of camp leadership reported that a camper had received epinephrine to treat anaphylaxis (Schellpfeffer, Leo, Ambrose, & Hashikawa, 2020). As such, providing campers with safe access to prescription and over-the-counter medications is critical to ensure that they not only receive ongoing treatment for both acute and chronic diseases but have emergency rescue medications available for life-threatening conditions such as anaphylaxis or epilepsy (“ACA Facts and Trends,”). However, studies on the epidemiology of prescription and over-the-counter medications at summer camps have not been available nationally because of the lack of basic medication usage data. More recently, however, the widespread availability and adoption of camp-specific, web-based electronic health record (EHR) systems by summer camps allow camp leadership to capture camper health and medication information, including national data on summer campers’ medication usage. Our study objective was to understand the epidemiology of summer campers’ prescription and over-the-counter medication usage at summer camps by leveraging a summer camp-specific EHR dataset of a cohort of U.S. summer camps to review and categorize all camp medications administered over a one-year period. By studying the quantity and variability of camp medications, we seek to call attention to the importance of summer camps creating and following medication administration policies based on national best practices.

Methods

We partnered with CampDoc.com (DocNetwork LLC, Ann Arbor, MI), an EHR system designed specifically for summer camp providers to manage campers’ medical history, medications, and illness or injury reports. Use of the CampDoc.com network for surveys and de-identified EHR data is well established in the literature (Bunke et al., 2021; Chang et al., 2017; Garst et al., 2021; Kolberg et al., 2020; Schellpfeffer, Leo, Ambrose, & Hashikawa, 2017; Schellpfeffer et al., 2020). We used available de-identified data input by

caregivers or camp health care providers for the 2019 calendar year (January 1 to December 31) from a cohort of 870 U.S. camps. Medication name, route, dose, timing, and indication for administration were included in the de-identified data set. Data on campers between five to seventeen years-of-age were analyzed. Campers could have more than one medication entry. Medication entries for employees (i.e., camp staff) were excluded from all analyses as these data were beyond the scope of the current study. A medication coding book (Table 1) was developed with a pediatric pharmacist to outline a strategy for appropriately classifying medications into broad systemic categories (primary categories) and then further categorized based on the mechanism of action or indication (subcategories). Three research assistants abstracted and coded all data in Excel, (Microsoft Corporation, 2020) with each assistant responsible for coding approximately one-third of the entire data set. The lead author subsequently checked and reviewed all coded entries and uncertainties were further evaluated by a pediatric










Table 1. Medication Coding Book.

Medication Coding Book	
Primary Categories	Subcategories
Antimicrobial Agents	Antibiotics, Antifungals, Antiparasitics, Antiretrovirals, Antivirals, Topical Antimicrobial Agents
Antihistamines and Allergy Agents	
Antineoplastic agents	Chemo-Protective Agents
Biologics	
Cardiovascular	Antiarrhythmic Agents, Antihyperlipidemic Therapies, Blood Pressure Agents
Cough and Cold	
Dermatologic	Antiacne Agents, Eczema Treatment, Rash Treatment, Topical Steroids
Emergency And Rescue Agents	Adrenal Insufficiency Rescue, Anaphylaxis Rescue Agents, Asthma Rescue Inhalers, Hypoglycemia Rescue Agents, Status Epilepticus Rescue
Endocrine and Hormonal Therapies	Antidiabetic Agents, Contraception, Hormone Replacement, Systemic Steroids, Thyroid Agents
ENT Therapies	
GI Agents	Anti-diarrheal Agents, Antiemetic Agents, Constipation, Inflammatory Bowel Disease, Motility Agents, Reflux Agents
Heme Agents and Factor Products	Anticoagulant and Antiplatelet, Factor Products, Sickle Cell Agents
Herbal/supplements/ Vitamins	
Immunosuppressants	
Muskuloskeletal	Gout Agents
Non-Emergent Neurologic Agents	Antiepileptic Drugs, Antimigraine
Ophthalmologic	Glaucoma Agents
Oral Preps and Mouthwashes	
Pain and Spasticity	Cannabidiol Products, Prescription Pain Medications
Pain OTC	
Psychotropic Agents	Antidepressants, Antipsychotics, Anxiolytics, Attention Deficit Hyperactivity Disorder Agents, Bipolar Disorder Medications
Renal Agents	Diuretics
Respiratory	Asthma Controllers, Cystic Fibrosis Agents
Sleep Agents	Insomnia, Narcolepsy
Unknown/ Other	
Urologic	Anti-Enuresis/ Incontinence Agents

pharmacist (as an independent auditor) to determine appropriate coding (Akkerman, Admiraal, Brekelmans, & Oost, 2008). Data were analyzed using descriptive statistics with SAS OnDemand for Academics software (SAS Institute, 2021). Statistical methods included determination of averages, standard deviations, and frequencies of occurrences with the primary goal of describing the themes of the dataset. Our study was deemed exempt by the medical school institutional review board.

Results

Data were available from 75,072 campers encompassing 163,853 medications from 870 camps, with camps represented from all U.S. census geographic regions including: Northeast (31%), Midwest (23%), South (24%), and West (21%) (Figure 1). Average camper age was 12.43 years with a standard deviation of 2.74 years. Gender distribution was Male ($n = 68,297$; 42.69%), Female ($n = 91,678$; 57.30%), Other Gender Identity ($n = 17$; 0.01%), and 3,860 entries had no gender listed. An average of 188 medication entries were reported per summer camp. Medications were administered in

		(N=870 CAMPS)		
NORTHEAST (31%)		NEW ENGLAND (16%)		MIDDLE ATLANTIC (14.5%)
		EAST NORTH CENTRAL (17%)		WEST NORTH CENTRAL (6%)
MIDWEST (23%)		SOUTH ATLANTIC (15%)		EAST SOUTH CENTRAL (3%)
		WEST SOUTH CENTRAL (6%)		
SOUTH (24%)		MOUNTAIN (9.5%)		PACIFIC (12%)
				NOT PICTURED: CANADA/ARMY/AIRFORCE (1%)
WEST (21%)				

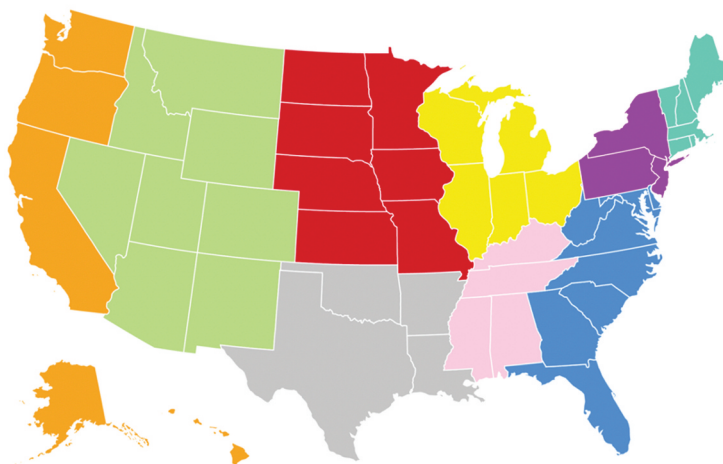


Figure 1. Distribution of camps across the United States grouped into geographical regions.

the following forms: Oral (n = 114,733; 70.02%), Inhalation (n = 20,940; 12.78%), Topical (n = 14,943; 9.12%), Injection (n = 7,467; 4.56%), and Other/Unknown (n = 5,770; 3.52%).

Medications were classified into 26 primary classifications (Table 2). Within the primary classifications, *Antihistamines/Allergy Agents* represented the highest proportion of medications at 24.14% (n = 39,560), followed by *Psychotropic Agents* at 20.46% (n = 33,521), *Emergency and Rescue Agents* at 12.05% (n = 19,740), *Herbal, Supplement and Vitamin* at 7.22% (n = 11,838), and *Respiratory* at 5.33% (n = 8,735) (Table 2). These five categories comprised nearly 70% of all camp medications. In total, 98,268 medications were further organized into 52 distinct medication subcategories (Table 2). Notable medication subcategories included the following: *Attention Deficit Hyperactivity Disorder Agents* (11.37%; n = 18,634), *Asthma Rescue* (7.85%; n = 12,860), *Anaphylaxis Rescue* (3.80%; n = 6,234), *Antiepileptic Medications (non-rescue)* (2.02%, n = 3,315), *Status Epilepticus Rescue Agents* (0.31%; n = 506), and *Prescription Pain Medications* (0.51%; n = 836). There were also a substantial number of medications for mental health, sleep, and behavioral disorders: *Anti-Depressants* (3.35%; n = 5,481), *Anxiolytics* (3.29%; n = 5,394), *Insomnia Agents* (3.18%; n = 5,204), *Anti-psychotics* (1.41%; n = 2,314), and *Bipolar Agents* (0.17%; n = 283).

Discussion

To our knowledge, our study is the first to describe the epidemiology of medications administered at summer camps across the U.S. and highlights the vast quantity and extensive variety of prescription and over-the-counter medications that need to be managed by credentialed health care providers in camps. These medications are essential to campers' well-being. Currently, medication administration and management are primarily carried out by registered nurses. However, in the camp setting, registered nurses are often also required to perform acute care roles in addition to providing medication management services, and they are roles which camps often struggle to fill.

We found that a substantial proportion of camp medications were in the *Emergency and Rescue Agents* category (12%), including epinephrine autoinjectors for anaphylaxis, abortive rescue medications for status epilepticus, and glucagon for hypoglycemic diabetic children. This finding is particularly important because summer camps often have different daytime and nighttime supervision levels compared to home and school environments, with children with complex medical needs being particularly vulnerable during transitions of care from camp to home and in emergency medical situations. A shortage of non-nurse, trained camp staff that can administer emergency and rescue

Table 2. Medication categories and subcategories.

Broad Medication Categories (n = 163,853)					
Medication Category	Frequency	Percentage (%)	Medication Category	Frequency	Percentage (%)
Antihistamine and Allergy	39,560	24.14	Urologic Agents	1,159	0.71
Psychotropic Agents	33,521	20.46	Cough and Cold	1,139	0.70
Emergency and Rescue Agents	19,740	12.05	Heme Agents and Factor Products	1,057	0.65
Herbal/ Supplement/ Vitamin	11,838	7.22	Pain OTC	920	0.56
Respiratory	8,735	5.33	Ophthalmologic	802	0.49
Pain and Spasticity	7,898	4.82	Immunosuppressants	784	0.48
GI Agents	7,746	4.73	ENT Therapies	549	0.34
Endocrine and Hormonal Therapies	6,909	4.22	Unknown/Other	411	0.25
Antimicrobial Agents	5,595	3.41	Antineoplastic Agents	252	0.15
Non-Emergency Neurologic	5,041	3.08	Biologics	191	0.12
Sleep Agents	4,256	2.60	Oral Preps and Mouthwashes	155	0.09
Dermatologic	3,475	2.12	Renal Agents	153	0.09
Cardiovascular	1,894	1.16	Musculoskeletal	73	0.04
Medication Subcategories (n = 98,268)					
Medication Category	Frequency	Percentage (%)*	Medication Category	Frequency	Percentage (%)*
Attention Deficit Hyperactivity Disorder	18,634	11.37	Topical Steroids	664	0.41
Asthma Rescue Inhalers	12,860	7.85	Rash Treatment	531	0.32
Asthma Controllers	9,200	5.61	Status Epilepticus Rescue	506	0.31
Anaphylaxis Rescue Agents	6,234	3.80	Factor Products	500	0.31
Antidepressants	5,481	3.35	Bipolar Disorder Medications	283	0.17
Anxiolytics	5,394	3.29	Sickle Cell Agents	264	0.16
Insomnia	5,204	3.18	Antivirals	229	0.14
Antiepileptic Drugs	3,315	2.02	Anticoagulant and Antiplatelet	179	0.11
Antibiotics	3,270	2.00	Inflammatory Bowel Disease	168	0.10
Constipation	2,382	1.45	Diuretics	137	0.08
Reflux Agents	2,359	1.44	Cannabidiol Products	133	0.08
Antipsychotics	2,314	1.41	Antiarrhythmic Agents	122	0.07
Contraception	2,191	1.34	Anti-diarrheal Agents	116	0.07
Topical Antimicrobial Agents	1,940	1.18	Antihyperlipidemic Therapies	116	0.07
Antimigraine	1,757	1.07	Antifungals	110	0.07
Antiemetic Agents	1,661	1.01	Hypoglycemia Rescue	101	0.06
Antidiabetic Agents	1,302	0.79	Cystic Fibrosis Agents	70	0.04
Antiacne Agents	1,276	0.78	Motility Agents	59	0.04
Thyroid Agents	1,251	0.76	Narcolepsy	46	0.03
Hormone Replacement	1,245	0.76	Antiparasitics	33	0.02
Anti-Enuresis/ Incontinence Agents	1,123	0.69	Chemo-Protective Agents	29	0.02
Blood Pressure Agents	944	0.58	Antiretrovirals	12	0.01
Eczema Treatment	859	0.52	Gout Agents	9	0.01
Prescription Pain Medications	836	0.51	Adrenal Insufficiency Rescue	8	0.005
Systemic Steroids	809	0.49	Glaucoma Agents	2	0.001

* – Percentage of total medication entries (163,853)

medications in summer camps also poses a challenge for summer camps caring for children with chronic health conditions and special medical needs who are not in their usual care environment.

Summer camps are often located far from children's hospitals or emergency medical services (Chang et al., 2017). In the emergency setting, many camps do not routinely carry stock emergency medications and are dependent on campers' and parents' preparedness to bring their required medicines to camp (Schellpfeffer et al., 2020). Additionally, many camp activities (e.g., canoeing trips or horseback rides) are remote excursions away from the central camp setting where medications are typically stored, and nurses are not as readily available to administer them. These situations potentially lead to an individual with less medical training being required to administer a dose of a medication with a specific indication and may be even more concerning if the camper's emergency rescue medication is not readily accessible or given incorrectly.

Summer camps that do not use EHRs must have a robust infrastructure established with medical personnel tasked with tracking and managing chronic and emergency medications brought from home. While many camps have protocols in place for conditions requiring urgent and emergent medications, there are often significant differences between camps and national standards, with varying degrees of execution of these plans (Chang et al., 2017; Olympia et al., 2015). A previous study asking camp leadership what plans their camps have in place found that only 47.6% of camps in the U.S. required individualized emergency action plans for campers (Schellpfeffer et al., 2020). Without requiring personalized action plans for campers, the onus subsequently falls on the camp itself to have an established plan, of which in some cases there may be no plan at all. Particularly at residential camps, registered nurses have extended roles as medical professionals guiding the majority of care for the participating children. While there are some similarities to the school registered nurse role, there is often an added component of increased distance from health care facilities as well as a full schedule (24 hours/day) as opposed to a partial day. Depending on the type of camp, there may also be a larger regimen of complex medication plans. For example, at a camp devoted to a group of patients who share a similar systemic disease or diagnosis, the camp health care providers hold a significant responsibility in the intake, storage, dispensing, and documenting of medications as well as the responsibility of responding to medication challenges (errors, adverse events, contraindications), as these patient populations are more susceptible to serious health consequences if there are mistakes. Given our study findings, primary care providers must provide timely anticipatory guidance to children and families before the summer camp season to confirm that they have adequate access to both their daily medications and emergency rescue medications at

camp throughout all activities and to ensure that children have updated emergency medical plans available to camp staff to manage medical emergencies.

The American Camp Association and Association of Camp Nursing also place a high priority on ensuring that campers maintain MESH. Our finding shows that a substantial proportion of medications for campers are for maintaining their chronic mental health disorders. Given that summer camp typically is a time for children and adolescents to engage with new peers, participate in new activities, and learn independence from home, it is critical that these campers have routine and safe access to their usual medications that are prescribed based upon evidence-based psychotherapy treatments (Wu, Hamblin, & Storch, 2015). Co-occurring psychiatric and mental health disorders can also significantly impact the treatment of other medical conditions, and thus primary care providers must ensure that campers continue all classes of their medications at camp so they can optimally engage in camp activities and maximize their camp experience. Summer camp health care providers and leadership must work with parents so that children avoid experiencing unplanned “drug holidays” while at camp that may ultimately worsen their chronic mental and behavioral conditions.

Camp stakeholders face several challenges when creating camp medication policies and procedures. First, there is substantial regulatory variability among states for prescriptive credentials and how medications are dispensed in camp settings across the U.S. (Erceg, 2010). This may lead to camp to camp variability on dispensing practices, ranging from who can administer medications (e.g., physician, nurse, emergency medical technician, first aid provider, administration, staff) to how medication management practices are enforced, including reporting of adverse events. Second, how camp policies define “medications” is also variable (Erceg, 2010). Some camps limit medications to those substances regulated by the U.S. Food and Drug Administration (FDA). In contrast, other camps have broadened their definition to include any substance a person might use to maintain and improve their health. Our study found that campers used a substantial number of *Herbal, Supplement and Vitamin* products in summer camp settings. Many of these products are not FDA regulated and their specific mechanisms and indications may be unknown to health care providers, but the variability of the camps’ definition of “medications” may make it difficult for camp providers to limit the use of these agents. Standardizing the definition of medications may decrease the sheer volume of non-essential products (e.g., Herbals, Supplements, Vitamins) administered at camps, similar to school and childcare center policies that restrict the administration of these types of substances. Third, while the American Academy of Pediatrics (AAP) and Association of Camp Nursing have both established recommendations for camps, they are not yet required to be implemented across camps at a national level (Ambrose & Walton, 2019;

Medication Management for Day and Resident Camps, 2017). Previous research demonstrates that compliance of camps in the U.S. with National AAP and U.S. Department of Homeland Security (DHS) recommendations is inadequate and many camps are lacking in planning for the proper execution of emergency medical plans, including ensuring access to emergency medical equipment and medications (Olympia et al., 2015). Widespread and consistent implementation of standardized practice guidelines across camps must be considered a first step in improving medication administration safety in summer camps across the U.S. Due to the magnitude and complexity of medications managed and administered during camp sessions, the study findings suggest the potential for medication-related errors at camps is substantial, particularly given the lack of standardized camp protocols and campers who may not want to involve camp staff when taking their over-the-counter and prescription medications (Rudolf, Alario, Youth, & Riggs, 1993). Additionally, the large number of medications being brought to camps, including a substantial number of specialized medications for children with specific medical needs, necessitates open communication practices by campers, parents, and camp health care providers during the “transition of care” when campers arrive at summer camps (Garst, Weinberg, Erceg, & Faricy, 2021). There is an inherent need for summer camp stakeholders to use a defined system of quality improvement initiatives to ensure the safe and timely administration of medications to children attending camp, including intentional communication practices that encourage the transition of care for campers from home to camp settings (Garst et al., 2021).

Our research is presented in the context of limitations. Firstly, our population may have self-selected for a certain subset of children potentially requiring more medications. Although many of our camps were general population summer camps (i.e., those providing programming and services to a broad, diverse, and abled youth population), a small subset of camps targeted children with certain illnesses, such as sickle cell and oncology-related diagnoses, and we were unable to determine this proportion given the deidentified nature of our study. However, our three largest categories generally included medications we would expect to find at both general and specialized camps. Secondly, although our study was limited to one EHR system across one year, our data were from a typical pre- COVID-19 camp year, and CampDoc.com is the largest camp-specific EHR available. Thirdly, the de-identified nature of the data set did not allow us to determine the exact number of medications associated with each camper. Despite this limitation, we obtained an extensive cross-sectional sample of medications administered across a broad cohort of camps. Lastly, while we did not obtain inter-rater reliability scores between the three data abstractors, the primary author was able to recheck the entire coded data, and any conflicting data from the three original abstractors were resolved with the assistance of a pediatric pharmacist (Cutcliffe & McKenna, 2004).

In conclusion, our study provides a broad overview of the types of medications brought to camp by children across the U.S., including emergency medications. Our study also highlights the need for emergency physicians, primary care providers, nurses, and public health stakeholders to advocate for all camps to implement the universal existing AAP and Association of Camp Nursing recommendations, which include the need for precise individual emergency plans, to ensure the consistent, safe delivery of chronic and emergency medications to optimize children's health and safety in summer camps (Ambrose & Walton, 2019; Medication Management for Day and Resident Camps, 2017). Our study specifically draws attention to the importance of pre-camp transitions of care related to medication administration between primary care teams and providers caring for children in summer camp settings. Further longitudinal studies of camp-specific medications are needed across multiple years to evaluate this population of at-risk children in summer camps comprehensively.

Implications for practice

We found that a substantial volume and variety of prescription and over-the-counter medications are administered to children in summer camp settings. Our findings support the need for medical providers to discuss medication storage and administration with families before children attend summer camps. The lack of adoption of standardized protocols for the management of medications – including intake, storage, dispensing, and documentation of medications – poses risks for medication-related errors and adverse effects among children attending summer camps. The medical community needs to support camp stakeholders' efforts to encourage the widespread adoption of safe medication administration policies by summer camps nationally.

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