Perceptions Surrounding Onychomycosis in the Health Professions Student Population

The Disease, Treatments, and Quality of Life

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Background: Discolored toenails is a common complaint presented to podiatric physicians, dermatologists, and primary-care physicians. Although various local and systemic conditions influence changes in nails, nearly 50% is due to fungal infections. We surveyed the health professions student population to gain insight into how future medical professionals may approach this condition and to explore perceptions of onychomycosis, treatments, and effects on quality of life.

Methods: The primary outcome measure was a self-reported online Google Forms survey developed by the authors and sent to podiatric, allopathic, and osteopathic medical students and nursing students in Philadelphia, Pennsylvania.

Results: Of the 245 respondents, 92% agreed that toenail fungus is both a health and a cosmetic concern. Seventy-seven percent of respondents said “yes” when asked if they would seek treatment, and 67% would wait 1 month to 1 year to see a medical professional. When seeking treatment, 57% reported that they would see a primary-care physician initially, and 27% and 5% would seek care from a podiatric physician or dermatologist, respectively. A total of 91% would spend up to \$300 annually for treatment, with only 4% willing to spend more than \$500 per year. Respondents’ greatest concern would be physical appearance.

Conclusions: Although agreement exists among the health professions students surveyed that toenail fungus presents both a cosmetic and a health concern, inconsistencies regarding time to treatment, treating professional, and effects on quality of life persist. It is not reasonable for all medical professionals to effectively recognize and treat nail disease, but it is paramount that patients are directed to medical professionals who can accurately exclude other conditions to alleviate social and financial burdens patients may face due to onychomycosis. (J Am Podiatr Med Assoc 110(5): 1-6, 2020)

Onychomycosis, a type of nail disease, is a common fungal infection of the nail plate that can be treated by various medical specialties. The global prevalence is approximately 5.5%.¹ The most common predisposing factor is increasing age; however, patients who experience trauma, contract tinea pedis, or have a compromised immune system due

to disease, such as diabetes or human immunodeficiency virus, are at risk for this condition as well.²

Classically it is recognized that nearly 50% of all nail disease is due to fungal infections. This leaves half of all nail abnormalities attributed to underlying systemic disease, external trauma to the nail itself, or genetics.³ It is, therefore, critical to properly diagnose onychomycosis to rule out other, more serious causes of nail changes before initiating unwarranted antifungal therapy.

Today, many methods are available to clinicians for diagnosis of onychomycosis. Traditional tests include potassium hydroxide preparation, calcofluor white, periodic acid-Schiff, nail biopsy, and fungal culture. However, recently, use of polymerase chain reaction has allowed for more rapid and sensitive detection of fungal species.⁴ Studies have

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found that polymerase chain reaction provides more accurate results in a shorter amount of time despite increased cost over other diagnostic methods.⁵ In addition, dermoscopy has also been shown to be a reliable method for detection of onychomycosis. With training, a physician with a dermatoscope alone may be able to diagnose onychomycosis in up to 90% of patients.^{6,7}

To treat onychomycosis before using one of the diagnostic methods noted previously herein may be ill advised financially in the context of certain antifungal regimens. A recent study by Gupta et al⁸ in the *Journal of Cutaneous Medicine and Surgery* found that costs for incorrect diagnosis of onychomycosis range from \$350 CAD to \$1,175 CAD versus \$320 CAD to \$930 CAD with previous confirmatory testing. Conversely, a study from 2016 in the *Journal of the American Medical Association* suggested that immediate treatment with terbinafine for suspected onychomycosis is more cost-effective than pretreatment testing via potassium hydroxide or periodic acid–Schiff.⁹

Although elevation of liver enzyme levels is a commonly purported concern with terbinafine treatment regimens, a study found an increased incidence of psoriasis in patients treated with terbinafine or itraconazole for onychomycosis, thus providing more support for confirmatory testing before pharmacologic intervention.¹⁰ Furthermore, a 2017 Cochrane Review corroborates that terbinafine and/or itraconazole is advised as the most effective oral therapy for the treatment of onychomycosis but does advise confirmation of diagnosis by microscopy or culture.¹¹ Various opinions and approaches regarding testing and treatment of onychomycosis are present in the literature.

In addition to a variety of diagnostic methods, diagnosis and treatment of nail disease by podiatric physicians, dermatologists, primary-care physicians, and nurses varies based on the training of these health professionals. Because approximately half of the time a patient will present with another nail etiology that warrants efficient work-up, exploring the understanding of onychomycosis from the perspective of various health professions is important.

In a survey of third-year dermatology residents by Lee et al¹² in the *Journal of the American Academy of Dermatology* in 2011, 58% of respondents had performed fewer than ten nail procedures, and 30% felt that they were not “competent” in nail surgery thus far in residency. Furthermore, Hare and Rich,¹³ in *Dermatologic Clinics* in 2016, stated that “[r]esidents are often not taught how to work up a nail dystrophy to arrive at a differential diagnosis based

on history and clinical nail morphology.” These findings suggest that dermatologists—specialists in hair, skin, and nails—may not be adequately prepared to evaluate and treat nail disease.

A 2015 survey study of 318 home-care nurses (registered nurses, public health nurses, and licensed practical nurses) by Stolt et al¹⁴ in the *Journal of Clinical Nursing* using a Foot Care Knowledge Test found an average score of 68.5%. This gap in knowledge is concerning considering the important role that nurses serve in hospital- and home-based patient care settings.

Literature regarding training of primary-care physicians with respect to nail disease is sparse. With the previously mentioned findings in mind, the extent to which toenail disease and its etiologies—most notably onychomycosis—are understood well by podiatric, allopathic, and osteopathic medical and nursing students is questionable.

The purpose of this study was to explore current health professions students’ perceptions of onychomycosis, or “toenail fungus,” to determine the steps that health professions students would take to treat their own toenail fungus and to discuss the effects on quality of life. This study may provide a glimpse into how future medical providers may approach this condition in their patient populations. If lack of knowledge or misconceptions are discovered, then this study may help to increase awareness of general nail health and of how to more effectively treat and manage onychomycosis.

Materials and Methods

Population

The primary outcome measure was a self-reported online Google Forms survey that we developed. The survey was created with podiatric, allopathic, and osteopathic medical students as well as nursing students as the intended audiences.

After obtaining institutional review board approval from Temple University’s Human Research Protection Program (Philadelphia, Pennsylvania), the survey link was sent by e-mail to medical students at the Lewis Katz School of Medicine at Temple University, the Temple University School of Podiatric Medicine, the Philadelphia College of Osteopathic Medicine, and the Sidney Kimmel Medical College at Jefferson Medical College, as well as undergraduate students in the Bachelor of Science in Nursing program at Temple University. Unsuccessful attempts were made to distribute the survey to allopathic medical students at Drexel

Table 1. Respondent Demographic Characteristics

Program	Respondents (No. [%]) (N = 245)	Sex (No.)		Year of Training (No. [%])			
		Male (n = 83)	Female (n = 162)	1 (n = 86)	2 (n = 71)	3 (n = 51)	4 (n = 37)
Podiatric medicine	37 (15)	20	17	6	12	19	0
Allopathic medicine	100 (41)	29	71	35	40	15	10
Osteopathic medicine	79 (32)	32	47	36	14	11	18
Nursing	29 (12)	2	27	9	5	6	9

University's College of Medicine and the Perelman School of Medicine at the University of Pennsylvania. See Table 1 for respondent demographics.

Survey Content

The survey included questions pertaining to students' demographics, understanding of onychomycosis as a health and/or cosmetic concern, treatments available, and effects of the infection on quality of life. The survey asked the respondents a series of questions about what they would or would not do if they suspected they had toenail fungus. See Table 2 for a sample of the survey questions.

Statistical Analysis

The data from the Google Forms survey were exported to Microsoft Excel (Microsoft Corp, Redmond, Washington) for analysis. In Microsoft Excel, the tables and graphs were assembled and percentages calculated.

Results

Among the 245 health professions students sur-

veyed there were 37 podiatric, 100 allopathic, and 79 osteopathic medical students and 29 nursing students. Sixty-six percent of respondents were female and 34% male (Table 1).

Ninety-two percent of respondents agree that toenail fungus is both a health and a cosmetic concern (Table 2 and Fig. 1). Furthermore, 56% agree that there may be other health concerns associated with toenail fungus, 26% say that it depends on the individual, and 17% are not sure (Table 2).

If a respondent thought that he or she had toenail fungus, 77% would seek treatment. Of all of the respondents, 24% would start by seeing a medical professional and 50% by buying over-the-counter medication. When it came to seeing a medical professional, 21% would wait up to 1 week, 45% 1 month, and 20% a few months (Table 2). Overall, 57% of students reported that they would see a primary-care physician first, and only 27% and 5% would seek care from a podiatric physician or dermatologist, respectively (Table 2 and Fig. 2). Most podiatric medical students would see a podiatric physician first (86%), and most allopathic medical (69%), osteopathic medical (61%), and

Figure 1. Is toenail fungus a health or a cosmetic concern (N = 245)?

Figure 2. Seeking treatment for onychomycosis (N = 245).

Table 2. Survey Summary

Question	Answer Choices	Respondents (%)
Toenail fungus is a ...	... Cosmetic concern.	7
	... Health concern.	1
	... Both a cosmetic and a health concern.	92
	... Neither.	0
Are there any other health concerns associated with toenail fungus?	... Yes.	56
	... No.	1
	... It depends on the individual.	26
	... I'm not sure.	17
If you thought you had toenail fungus ...		
Would you seek treatment?	...Yes.	77
	...No.	4
	...Maybe.	19
What would you do first?	... Try cutting it out.	9
	... Try washing it out.	12
	... Buy over-the-counter medication.	50
	... Paint over it with nail polish.	3
	... See a medical professional.	24
	... Do nothing.	2
How long would you wait to seek treatment from a medical professional?	... <1 week.	21
	... A month.	45
	... A few months.	20
	... A year.	2
	... Depends on the season.	8
	... I would not seek treatment.	4
Where would you seek treatment?	... Podiatric physician.	27
	... Primary-care physician.	57
	... Urgent care center.	7
	... Dermatologist.	5
	... I don't know.	3
	... I would not seek treatment.	1
How much would you be willing to spend per year to treat your toenail fungus?	... Nothing.	2
	... <\$100.	62
	... \$100–\$300.	27
	... \$301–\$500.	5
	... \$501–\$1,000.	2
	... >\$1,000.	2
Which of the following would be your biggest concern?	... Finances.	1
	... Overall health.	18
	... Physical comfort.	19
	... Physical appearance.	46
	... Where did I pick up fungus?	16
Would it affect your day-to-day life?	... Yes.	42
	... No.	24
	... I'm not sure.	34
Would you be worried?	... Yes.	54
	... No.	38
	... I'm not sure.	8
Would you be annoyed?	... Yes.	73
	... No.	19
	... I'm not sure.	8
What treatments would you be willing to try? (Select all that apply.)	... I would not try any.	4 students
	... Have toenail removed.	41 students
	... Laser.	120 students
	... Take a pill.	202 students
	... Brush liquid on nail.	226 students

nursing (66%) students would see a primary-care physician first.

In terms of treatment, most of the respondents would be most amenable to a liquid brushed on the toenail, followed by a pill, laser therapy, and toenail removal. A total of 91% of the respondents would spend up to \$300 for treatment in a year, with only 4% willing to spend more than \$500 per year. A majority (62%) would be willing to spend up to \$100 (Table 2).

Regarding quality of life, 42% of the respondents claimed that having toenail fungus would affect them day-to-day, 34% were not sure, and 24% said that it would not affect them. The greatest concern of most respondents was physical appearance (46%) and not overall health. Finances were of greatest concern to only 1% of those surveyed. Having toenail fungus would worry 54% and annoy 73% of the respondents (Table 2).

Discussion

Agreement exists among the health professions students surveyed that toenail fungus presents both a cosmetic and a health concern. Yet, only approximately 77% of respondents would seek treatment for suspected onychomycosis. The results of this survey also suggest that most of the students would initially present to a primary-care physician for treatment. Whether a primary-care physician is comfortable diagnosing onychomycosis and ruling out serious differential diagnoses such as psoriasis and melanoma is beyond the scope of the present study. With the findings in *Dermatologic Clinics* by Hare and Rich¹³ suggesting that dermatology residents are undertrained regarding diagnosis of nail dystrophy, there is concern that cases of onychomycosis and other conditions may be overlooked by even specialized medical providers.

If proper evaluation and treatment is delayed, the intangible effects of onychomycosis, such as the social, mental, and economic burdens, can become crippling for some patients.¹⁵ Based on the survey results, it cannot be ignored that physical appearance is of greatest concern to those affected by onychomycosis. Regarding mental burdens, most respondents would be worried and annoyed about their toenail fungus daily. Regarding economic burdens, most of those surveyed would not be willing to spend more than \$300 a year to treat this condition, and only 4% would be willing to spend more than \$500 a year. Although it is not reasonable for podiatric, osteopathic, and allopathic physicians

and nurses alike to effectively recognize and treat the condition and its mimickers, it is paramount that patients are directed to medical providers who can alleviate any potential burdens to patients.

This survey study presents a few limitations. First and foremost, as a survey study conducted via e-mail, there is no guarantee that the students the survey was sent to took it themselves. Second, the survey was distributed only to health professions students in the Philadelphia area, so conclusions on a more national level cannot be drawn. Last, because sample sizes were small and not evenly distributed across training programs, year in training, or sex, significant conclusions cannot be drawn between groups.

Although this study is not meant to change how onychomycosis is diagnosed and treated today, it seeks to provide a unique perspective regarding a common nail disease and its effects on quality of life as understood by soon-to-be medical professionals. After completion of this Philadelphia-area study, it may be necessary to educate other health professions students in the Philadelphia area about general nail health. As a next step, studies comparing diagnosis and treatment of other pathologic conditions by various board-certified physicians may be prudent. From a public health standpoint, studies such as this could provide evidence for more targeted and worthwhile referrals in an effort to save time and money for patients, providers, and the health-care system at large.

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