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Prevalence and Association of Pain Experiences, Medication Literacy, and Use of Medication among Children and Adolescents in Taiwan

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ABSTRACT

Objective: This study assessed the prevalence of children's and adolescents' pain experiences and use of medicine and examined the relationships between pain experiences, medication knowledge, literacy, and use of medicine.
Method: A probability-proportionate-to-size sampling method was used to systematically draw a random sample of schools. In 2014, a national representative sample of 2309 students from 35 primary schools (5th–6th grade), 2700 students from 30 middle schools, and 2013 students from 20 high schools completed the online survey.
Results: Overall, 85.6% of children and adolescents reported experiencing pain during the past year that included headache (63.0%), throat ache (59.3%), muscle ache (58.3%), stomach pain (42.9%), menstrual pain (girls: 42.1%), and dental pain (38.5%). Children and adolescents had taken cold/cough medicine (48.1%), acetaminophen (15.0%), antacids (14.8%), and nonsteroidal anti-inflammatory drugs (NSAIDs) (10.5%) in the past year. Multivariate analysis results indicated that after controlling for pain experiences children and adolescents who had lower levels of medication knowledge and literacy were more likely to use pain medication and antacids more frequently. In addition, children and adolescents who had lower medication knowledge, lower literacy, asked doctors to prescribe antacids, and co-administered with antacids were more likely to report long-term use of antacids.
Conclusions: Lower levels of medication knowledge and literacy among children and adolescents were associated with more frequent use of pain medication and antacids.

Introduction

Pain is common at all ages and represents a substantial burden on both individuals and society (Hoy et al., 2014; Langley, 2012; Takura et al., 2015). The prevalence and burden of pain in children and adolescents is high and growing (Van Wambeke & Morlion, 2014). A WHO cross-national survey conducted in 28 countries indicated that three-quarters of adolescents had experienced headache, stomach-ache, or backache at least monthly in the past six months (Swain et al., 2014). When children and adolescents experience acute pain it interferes with school and family life and affects their physical and psychological development by leading to school absence, sleep problems, eating problems, mood problems, inability to meet friends, inability to pursue hobbies, and limiting the activities of daily living (Haraldstad, Sorum, Eide, Natvig, & Helseth, 2011; Lima et al., 2014; Swain et al., 2016; Vila, Kramer, Obiols, & Garralda, 2012).

The prevalence of self-medication among children and adolescents varies widely. One study (Shehnaz, Agarwal, & Khan, 2014) reviewed 163 publications and found that the prevalence of self-medication among adolescents ranged from 2% to 92% in different countries due to different measures (i.e., recall period) and populations (i.e., age group), while analgesics was the most frequently used over-the-counter (OTC) form of self-medication. For example, in Jordan the prevalence of self-medication among adolescents was 87%, while 75% of self-medication was used for pain relief (ALBashtawy, Batiha, Tawalbeh, Tubaishat, & AlAzzam, 2015). A review study indicated a high prevalence of self-medication among children and adolescents, and found that drugs with the highest rates of consumption included analgesics, antipyretics and anti-inflammatory agents (Pfaffenbach, Tourinho, &

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Bucaretchi, 2010). Female adolescents, older adolescents, those with lower maternal education, and those who had familial experiences with self-medication were most at risk (Bertoldi et al., 2014; Shehnaz et al., 2014).

Despite the high prevalence of OTC drug use, studies have indicated knowledge gaps about OTC drug use, side effects, and contraindications among adolescents (Holmstrom, Bastholm-Rahmner, Bernsten, Roing, & Bjorkman, 2014; Wilson, Singh, Blumkin, Dallas, & Klein, 2010). For example, acetaminophen is the leading worldwide cause of drug overdose and acute liver failure (Chiew, Gluud, Brok, & Buckley, 2018). However, most adolescents reported misunderstanding the proper use of acetaminophen and a lack of knowledge regarding the risks of overdose (Shone, King, Doane, Wilson, & Wolf, 2011). Low health literacy is a known risk factor for the misunderstanding and unsafe use of acetaminophen among adolescents and adults (Devraj, Herndon, & Griffin, 2013; Shone et al., 2011; Wolf et al., 2012). A study found that children had misconceptions about medicines, while parents' education levels and occupations influenced children's beliefs about medicines (Dawood, Mohamed Ibrahim, & Abdullah, 2015).

In addition, studies also found antacids were commonly inappropriately prescribed and overused (Gupta et al., 2010; Redfern, Brown, Karhoff, & Middleton, 2015), while most people were unaware of the risks associated with the use of antacids such as drug interactions (Ogawa & Echizen, 2011) and infections (i.e., gastroenteritis) (Lai et al., 2016). The results of a previous study showed that health science college students also have misperceptions that antacids should be added into all prescriptions to avoid gastrointestinal upset (Eissa, 2013). Taiwan residents also have misperceptions that all western medicines cause stomach harm and that the taking medicines should be co-administered with antacids to avoid gastro-irritant effects. People often ask physicians to prescribe antacids to prevent stomach harm. In Taiwan most medicines, including antacids, are reimbursed under the National Health Insurance (NHI) program, and antacid coprescriptions are common in Taiwan (Chen, Chou, & Hwang, 2003). According to the 2002 Taiwan NHI database, 32% of all prescriptions included antacids (Chen, 2004).

Pain is a global public health problem. In Asian societies adolescents often face higher levels of academic pressure, and stress has been significantly associated with psychological as well as physical pain symptoms such as headache, stomach pain, and back pain (El Ansari, Oskrochi, & Haghgoo, 2014; Vila et al., 2012; Zhang et al., 2014; Zhao et al., 2014). In Taiwan there are three legal categories of medicines including general over-the-counter (OTC) medicines, pharmacy medicines (drugs as directed by pharmacists or physicians), and prescription-only medicines, and no age restrictions for purchasing non-prescription medicines. Most pain medications and antacids are classified as pharmacy medicines; however, consumers seldom consult pharmacists and pharmacists may not automatically ask consumers. The prevalence of drugstore chains in Taiwan is increasing, which means that children and adolescents can more easily obtain medicines and are exposed to more risks from the use of pain medications and antacids. However, few studies have focused on the relationship between pain experiences, medication literacy, and pain medications and antacids use among children and adolescents in Asian societies. The present study aims to assess the prevalence of pain experiences and medicine use among children and adolescents in Taiwan and to examine the relationships between pain experiences, medication knowledge, self-efficacy, literacy, and use frequency of pain medications and antacids.

Methods

Participants

The participants in this study included students from primary schools, middle schools, and high schools. In 2014, there were 2644 primary schools, 738 middle schools, and 503 high schools in Taiwan. A probability-proportionate-to-size sampling method (Lohr, 2010) was used to systematically draw a random sample of schools. Three to four classes were randomly selected from each school. The sample schools for the present study included 35 primary schools, 30 middle schools, and 20 high schools. However, 5 schools, including three primary schools, a middle school, and a high school, refused to participate in the survey. A total of 2309 students (5th–6th grade; 11–12 years old) in primary schools, 2700 students in middle schools (7th–9th grade; 13–15 years old), and 2013 students in high schools (10th–12th grade; 16–18 years old) completed the online survey in November 2014. The response rate was 91%. No statistically significant differences were found between our sample and the Taiwan primary and middle school populations with respect to gender and age distribution, but significant differences were found in the gender and age structure between our sample and the high school population in Taiwan. The online self-administered questionnaire was anonymous. Students took the online survey in their school computer rooms. Approval was obtained from the Institutional Review Board (IRB) at Tri-Service General Hospital. Consent forms were taken home by students to give to parents requesting their consent to allow the children to participate in the survey.

Instruments

The self-administered questionnaire was developed based on prior studies including the core abilities of correct medication usage (Chi et al., 2012), pain medications usage (Chang et al., 2015), and medication label literacy (Tsai, Lee, & Chang, 2014). Ten experts including pharmacists, health educators, and public health professionals were invited to assess the content validity of the questionnaire, while adopting experts' recommendations such as using appropriate words and scoring. In addition, a pretest survey was conducted to examine primary, middle, and high-school students' responses to the online survey and to evaluate the reliability of the data yielded by the questionnaire. The Cronbach's alpha values for medication knowledge (Cronbach's $\alpha = 0.87$) and for medication self-efficacy (Cronbach's $\alpha = 0.95$) were high, while the Cronbach's alpha values for medication label literacy only reached the middle range (Cronbach's $\alpha = 0.61$).

Medication knowledge

Medication knowledge was measured using 19 statements including knowledge of correct medication use (10 items), pain medication (4 items), and antacids (5 items). The questions of knowledge regarding correct medication use and pain medication were described in a prior study (Chang et al., 2015). The questions concerning the use of antacids included the following: “Taking medicine must be combined with antacids to prevent harm to the stomach”; “Long-term use of antacids increase the risk of low stomach acid, bacterial overgrowth, and infection”; “Combining the taking of medicine with antacids alter the effectiveness of the medicine”; “If individuals have stomach discomfort, they could take leftover antacids”; and, “People could reduce excess stomach acids by implementing a healthy lifestyle such as not eating irritating foods.” The response options included correct, incorrect, and unknown. Students received one point if they answered an item correctly. Higher scores were equated to a higher level of medication knowledge.

Literacy of medication labeling

Literacy of medication labeling was measured with 6 questions. Medication package labeling for antacids was used as an example and contained information that included patient name, gender, age, administration, drug name, appearance, indication, side effects, instructions, and consulting phone numbers. Participants were asked to read the printed medication package labeling then answer the questions. The questions included the following. “What is a probable disease or symptom that would cause a person to take this medicine (response choices:

insomnia, cough, stomach discomfort, and headache)?" "According to the medication package labeling information, how should a person take this medicine (response choices: chewing one tablet with water after each 3 meals, taking one tablet before breakfast and dinner, taking one tablet with juice after each 3 meals, chewing one tablet with water before breakfast and dinner)?" "According to the medication package labeling information, how many days a person take this medicine (response choices: 3 days, 7 days, 15 days, 14 days)?" "Which of the following symptoms should cause a person to consult a physician or pharmacist immediately (response choices: insomnia, cough, severe diarrhea, runny noise)?" "Which of the following telephone number should a person call to consult a pharmacist if he/him had medication questions? (response choices: (02)1234-1234, (08)8765-8765, (03) 1133-5577, (02)8765-4321)?" "According to the medication package labeling information, which of the following tablets is this medicine (Antagel) (response choices: showing four kinds of tablets with different appearance)?" The answers included four response options, with only one correct choice. A higher score was equated to a higher literacy of medication package labeling.

Medication self-efficacy

Medication self-efficacy was measured using 20 statements including self-efficacy of correct medication (10 items), pain medication (5 items), and antacids usage (5 items). The questions concerning the self-efficacy of correct medication use, including pain medications, were described in a prior study (Chang et al., 2015), while questions concerning self-efficacy of the use of antacids included "I can follow a physician's instructions and do not request antacid prescriptions from a physician"; "I won't combine the taking of medicine with antacids except following physician's instruction"; "I won't use antacids for a long-term period" "I can implement a healthy lifestyle and do not eat irritating foods to decrease stomach discomfort"; and, "If I have stomach discomfort, I would consult a physician or a pharmacist and would not purchase medicine from unlicensed sources." The response options were assessed using a 5-point Likert scale that ranged from "strongly not confident" to "strongly confident." A higher score was equated to a higher level of correct medication usage confidence.

Pain experiences

Pain experiences were measured by asking children and adolescents whether they had experienced any of the following types of pain during the past year: stomach pain, dental pain, headache, menstrual pain, throat ache, and muscle pain. In addition, children and adolescents were asked whether they had stomach pain caused by any of the following situations during the past year: academic pressure, skipping breakfast, meals at irregular intervals, eating too much, eating irritating food, consuming caffeinated drinks, drinking alcohol, and smoking cigarettes. The response options for each of the items were either yes or no.

Medicine obtaining/purchasing

Children and adolescents were asked whether they bought medicine from pharmacies during the past year. In addition, children and adolescents were asked whether they had obtained medicine from the following sources: family members' or friends' recommendations, TV advertisements, radio advertisements, online sales, park or street vendor sales, overseas suppliers, and traditional therapists' recommendations. The response options for each item were either yes or no. If children and adolescents answered that they obtained medicine from any item, it was coded as obtaining medicine from unlicensed sources.

Medicine use

Frequency of medicine use was measured based on children's and adolescents' answers to how often they had ever used antipyretic analgesics containing acetaminophen (i.e., paracetamol), anti-inflammatory painkillers (i.e., aspirin), cold and cough medicine, and antacids. Response options included the following: "never", "ever before a year", "a few times within a year", "a few times within a month", and "a few times within a week". If students reported that they used the medicine "a few times within a month", they were coded as frequent medicine use. In addition, among students who ever used antacids in the past year, students were further asked during the past year whether they automatically asked their doctors to prescribe antacids; whether they continuously used antacids >2 weeks; and, the reasons they used antacids (co-administered with antacids to avoid stomach harm caused by medicine use; for excess stomach acid (e.g. heartburn, acid reflux); for stomach ulcer; or others). Moreover, students were asked whether they had chronic diseases from long-term (>3 months) medication use. The response options were either yes or no.

Data analysis

SAS software (version 9.4) was used to perform the statistical analysis. Percentages and means were calculated for all variables. A chi-square test was conducted to compare children's and adolescents' pain experiences, use of medicine, and obtaining/purchasing sources of medicine by education levels and by gender. The children's and adolescents' medication knowledge, self-efficacy, and literacy by education level and by gender were compared via *t*-test and ANOVA. In addition, multiple logistic regression was conducted to examine factors related to children's and adolescents' frequent pain medication and antacid use controlled for gender, grade, chronic disease variables, and pain experiences. Statistical significance was determined to be a p-value of <0.05.

Results

Prevalence of pain experiences by school level and gender

Table 1 lists the prevalence of children's and adolescents' pain experiences in the past year by school level and by gender. Overall, 85.6% of children and adolescents reported that they experienced pain during the past year, most commonly headache (63.0%), throat ache (59.3%), muscle pain (58.1%), stomach pain (42.9%), menstrual pain (girls:

Table 1
Prevalence of pain experiences in the past year by school level and gender.

	Total	By school level				By gender		
	%	Primary %	Middle %	High %	p value	Girl %	Boy %	p value
Pain experiences								
Headache	63.0	60.5	61.6	67.8	<0.001	68.0	57.4	<0.001
Throat ache	59.3	60.1	56.3	62.3	<0.001	65.2	52.6	<0.001
Muscle pain	58.1	44.8	61.1	69.4	<0.001	61.2	54.7	<0.001
Stomach pain	42.9	33.6	43.4	52.9	<0.001	46.8	38.4	<0.001
Menstrual pain (girl)	41.4	9.0	47.8	63.2	<0.001	41.4		
Dental pain	38.5	47.9	33.3	34.7	<0.001	39.4	37.5	0.105
Stomach pain causes								
Academic pressure	31.3	22.4	32.1	40.4	<0.001	34.0	28.2	<0.001
Eat irritating food	30.2	26.1	30.2	34.9	<0.001	30.9	29.4	0.170
Skip breakfast	25.1	18.3	28.9	27.9	<0.001	26.8	23.2	<0.001
Consume caffeine drinks	24.6	25.3	23.9	24.7	0.550	23.6	25.7	0.067
Meals at irregular intervals	24.0	15.9	25.1	31.8	<0.001	25.9	21.8	<0.001
Eat too much	14.7	11.3	14.6	18.7	<0.001	12.3	17.5	<0.001
Drink alcohol	3.7	3.3	3.6	4.2	0.295	1.9	5.6	<0.001
Smoke cigarette	2.8	2.5	2.6	3.3	0.264	1.1	4.7	<0.001

Note: Total N = 7022; primary school (5th -6th grade) N = 2309, middle school N = 2700, high school N = 2013; girl N = 3724, boy N = 3298.

42.1%), and dental pain (38.5%). By school level, the rates of headache, muscle pain, stomach pain, and menstrual pain among high school students were significantly higher than the rates among middle school students and primary school students, while the rates of dental pain was higher among primary school students. By gender, the rates of different types of pain among girls were significantly higher than the rates among boys.

In addition, children and adolescents reported experiencing stomach pain in the past year caused by academic pressure (31.3%), eating irritating food (30.2%), skipping breakfast (25.1%), meals at irregular intervals (24.0%), consuming caffeinated drinks (24.6%), eating too much (14.7%), drinking alcohol (3.7%), and smoking cigarettes (2.8%) (Table 1). The rates of different causes of stomach pain increased as children and adolescents transitioned to higher school levels.

Prevalence of the use of medicine by school level and gender

Table 2 lists the prevalence of students' use of medicine by school level and by gender. A total of 267 students (3.8%) reported that they had a chronic disease from long-term (>3 months) medication use. Overall, almost half (48.1%) of children and adolescents reported that they had taken cold/cough medicine in the past year, while one-seventh of children and adolescents had taken pain medication including acetaminophen (15.0%) and NSAIDs (10.5%). In addition, 14.8% of children and adolescents had taken antacids in the past year. By school level, the rates of medicine use in the past year among high school students were significantly higher than the rates among middle school students and primary school students. By gender, the rates of cold/cough medicine and acetaminophen use among girls were significantly higher than the rates among boys.

Among students who used antacids during the past year, 26.2% reported that they asked their doctors to prescribe antacids, while 20.8% reported that they continuously used antacids for more than two weeks. In addition, 37% reported that they co-administered with antacids to avoid stomach harm caused by medicines, while 55.3% reported they used antacids for excess stomach acid. By gender, the rates of asking a doctor to prescribe antacids and long-term antacids use (>2 weeks) were significantly higher among boys than among girls.

Sources of medicine by school level and gender

Overall, one-third of children and adolescents reported purchasing medicine from pharmacies during the past year. In addition, children and adolescents reported obtaining or purchasing medicine from other sources in the past year including overseas suppliers (12.6%), family members and friends' recommendations (12.0%), traditional therapists recommendations (7.2%), park or street vendor sales (4.5%), TV advertisements (3.6%), radio advertisements (2.6%), and online sales (2.3%) (Table 2). The rates of purchasing medicine from pharmacies were significantly higher for high school girls than for boys, while the rates of obtaining or purchasing medicine from other sources were higher among boys compared with girls.

Levels of medication knowledge, self-efficacy and literacy by school level and gender

Table 3 lists medication knowledge, self-efficacy and medication package labeling literacy by school level and gender. Children and adolescents had low scores for pain medication knowledge (mean = 0.69) and antacids knowledge (mean = 0.74). For example, 51.4% of students did not know the maximum dose of acetaminophen, while 42% of students did not know that people who drink alcoholic beverages or have hepatitis increase their liver damage risk when taking pain medication containing acetaminophen. In addition, 30% of students had the mistaken belief that taking medicine combined with antacids would prevent harm to the stomach, while 30.9% of students did not know that taking medicine with antacids may alter the effectiveness of the medicine. Moreover, children and adolescents had a low level of confidence in consulting physicians about the use of medicine containing acetaminophen in order to avoid an overdose. Children and adolescents also had a low level of confidence in their ability to implement a healthy lifestyle by not consuming spicy foods, coffee or alcohol in order to reduce stomach discomfort. High school students had higher scores for medication knowledge and medication package labeling literacy compared with middle school and primary school students. Girls had higher scores of medication knowledge, self-efficacy and medication package labeling literacy compared with boys.

Table 2
Prevalence of medicine use and sources in past year by school level and gender.

	Total	By school level				By gender		
	%	Primary %	Middle %	High %	p value	Girl %	Boy %	p value
Medicine buy/obtain from								
Pharmacy stores	33.9	27.6	35.7	38.8	<0.001	35.3	32.4	0.011
Overseas suppliers	12.6	12.6	11.4	14.4	0.011	13.7	11.4	0.004
Family/friends	12.0	12.7	10.8	12.8	0.055	10.9	13.2	0.008
Traditional therapists	7.2	10.5	6.3	4.8	<0.001	5.2	9.6	<0.001
Park/street vendor sale	4.5	6.8	4.0	2.7	<0.001	2.9	6.4	<0.001
TV averts	3.6	4.4	3.3	2.9	0.016	2.0	5.3	<0.001
Radio averts	2.6	3.9	2.2	1.7	<0.001	0.9	4.5	<0.001
Online sale	2.3	3.0	2.1	1.9	0.045	1.1	3.8	<0.001
Medicine use (past year)								
Cold/cough	48.1	46.3	44.5	55.1	<0.001	53.8	41.8	<0.001
Acetaminophen	15.0	9.0	14.0	23.2	<0.001	16.6	13.1	<0.001
Antacids	14.8	9.7	12.6	23.5	<0.001	15.7	13.7	0.024
NSAIDs	10.5	6.4	9.2	16.9	<0.001	10.8	10.2	0.477
Antacid use (past year)								
Ask to prescribe antacids	26.2	29.3	26.4	24.0	0.257	18.5	35.7	<0.0001
Long-term antacids use (>2 weeks)	20.8	25.0	19.6	19.1	0.114	14.4	28.7	<0.0001
Antacids use reason								
For protection from medicine stomach harm	37.0	39.4	37.9	34.5	0.351	35.4	38.9	0.222
For excess acid	55.3	39.4	52.8	68.1	<0.0001	59.9	49.6	<0.0001
For stomach ulcer	15.7	16.2	17.3	13.9	0.357	11.5	20.9	<0.0001

Note: 1.Total N = 7022; primary school (5th -6th grade) N = 2309, middle school N = 2700, high school N = 2013; girl N = 3724, boy N = 3298.

Table 3
Medication knowledge, self-efficacy, and literacy by school level and gender.

	Total	By school level				By gender level		
	Mean (SD)	Primary Mean (SD)	Middle Mean (SD)	High Mean (SD)	ANOVA test p value	Girl Mean (SD)	Boy Mean (SD)	*t*-Test p value
Knowledge (overall)	0.80 (0.19)	0.78 (0.20)	0.80 (0.18)	0.83 (0.18)	<0.001	0.83 (0.16)	0.78 (0.21)	<0.001
Correct medication usage	0.88 (0.17)	0.86 (0.18)	0.89 (0.17)	0.90 (0.17)	<0.001	0.90 (0.14)	0.85 (0.21)	<0.001
Pain medication usage	0.69 (0.29)	0.67 (0.30)	0.68 (0.29)	0.74 (0.27)	<0.001	0.71 (0.27)	0.67 (0.31)	<0.001
Antacids usage	0.74 (0.29)	0.72 (0.30)	0.74 (0.30)	0.76 (0.28)	<0.001	0.77 (0.27)	0.70 (0.31)	<0.001
Self-efficacy (overall)	4.14 (0.82)	4.16 (0.85)	4.14 (0.82)	4.11 (0.77)	0.183	4.22 (0.72)	4.04 (0.91)	<0.001
Correct medication usage	4.12 (0.82)	4.16 (0.85)	4.10 (0.83)	4.08 (0.77)	0.007	4.19 (0.72)	4.04 (0.91)	<0.001
Pain medication usage	4.11 (0.92)	4.10 (0.98)	4.13 (0.91)	4.10 (0.87)	0.497	4.20 (0.83)	4.00 (1.00)	<0.001
Antacids usage	4.20 (0.92)	4.21 (0.97)	4.20 (0.91)	4.18 (0.86)	0.626	4.29 (0.82)	4.09 (1.00)	<0.001
Medication package labeling literacy	0.89 (0.18)	0.87 (0.20)	0.88 (0.18)	0.92 (0.16)	<0.001	0.92 (0.14)	0.85 (0.21	<0.001

Note: Total n = 7022; primary school (5th -6th grade) N = 2309, middle school N = 2700, high school N = 2013; girl N = 3724, boy N = 3298.

Factors related to the frequent use of pain medication and antacids

Table 4 lists the factors related to frequent analgesics, NSAIDs and antacids usage. Multiple logistic regression results showed that after controlling for gender, grade, and chronic disease, and pain experiences, students who had lower levels of medication knowledge, lower medication labeling literacy, and obtained/purchased medicine from unlicensed sources were more likely to use analgesics and NSAIDs frequently.

In a similar manner, multiple logistic regression results showed that after controlling for gender, grade, chronic disease, pain experiences, and excess stomach acid experiences, students who had lower levels of medication knowledge, lower medication labeling literacy, and had obtained/purchased medicine from unlicensed sources were also more likely to use antacids frequently.

Factors related to inappropriate use of antacids

Table 5 lists the factors related to inappropriate use of antacids. Multiple logistic regression results showed that after controlling for gender, grade, chronic disease, and excess stomach acid experiences, students who had lower levels of medication labeling literacy and obtained medicine from unlicensed sources were more likely to co-administer with antacids to allay fears that taking medicines might hurt their stomach. In addition, students with lower medication labeling literacy, who obtained medicine from unlicensed sources, and who used antacids for protection purposes were more likely to ask doctors to prescribe antacids in the past year. Moreover, students who had lower levels of medication knowledge, lower levels of medication label literacy, had asked doctors to prescribe antacids, and co-administered with antacids were more likely to report long-term use of antacids.

Table 4
Factors related to the frequent use of pain medications and antacids.

	Acetaminophen		NSAIDs		Antacids	
	OR	95%CI	OR	95%CI	OR	95%CI
Gender (girl = 0, boy = 1)	2.26	1.27–4.01	1.51	1.01–2.24	1.29	0.81–2.04
Grade 5th–12th	0.98	0.88–1.08	1.09	1.02–1.18	1.04	0.95–1.14
Chronic disease (no = 0, yes = 1)	0.67	0.21–2.14	1.81	1.04–3.16	2.97	1.66–5.34
Knowledge	0.12	0.05–0.27	0.20	0.10–0.39	0.13	0.06–0.27
Self-efficacy	1.06	0.86–1.32	0.94	0.80–1.10	1.00	0.83–1.22
Drug labeling literacy	0.24	0.10–0.57	0.27	0.14–0.53	0.24	0.11–0.53
Obtain medicine from unlicensed sources	1.70	1.12–2.59	2.32	1.73–3.10	1.78	1.23–2.59
Headache	1.50	0.90–2.50	1.36	0.94–1.98	0.77	0.50–1.19
Menstrual pain	2.14	1.06–4.32	2.24	1.44–3.50	1.39	0.80–2.44
Throat ache	0.81	0.51–1.29	1.17	0.83–1.64	0.76	0.50–1.14
Stomach pain	1.50	0.95–2.35	1.32	0.96–1.82	2.98	1.95–4.55

Note: 1. Multiple logistic regression was conducted. 2. OR = odds ratio, 95% CI = 95% confidence interval. 3. Acetaminophen use model: N = 7002 (frequent use yes n = 105, no n = 6897). 4. NSAIDs use model: N = 7001 (frequent use yes n = 213, no n = 6788). 5. Antacids use model: N = 7003 (frequent use yes n = 134, no n = 6869).

Discussion

In the results of the present study, children and adolescents reported pain experiences including headache, throat ache, muscle pain, menstrual pain, and dental pain were common complaints among children and adolescents in Taiwan. Prior studies (Lima et al., 2014; Swain et al., 2014) also found that headache, stomach pain, and muscle pain were common among children and adolescents and had an impact on their quality of life. In addition, results of the present study were consistent with other studies (Swain et al., 2014) that found pain experiences to be more prevalent among girls and older adolescents. Studies

Table 5
Factors related to inappropriate use of antacids.

	Ask to prescribe antacids		Co-administered with antacids		Long-term use of antacids	
	OR	95%CI	OR	95%CI	OR	95%CI
Gender (girl = 0, boy = 1)	2.02	1.51–2.70	0.89	0.69–1.16	1.42	1.01–1.99
Grade 5th–12th	0.94	0.87–1.01	1.05	0.98–1.12	0.99	0.91–1.08
Chronic disease (no = 0, yes = 1)	1.51	0.87–2.64	1.58	0.96–2.60	0.97	0.49–1.91
Knowledge	0.50	0.21–1.23	0.63	0.28–1.40	0.29	0.11–0.80
Self-efficacy	1.04	0.88–1.24	1.05	0.90–1.23	0.91	0.75–1.11
Drug labeling literacy	0.20	0.10–0.43	0.28	0.14–0.57	0.11	0.05–0.25
Obtain medicine from unlicensed sources	1.67	1.25–2.23	1.37	1.06–1.78	1.08	0.77–1.52
Excess stomach acid	3.73	2.67–5.21	0.57	0.44–0.75	2.51	1.70–3.70
Ask to prescribe antacids			2.29	1.71–3.06	3.89	2.77–5.48
Co-administered with antacids					1.54	1.10–2.15

Note: 1. Multiple logistic regression was conducted. 2. OR = odds ratio, 95% CI = 95% confidence interval. 3. Ask to prescribe antacids model: N = 1181 (yes n = 310, no n = 871). 4. Co-administered with antacids model: N = 1181 (yes n = 435, no n = 746). 5. Long-term use of antacids model: N = 1181 (yes n = 246, no n = 935).

(Larsson & Sund, 2007; Swain et al., 2014) have shown that headache, stomachache and backache frequently coexists among children and adolescents, while a greater number of somatic pain sites have been associated with poor mental health (Ando et al., 2013). The high prevalence of pain suggests the need to develop and implement comprehensive pain prevention and management programs for the population in order to reduce the growing burden of pain.

In addition, the results of the present study were similar to those of other studies (Fouladbakhsh, Vallerand, & Jenuwine, 2012; Shone et al., 2011; Wilson et al., 2010) showing a low level of adolescents' knowledge and self-efficacy of pain medication usage. In the present study, more than half of students were unaware of the maximum dose of acetaminophen. Children and adolescents reported lower confidence in their ability to avoid taking two or more types of pain medication containing acetaminophen, while one-third of children and adolescents did not read drug labels when taking OTC drugs. Several other studies (Devraj et al., 2013; Shone et al., 2011; Wolf et al., 2012) have linked low health literacy and a resultant poor level of knowledge with the unsafe use of pain medication. When the Taiwan government implemented Health Promoting School-community pharmacist partnership programs, it had a positive impact on enhancing correct medication use and pain medication literacy (Chang et al., 2015). It is important for communities to continuously implement medication education interventions and campaigns to promote medication literacy and the safe use of medicines among children, adolescents and adults.

Moreover, this study found that some children and adolescents incorrectly believed that combining antacids with medicine could avoid harm to the stomach, while some children and adolescents had inappropriate behaviors such as automatically asking doctors to prescribe antacids, co-administering with antacids, and long-term use of antacids. The Taiwan government should educate consumers regarding the risks of antacid use and encourage providers to communicate with patients about the potential risks of the long-term use of antacids. A study showed that the use of education intervention and medication reconciliation forms could decrease inappropriate prescriptions of acid suppression therapy and further decrease healthcare costs and drug interaction risks (Gupta et al., 2013).

This study also found that children and adolescents were unaware that lifestyle and dietary factors could lead to increases in stomach acid. In addition, some children and adolescents reported experiencing stomach pain caused by academic pressure as well as the habitual eating of irritating foods and consumption of caffeine. Other studies have also found that children and adolescents with high levels of academic pressure and stress were more likely to experience pain, physical symptoms, and emotional problems (Petrauskiene & Matuleviciute, 2007; Vila et al., 2012; Zhao et al., 2014). A study also found that headaches and stomachaches were associated with poor eating and substance use among children and adolescents (Fife & Forste, 2016). Since adolescents reporting recurrent abdominal pain are at risk for irritable bowel symptoms (Gulewitsch, Enck, Hautzinger, & Schlarb, 2011), it is important to help children and adolescents implement healthy lifestyles to help prevent pain from physical and psychological problems.

In the present study, some children and adolescents reported obtaining or purchasing medicine from overseas suppliers, advertisement sales, and online sales. These results were similar to other studies (Abahussain & Taha, 2007; Silva, Catrib, de Matos, & Gondim, 2011) that found adolescents' medicine knowledge and purchasing behaviors were influenced by media. The results of that study implied that medication education should include media literacy to enhance students' capabilities to analyze medication messages and carefully review medication advertisements in order to reduce medication risks. In addition, studies have found that maternal education, parental attitudes toward medicine, parents' beliefs and self-medication are associated with children's use of OTC and alternative medicine (Gorodzinsky, Davies, & Drendel, 2014; Italia et al., 2015; Shehnaz et al., 2014; Siponen, Ahonen, Kiviniemi, & Hameen-Anttila, 2013). The medication misuse by children has also been associated with low levels of health literacy seen in parents (Yin et al., 2013). This result implies that parental training programs should include medication risk communication that will enhance medication literacy and reduce childhood medication misuse.

Our multivariate results revealed that after controlling for gender, grade, pain experiences, and chronic diseases, children and adolescents who had lower levels of medication knowledge, self-efficacy, literacy, and who obtained or purchased medicine from pharmacies or other sources were more likely to use pain medications and antacids frequently. These results reflected a serious problem whereby children and adolescents with lower levels of medication knowledge and literacy are known to use medicine more frequently. Children and adolescents may be unaware of the risks and potential adverse effects of medicine. Prior studies have also found knowledge gaps and a lack of proper medication advice and instructions among adolescents (Shehnaz et al., 2014; Silva et al., 2011).

There is an urgent need to involve schools, families, and community pharmacists in medication education to promote medication literacy and safe use of medicine for children, adolescents, parents, and community members (ALBashtawy et al., 2015; Shehnaz, Khan, Sreedharan, Issa, & Arifulla, 2013; Silva et al., 2011). The findings provided insight into policy and practical implications that can be useful when governments encourage “responsible self-medication”, because it is important to enhance public medication literacy and strengthen pharmacists' good practices to prevent consumers' inappropriate use of non-prescription medicines.

Limitations

This research had some limitations. First, some teachers said the questionnaire was too long for some primary students (5th–6th grade students). Future studies could develop a shortened questionnaire version for primary school students. Second, this study asked children and adolescents to report the frequency of taking antipyretic analgesics containing acetaminophen (e.g., Panadol), anti-inflammatory painkillers (e.g., Aspirin), cold and cough medicine, and antacids. Some children and adolescents may not know how to differentiate between antipyretic analgesics containing acetaminophen and NSAIDs. However, we added drug trade names as example to reduce misclassification bias. Third, the prevalence of pain and medication use were measured based on children's and adolescents' self-reported data during the past year, and recall bias might have underestimated the prevalence of pain and/or the use of medicine. At least one study found that children and adolescents commonly recalled a lower frequency of pain than what was found in an assessment of prospective diary reports (Chogle et al., 2012). Future studies should consider asking children and adolescents to list the pain experienced in the past 1 or 3 months or to maintain a written daily diary in order to limit recall bias. Fourth, this study did not collect variables such as stress, sleep, and activity levels, which might influence pain experiences. Fifth, this study collected students' pain experience causes, while students may not be aware that some risk behaviors (e.g., smoking, alcohol drinking) may induce pain. Future questionnaires could be revised to reduce social desirability bias. Finally, this study assessed neither the frequency nor the intensity of different types of pain. Further research is needed to explore children's and adolescents' pain characteristics, risk factors, and the impact of different types of pain and to develop prevention and intervention programs to reduce the burden of pain and inappropriate medicine use in children and adolescents.

Conclusions

This study provides an important context to explore children's and adolescents' pain experiences and examine the relationship between medication literacy and medication use. The results indicated that

pain experiences such as headache, muscle-ache and stomach pain were common among Taiwan children and adolescents —girls and older adolescents in particular. Multivariate analysis results showed that after controlling for gender, grade, chronic disease, and pain experiences, children and adolescents who had lower medication knowledge and lower label literacy were more likely to use pain medications and antacids more frequently. Governments could continuously encourage schools to cooperate with health professionals and implement medication literacy enhancement programs for teachers, students and parents to reduce medication risks. Future longitudinal research is needed to explore the trajectories of pain experiences, medication use, and literacy and health outcomes among children and adolescents.

Contributors

Fong-Ching Chang conducted the statistical analyses and wrote the manuscript. All authors were involved in designing the study, collecting the data, and all authors contributed to and have approved the final manuscript.

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Conflict of interest

The authors declare that they have no conflict of interest.

Institutional review board

Approval was obtained from the Institutional Review Board (IRB) at Tri-Service General Hospital. Consent forms were taken home by students to give to parents requesting their consent to allow the children to participate in the survey.

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