College Student Perceptions of Using a Symptom-Based Algorithm to Enhance Vending Machine Over the Counter (OTC) Medication Use

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ABSTRACT

BACKGROUND: People use symptom checkers for clinical decision-making, including over the counter (OTC) product selection. Health and wellness vending machines (HWVM) that stock OTC medications are common on college campuses, including the University of Rhode Island (URI). No system integrates access to self-assessment health tools for OTC medication selection with HWVM.

OBJECTIVE: The study objective is to assess college students' preferences for using a symptom checking algorithm, either on a kiosk adjacent to the vending machine or online.

METHODS: Survey responses were collected via Qualtrics™ in the spring of 2025. Survey questions included demographic information, students' use of the HWVM, and whether a symptom algorithm could enhance their experience using the HWVM.

RESULTS: 303 unique students participated in the survey. Among this sample, 17% (n=53) reported HWVM use. When students have new health issues, 64% (n=136) reported a preference for contacting a person, while 30% (n=64) prefer using an online source. Overall, 75% (n=145) of students reported that a symptom-based algorithm could enhance their experience using the HWVM. More students would access the algorithm via their phones (78%, n=145) versus a kiosk (57%, n=109).

CONCLUSIONS: Only one in six respondents reported using the vending machine. While most students prefer talking to a person for health decision-making, most students would use a symptom-based algorithm prior to vending machine OTC medication selection. Future research should be performed to validate algorithms, compare their use with HWVM inventory trends, and document user satisfaction.

KEYWORDS: Vending Machine; Nonprescription Drugs; Students, Undergraduate; Public Health Informatics; Symptom Assessment

BACKGROUND

Over-the-counter (OTC) medications have been readily accessible to the public for decades and may be purchased without the requirement for consultation nor recommendations from a healthcare professional.[1] However, the selection of an OTC product is improved when pharmacists educate patients on appropriateness based on self-reported symptoms, allergies, contraindications, etc.[2,3] In 1999, the OTC Drug Facts Label regulations made OTC labels more user friendly by introducing a standardized format improving clarity and readability.[4] Since the general public considers OTC products safe for self-diagnosis and treatment, their willingness to seek or use available information may be limited and potentially harmful. An estimated three out of 10 people fully understand how to take OTC medications correctly, leaving 70% at risk.[5] Adults commonly engage in the problematic use of OTC medication, and need guidance on their potential risks. For college students, social media impacts the prevalence of OTC medication misuse. Students have been shown to use expired medications, double the dose of medications when ineffective, or not read the drug facts label altogether.[5,6]

For these emerging adults, transitioning to higher education settings without parental involvement is a developmental period for decision-making skills and autonomy regarding their healthcare.[7] This may be a time where new and more intense life stressors may affect their ability to seek out and make informed decisions regarding their health.[8] Students gravitate towards anonymous transactions, from online shopping to gathering information, and may prefer less interpersonal contact when accessing medical care specifically.[9] One method to access health information, services, and the products themselves is through self-service kiosks.[10] In 2022, a scoping review was published on the implementation of health kiosks within healthcare settings. Among the studies examined, the most common role of health kiosks was providing health information.[11] Health kiosks have been utilized on college campuses for appointment check-in at student health services; however, utilizing symptom algorithms could enhance their functionality and improve the user experience.[12] Algorithms may also be accessed on websites and mobile phones to further improve accessibility. Some university health services design their websites to provide medication and symptom management information.[13]

The most prevalent and recent use of symptom algorithms in higher education settings were daily COVID-19 symptom checkers requiring students to report symptoms prior to attending class.[14,15] Algorithms may be designed to expand beyond viral infection symptom tracking to additional disease states, including nonpharmacologic and OTC medication recommendations for treatment.

To enhance OTC medication accessibility on college campuses, Purdue University and the University of North Carolina at Chapel Hill (UNC) implemented health and wellness vending machines (HWVM). Purdue University researchers conducted quality improvement surveys to promote more widespread usage of their HWVM.[16,17] For the latter, UNC developed a webpage on their campus health services portal, including information on the medications within their vending machine, such as image, brand and generic names, and a link to a standardized medication guide.[18] At the University of Michigan, an algorithm was created where students may click on a body part and information is provided regarding common conditions and self-care measures for the specified area.[19] In February of 2024, the University of Rhode Island (URI) College of Pharmacy in collaboration with URI Health Services launched a Health and Wellness Vending Machine. This vending machine provided access to a variety of low-cost OTC and wellness products to students anonymously in a secure section of the Kingston campus library, available 24/7 [**Figure 1**]. An initial study was published evaluating the use, potential barriers, and medication inclusion of URI's HWVM.[9] However, this study did not determine how college students select OTC medication and whether a symptom algorithm would be useful to students.

Figure 1. Contents of Health and Wellness Vending Machine (HWVM)

Category	Display #	Item	Cost ($)
Sexual/Reproductive Health	103	Emergency Contraception	$6
	101	Pregnancy Test	$4
	303	Safer Sex Kit w/condoms and lubricant	10 cents
Pain Reliever	501	Acetaminophen	10 cents
	503	Ibuprofen	10 cents
	406	Ear Ache Relief Drops (Similasan or Hyland's)	$7
	505	Disposable Thermometer	10 cents
GI Health	109	Pepto-Bismol (Bismuth Subsalicylate) Tablets for Nausea	10 cents
	412	Tums Antacid tablets	10 cents
	111	Anti-Diarrheal (Loperamide HCL)	10 cents
Oral Health	403	Blistex, Medicated Lip Ointment	10 cents
	105	Dental Health Kit (Toothbrush, Toothpaste and Dental Floss)	$2
Respiratory health	203	Robitussin Cough syrup	10 cents
	410	Saline Nasal Spray for Congestion	10 cents
	205	Mucinex (Expectorant and Cough Suppressant)	$8
	207	Sunscreen	10 cents
Allergies	307	Benadryl (Banophen Diphenhydramine) Antihistamine/Allergy Relief	10 cents
	507	Zyrtec (Cetirizine) Antihistamine/Allergy Relief	$2
	309	Bug Spray	10 cents
Skin health	605	Spray Deodorant	FREE
	311	Antifungal Cream (Clotrimazole) for Athlete's Foot	10 cents
	201	Topical Hydrocortisone for Rash or Itch	10 cents
Eye health	404	Visine (Tetrahydrozoline) Eye Redness Reliever	$5
	405	Eye Itch Antihistamine Drops (Zaditor)	$5
Sleep Health	209	Sleep Kit: Lavender Sachets/Ear plugs/Eye mask/Tea	10 cents
Harm Reduction	607	Naloxone 4 mg	10 cents
	603	Fentanyl Test Strip Kit	10 cents
Wellness	511	Maxi Pad	10 cents
	509	Tampax	10 cents
	401	Glasses Repair Kit	$2
	301	Disposable Masks	10 cents
	402	Hand Sanitizer	10 cents
	407	Band-Aids	10 cents
	305	COVID Test Kit	10 cents
	601	Empty Sharps Container	10 cents
	411	Kleenex Tissues	10 cents

Accepts RAM card payments ONLY

All purchases on RAM card are reported as "Wellness Vending". Individual items purchased are not listed in RAM card account.

Questions? Contact Health Promotion urihealthpromotion@uri.edu or 401-874-5954

Purpose/Objectives

The objective of this study is to assess college students' preferences for using a symptom-checking algorithm, either on a kiosk adjacent to the vending machine or online, and whether they believe this resource would aid in selecting appropriate products based on their symptoms.

METHODS

The survey conducted was voluntary, anonymous, and did not contain any identifiable information. Survey responses were collected from January 24, 2025, to February 21, 2025. Prior to the university-wide distribution of the survey, the survey questions were piloted with 12 students and facilitators serving on the URI Health Services Student Health Advisory Council (SHAC). Students enrolled in classes at URI who were 18 years or older were eligible to complete the survey. The survey was distributed to students using a printed advertisement with a QR code posted in the library as well as other campus buildings. In addition, images and videos produced via TikTok were posted to social media accounts including URI Wellness (@uriwellness), flyer distribution to students within the student union, and distributed to students electronically via email.

Survey Development

The survey was developed utilizing Qualtrics, a web-based survey platform (Qualtrics, Provo, UT). Completing the 24-question survey took no more than 10 minutes. Demographic data collected included age, year of study, current academic major, gender, ethnicity, race, sexual identity/orientation, extracurricular involvement, and place of residence (e.g., dorm room, fraternity/sorority housing, off-campus housing in the surrounding area or commuting from home). The survey included questions about students' use of the HWVM and how additional services, such as a symptom algorithm, may enhance their experience in product selection. Survey data were analyzed using descriptive statistics. Respondents were not required to answer any of the questions to complete the survey. This study was approved by the URI Institutional Review Board.

RESULTS

Survey and Demographic Data

A total of 303 students accessed the survey. [**Table 1**]. One hundred eighty-two completed the survey in its entirety, 60 partially completed the survey, and 61 withdrew from the survey. Fifty-six percent of total respondents were between the ages of 18–20 and 38% between the ages of 21–23, with

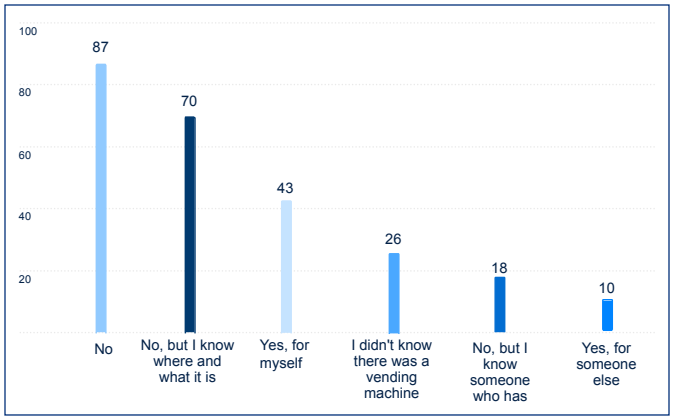
Table 1. Baseline Characteristics

	Number of Total Respondents (%) (n = 303)	Number of Respondents Who Used the HWVM (%) (n = 53)	Number of Respondents Who Did Not Use the HWVM (%) (n = 201)
Age (years)			
18–20	100 (56%)	30 (73%)	70 (52%)
21–23	68 (38%)	10 (24%)	55 (41%)
24–29	8 (4%)	1 (2%)	7 (5%)
30–39	2 (1%)	0 (0%)	2 (1%)
Gender			
Male	19 (12%)	3 (8%)	16 (13%)
Female	136 (83%)	30 (83%)	104 (83%)
Non-binary	5 (3%)	3 (8%)	2 (2%)
Grade level			
Freshman	26 (15%)	8 (20%)	18 (13%)
Sophomore	50 (28%)	14 (34%)	36 (27%)
Junior	37 (21%)	12 (29%)	24 (18%)
Senior	34 (19%)	3 (7%)	29 (21%)
Graduate level	30 (17%)	4 (10%)	26 (19%)
Ethnicity			
Hispanic, Latino/a, or Spanish origin	10 (6%)	1 (3%)	8 (6%)
Non Hispanic, Latino/a, or Spanish	147 (90%)	33 (92%)	113 (90%)
Race			
White/Caucasian	150 (86%)	33 (83%)	115 (88%)
Black or African American	8 (5%)	0 (0%)	8 (6%)
Asian or Pacific Islander	11 (6%)	4 (10%)	6 (5%)
American Indian or Alaskan Native	1 (1%)	1 (3%)	0 (0%)
Other	1 (1%)	1 (3%)	0 (0%)

Respondents were not required to answer any of the demographic questions to complete the survey.

most students in their sophomore year of study. Of all respondents, 83% were female. When asked about their major, 43% of students reported the College of Pharmacy followed by the College of Health Sciences (17%). A similar number of students reported living in on-campus dorms (36%) as compared to students who lived off-campus in the Kingston, Narragansett, or Wakefield, Rhode Island areas (37%).

Figure 2. Use of Health and Wellness Vending Machine (HWVM)



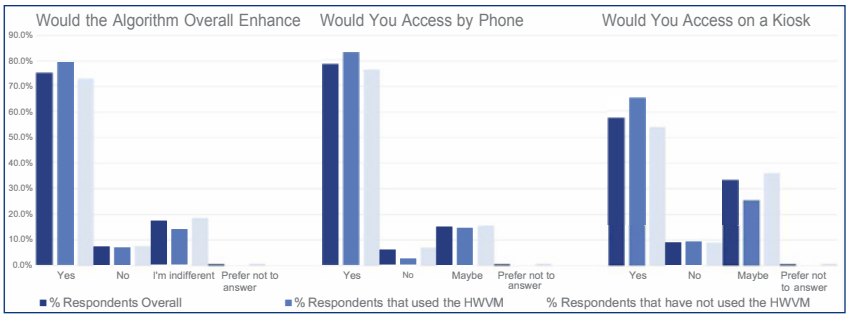
Current use of the HWVM

Fifty-three students (17%) reported using the HWVM for themselves or someone else while 201 students (66%) had not used the HWVM. Of the 201 students who had not used the HWVM, 70 were aware of its existence and 18 students knew someone who had previously used the HWVM [**Figure 2**]. Respondents were provided with a list of current medications and products within the HWVM. At the time of the survey, over half of the students who previously utilized the vending machine preferred its use instead of going elsewhere to get the products provided. Students reported a preference to utilize the vending machine over other locations due to reduced prices of products (42%), ease of access and location (19%), and/or privacy (17%). These preferences were similar between HWVM users and total respondents.

Algorithm Benefit and Use

Of the total respondents, 75% believe the symptom algorithm and drug information kiosk would enhance their experience with the HWVM [**Figure 3**]. This was slightly higher in the HWVM user group (79%). A greater number of total student respondents preferred accessing the symptom algorithm via their cell phones (78%) versus a kiosk (57%). Of the HWVM users, there was a greater percentage of those who believed accessing the algorithm via cellphones (83%) would be more beneficial than kiosks (65%) as well.

Figure 3. Algorithm Responses

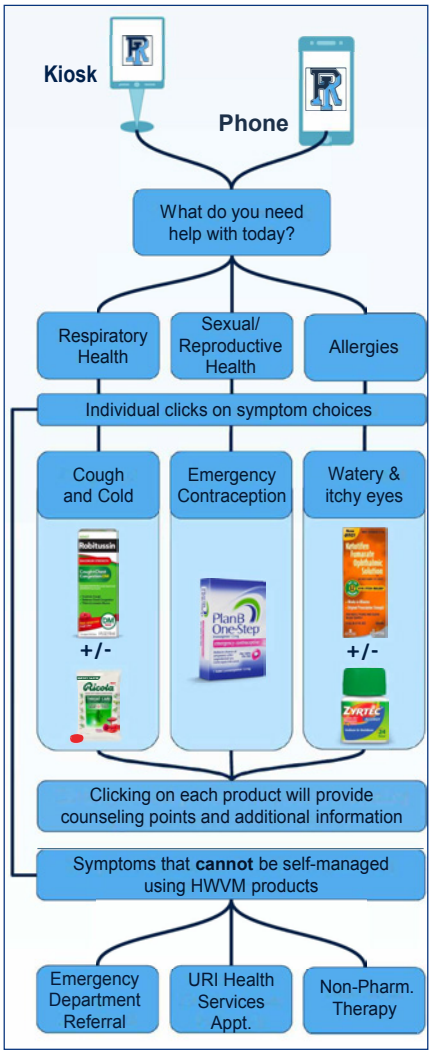


A significant number of total respondents were unsure whether accessing the symptom algorithm via the kiosk (33%) was preferred over accessing the algorithm via their cellphones (15%).

DISCUSSION

Our research is the first to specifically survey college students on their likelihood to use a symptom algorithm and health kiosk to help select OTC products in health and wellness vending machines (HWVM). While only one in six respondents reported using the vending machine, we found that 75% of students believed their experience would be enhanced if they were to use a symptom-based algorithm. We observed that more students would access the algorithm via their phones (78%, n=145) versus a kiosk (57%, n=109). This suggests that many students may want to gather information about the products online prior to selection from the OTC vending machine. Vending machine use is an inherently different experience than accessing nonprescription medications at the pharmacy, as the products and their drug facts label are out of reach. When selecting medication in the pharmacy aisle, individuals may hold the product, review the label, and compare it to other products prior to purchasing. Offering this drug information through the symptom algorithm and health kiosk would allow for individuals to be more informed about their decision prior to purchase. While students noted a preference for accessing the algorithms via their phones, many reported an interest in utilizing a kiosk, despite not being fully aware of its appearance and functionality. Accessing the algorithm via the kiosk adjacent to the vending machine may serve as a visual reminder for real-time assistance. Further, this may aid in triaging students to seek an evaluation by a healthcare practitioner with the University's Health Services by identifying those whose symptoms are not appropriate for self-treatment [**Figure 4**].

Figure 4. Symptom-Based Algorithm Example



The symptom algorithm, whether accessed from the health kiosk or phone, can guide the user through a series of questions to determine if their symptoms may be managed by self-treatment, if a product is available in the HWVM, or if a referral to a healthcare provider is warranted. For the former, the questions may be tailored to the reported symptoms, such as "Headache" or "Cough." Once the questions are completed, the algorithm will identify an appropriate medication along with its location within the vending machine. To ensure the algorithm's accuracy, our research team relied on evidence-based references to distinguish between individuals who are "self-care treatable" and those who meet criteria for "self-care exclusions." An individual who is self-care treatable refers to symptoms that may be safely treated at home with over-the-counter medication; however, an individual with an exclusion for self-care has symptoms that require an evaluation by a healthcare provider. For example, a student with watery eyes may have seasonal allergies, which can often be treated with over-the-counter antihistamine eye drops, or conjunctivitis, which requires professional evaluation and a prescription for an ocular anti-infective. In order to optimize HWVM at other colleges and universities, an expert team of pharmacists and other providers should regularly develop, evaluate, and update symptom algorithms and available medications. Our university embarked on a collaboration between the College of Pharmacy and campus Health Services, including the College of Nursing, to maintain, update, and proactively restock products to ensure availability. In addition to recommending OTC medications and products, pharmacists can develop non-pharmacologic counseling points. For example, if a student reports a headache and the symptom algorithm determines they are appropriate for self-management, counseling may include recommendations such as limiting screen time in addition to taking acetaminophen at the correct dosage.

Our study revealed that less than 18% of total survey respondents used it yet 90% were aware it existed. Although awareness was high, actual usage remained low, indicating that certain barriers may be limiting students from fully utilizing the resource. Students report utilizing the vending machine for its reduced price, accessibility, and privacy, mirroring data collected in a pre-implementation survey at the University of Rhode Island.[9] These reasons are consistent with results from vending machine surveys conducted at other universities. Purdue University reported success with its OTC vending machine due to its convenience, affordability, and accessibility. The relocation of their vending

machine to an area with greater foot traffic further improved utilization.[18] Similarly, UNC found that increased accessibility to commonly used OTC products was appreciated by the students. Using their "Healthy Heels To Go" webpage, students could visualize all the products found within the vending machine. Their webpage also included each drug facts label, information regarding the medications, and additional resources on health information.[19]

Data support that pharmacists' active involvement in self-care consultations allows for higher satisfaction rates for individuals and provides them with more confidence in future self-treatment.[20] However, it is widely understood that not all individuals feel comfortable conversing with pharmacists or other medical professionals on personal topics and would prefer to utilize a private algorithm via a kiosk or phone. Both options should remain in place for students. For those seeking in-person consultation, all products within the HWVM are available within the campus pharmacy at Health Services, where a pharmacist and a Doctor of Pharmacy student intern are readily available for consultation.

The demographics of the survey sample were consistent with those of the overall University population. According to the URI Common Data Set for the 2024–2025 academic year, approximately 58.2% of campus students were women, with 70.9% White and Non-Hispanic.[21] With more than half of respondents in the survey identifying as underclassmen, this may suggest that younger students are more health conscious or curious, as they are newly navigating their own independent health decisions. Having a large population sample from the younger student body also reflects the target population for additional interventions aimed at improving access to OTC health resources at URI.

Limitations

Data collected was associated with a single university, which can limit generalizability to broader populations, especially those with different health resources available. Next, the sample size was relatively small with predominantly White/Caucasian female respondents, which may not accurately represent the diversity of the student body at other colleges and universities. Lastly, results reflected a lower-than-expected use of the HWVM, which may have limited the number of responses related to algorithm and kiosk use.

CONCLUSION

This study is the first to evaluate the potential use of a symptom-based algorithm and kiosk to guide OTC medication selection at a university health and wellness vending machine. Implementation of these tools can support college students in making informed, autonomous health decisions by providing access to product information, symptom guidance, and links to campus health services. Survey findings suggest that students prefer accessing the algorithm via their phones rather than the kiosk, highlighting the importance of multiple accessible options for OTC guidance.

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