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REVIEW ARTICLE

The Impact of Hyperhidrosis on Quality of Life: A Review of the Literature

Krishan Parashar[1] · **Taylor Adlam**[2] · **Geoffrey Potts**[2]

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Abstract
Hyperhidrosis is a condition of excessive sweating, which can have profound physical and mental effects. Hyperhidrosis is a significantly impactful and distressing illness that warrants equal attention as other more well-known dermatologic conditions. However, because of a lack of awareness among the public, stigma, and difficulty with access to treatments (due to cost or insurance coverage), patients are less likely to be diagnosed and treated. In hyperhidrosis, quality-of-life surveys can be useful for determining the magnitude of symptoms and to evaluate treatment outcomes. The purpose of this study was to conduct a narrative literature review to investigate the impact of hyperhidrosis on quality of life. A total of 49 articles investigating the impact of primary hyperhidrosis on quality of life were selected for the review. Hyperhidrosis is a potentially debilitating illness that affects multiple domains of patients' lives including their psychological, physical, and social functioning. Despite the significant impacts, patients with hyperhidrosis are less likely to seek care. Here, we explore these impacts, and disparities in care, in more detail.

Key Points

Hyperhidrosis sufferers report a decreased sense of well-being, increased anxiety and depression, and functional, social, occupational, and physical impairments.

Hyperhidrosis is a significantly impactful and distressing illness that warrants equal attention as other more well-known dermatologic conditions.

1 Introduction

Hyperhidrosis (HH) is a disorder of significant sweating out of proportion to body temperature homeostatic requirements [1, 2]. It can be classified as either focal or systemic based on distribution, and primary (idiopathic) or secondary based on etiology [3]. The axillae are the most commonly affected region in primary focal HH due to the large number of sweat glands in this area and sensitivity to both heat and stressful stimuli [3]. Other commonly affected regions include plantar, palmar, and craniofacial [1–3]. Hyperhidrosis is estimated to affect 4.8% of the US population or approximately 15.8 million people [3].

Hyperhidrosis can significantly impact mental health, self-esteem, social interactions, relationships, and occupational choices [4]. Patients with primary HH compared with those without HH report greater disabilities in work/school, social functioning, and emotional health [5]. Up to 48% of patients with HH report poor or very poor quality of life (QoL) [6]. Excessive sweating can also result in physiological stressors such as cold and clammy hands, dehydration, and skin infections [4]. Stress from social situations may also trigger sweat production, which in turn perpetuates the cycle of stress and HH, impacting the QoL of patients with HH [1, 7].

Quality of life is described by the World Health Organization as an individual's own perception in comparison to their expectations of their own QoL [8]. This might be influenced by their goals, the culture and values of the society in which they live, and societal standards [8]. Quality of life is inherently a subjective and multifactorial measurement and

✉ Krishan Parashar
gs8544@wayne.edu

[1] Wayne State University School of Medicine, 540 E. Canfield Ave., Detroit, MI 48201, USA

[2] Department of Dermatology, Wayne State University, Detroit, MI, USA

relates to all aspects of an individual's living experience. Various validated tools have been described in the literature for the assessment of QoL in dermatologic conditions. Specifically, in HH, QoL surveys can be useful for determining the magnitude of symptoms and to evaluate treatment outcomes of dermatologic illnesses [1, 3, 4]. Quality-of-life tools are also relevant in raising disease awareness by identifying patients with unmet healthcare needs and providing insight into the patients' perspective [8]. The interpretation and publication of QoL data promotes changes in healthcare legislation and the distribution of resources to patients [8]. A wide range of validated tools are used in HH QoL studies. No standardized QoL index exists. The most used tools are the Hyperhidrosis Disease Severity Scale (HDSS) and the Dermatology Life Quality Index (DLQI) [4]. Based on the abundance of QoL studies in diseases such as eczema and psoriasis, there is a relative lack of QoL studies in HH. In this review, we summarize and discuss the existing literature on QoL in patients with HH from data obtained from QoL tools.

2 Methods

A search was conducted on PubMed with the following terms: "hyperhidrosis" and "quality of life" for all relevant sources from 2011 to August 2022 in PubMed. Inclusion criteria: English language, peer-reviewed clinical trials, prospective studies, retrospective studies, and review articles. Articles were included if they investigated patients with primary HH and the use of a QoL instrument to assess pre-treatment QoL. Exclusion criteria: studies investigating patients with secondary HH or meta-analyses. Studies that lacked a QoL instrument and did not investigate pre-treatment QoL were excluded. A total of 391 citations were identified from our literature search. Of these, 61 were selected for further evaluation based on the relevance of the title and abstract. A total of 49 articles examining the QoL in patients with primary HH were finally included in this review. Figure 1 demonstrates the flow diagram for article selection. Table 1 provides a summary of each study.

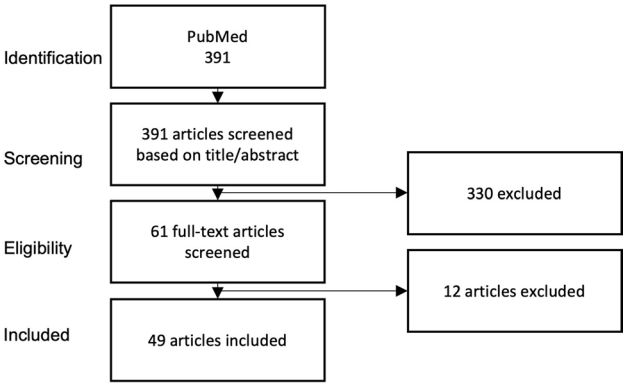

Fig. 1 Flow diagram for article selection

3 Results

3.1 Psychological Impacts: Anxiety and Depression

Patients with HH report a high level of psychological strain with an increased association of HH with both anxiety and depression [9]. In social situations, stress triggers sweat production, in turn, leading to higher stress levels. This vicious cycle has an exponentially increasing negative effect on the QoL of patients with HH [1, 7].

Gross et al. found that affected persons experienced more depressive symptoms compared with normal sweating control subjects, which were caused by feelings of shame and a lack of self-confidence [10]. In the same study, the subgroup of patients with axillary HH experienced the highest impact of increased chronic stress and higher levels of embarrassment [10]. Anxiety and depression were also found in patients with primary HH pre-sympathectomy [11]. During the coronavirus disease 2019 pandemic, patients reported higher levels of depression compared with the general population [12]. Heiskanen et al. found that depression was a common comorbidity in 511 patients with localized (11.6%) and generalized HH (28.6%) [13]. Anxiety was found in 12.7% of patients with generalized HH [13]. In a sample of 44,484 patients with HH, Klein et al. determined that patients had a higher odds of depression and anxiety compared with controls at baseline and follow-up [14]. Using healthcare claims data, they found that a small portion of patients (51.6%) received antiperspirant prescription treatment [14]. Patients were followed 12 months after the earliest International Classification of Diseases diagnosis code or prescription claim, and 48.4% of these patients had not filled a prescription for antiperspirants [14]. This could be due to a lack of awareness of treatment options and HH not being seen as a medical condition by some insurance companies, patients, and physicians [3]. A study found that 51% of patients have discussed HH with healthcare providers, with 60% of these patients not knowing it was a medical condition, and 47% believing nothing could be done [3].

Several studies show that HH treatments decrease sweat production and improve psychosocial symptoms. Sympathectomy was found to improve social esteem [15] and emotional scores as per the Hyperhidrosis Quality of Life Questionnaire (HQLQ) [16], a tool that scores QoL from one to five in four domains (functional, personal life, emotional self, and special circumstances) [17–22]. However, for patients undergoing thoracic sympathectomy, reflex sweating also known as compensatory HH may develop

Table 1 Studies investigating the effects of hyperhidrosis (HH) on QoL

Source [citation]	QoL scale	Study manuscript type	Sample (patients with HH)	Effect on QoL
Shayesteh et al. 2019 [1]	Interview	Qualitative interviews	15	Patients with primary HH reported feeling filthy and had difficulty managing symptoms. HH causes stigma and stress, which perpetuates sweating.
Doolittle et al. 2018 [3]	HDSS, survey	Survey/cross-sectional study	8160	Prevalence of HH is 4.8%. Only 51% of patients had discussed the condition with a healthcare professional. This is due to not thinking it is a medical condition (60%) or believing that there is nothing that can be done to treat it (47%). 70% of patients had a HDSS score of 3 or 4.
Lenefsky et al. 2018 [4]	N/A	Review	N/A	HH impacts lifestyle, social life, mental health, and professional life.
Lessa et al. 2014 [5]	Trier Inventory of Chronic Stress, Skindex-16	Prospective study	40	Patients with primary HH had worse QoL per Skindex-16 in the emotional (69.46 ± 30.55 vs 36.69 ± 33.84), symptom (17.15 ± 18.62 vs 27.44 ± 25.76), and functional domains (66.66 ± 33.54 vs. 24.59 ± 30.21) compared with patients without HH with other skin conditions (psoriasis, pigmentary conditions, skin infections). There was a higher incidence of anxiety disorder in patients with HH.
Hasimoto et al. 2018 [6]	HQLQ	Survey study	23	48% reported poor or very poor QoL. Patients reported embarrassment (33.3%), shame (25%), and discomfort (16.7%). Six patients saw a medical professional.
Kamudoni et al. 2017 [7]	Focus groups, interviews, online survey	Survey study, qualitative interviews	71	HH impacted daily life, mental and physical health, social and professional life. Patients spent excessive time managing their symptoms.
Kristensen et al. 2020 [9]	N/A	Review	N/A	Anxiety and depression ranged from 0 to 49% and from 0 to 60%, respectively, in patients with primary HH.
Gross et al. 2014 [10]	Trier Inventory of Chronic Stress, Beck Depression Inventory	Prospective study	40	Patients with primary HH experience more depressive symptoms and have a higher level of chronic stress compared with patients without HH.
Dias et al. 2016 [11]	Hospital and Anxiety Depression Scale	Survey study	54	Anxiety and depression were found in patients with primary HH pre-sympathectomy. CH after sympathectomy is associated with anxiety and worse QoL.
Woo et al. 2022 [12]	PHQ-9	Survey study, cross-sectional	222	Mean PHQ-9 score was 5.25 among patients with HH, which was higher than the general population during the COVID-19 pandemic. 10% of patients had progressively worsening symptoms and 30% had difficulty obtaining treatment.
Heiskanen et al. 2022 [13]	N/A	Retrospective study	511	11.6% of patients with primary HH had depression.
Klein et al. 2020 [14]	N/A	Survey study, cross-sectional	44,484	Higher odds of depression and anxiety compared with controls. Majority of patients did not obtain antiperspirant prescription after diagnosis.
Dharmaraj et al. 2016 [15]	QoL questionnaire and Rosenberg Self-Esteem Questionnaire	Pre-post interventional study	46	Sympathectomy was found to improve social esteem in patients with primary HH. Patients were found to have an increased risk of cutaneous disease at baseline.

Table 1 (continued)

Source [citation]	QoL scale	Study manuscript type	Sample (patients with HH)	Effect on QoL
Rieger et al. 2015 [17]	Keller, HQLQ, SF-36	Pre-post interventional study	52	Patients with pre-sympathectomy plantar HH had elevated Keller scores (denoting impairment in physical tasks such as putting on socks, wearing sandals, and walking barefoot) and HQLQ scores (3.69 in general domain, 2.08 in functional domain, 2.21 in personal domain, 2.70 in emotional response domain, and 3.04 in the special circumstances domain) that improved following treatment. Pre-operative SF-36 showed poor physical and mental component summary scores that increased following surgery.
Lima et al. 2018 [19]	HQLQ	Pre-post interventional study	58	89.8% of patients with plantar HH have very poor QoL prior to sympathectomy. Patients reported: instability of feet using open shoes/heels, sprains, sweat puddles, and frequently changing socks.
Hajjar et al. 2019 [20]	HQLQ	Pre-post interventional study	100	Among patients with primary HH, 49% poor QoL, 34% reported very poor QoL. The mean decrease in QoL scores was − 42.0 points toward better QoL.
Hur et al. 2022 [21]	HQLQ	Pre-post interventional study	30	Mean pre-sympathectomy QoL score for patients with plantar HH was 91.8 ("very bad" QoL), and the postoperative 12 months (QoL) score improved to 29.1 ("much better" QoL).
Zhang et al. 2022 [22]	HQLQ	Pre-post interventional study	367	Median pre-sympathectomy QoL score for patients with plantar HH was 40, and postoperative 12 months (QoL) score improved to 20.
Gong et al. 2013 [23]	Beck Depression Inventory, Beck Anxiety Inventory	Pre-post interventional study	19	Patients with CH had reduced anxiety and depression after treatment with oral glycopyrrolate.
Shayesteh et al. 2016 [24]	HDSS, SF-36	Pre-post interventional study	114	Patients with primary HH have lower mental (39.8 ± 11.2) and physical scores in the SF-36 compared with the general population denoting poorer QoL. No significant differences in anxiety, depression, or alcohol intake between patients with HH and controls.
Henning et al. 2022 [26]	SF-12	Retrospective cohort	2794 (self-reported HH) 284 (hospital diagnosed HH)	Self-reported HH associated with reduced mental and physical SF-12 scores. Hospital diagnosed HH was associated with reduced mental SF-12 scores.
Parrish et al. 2020 [27]	HDSS, DLQI, Zung Self Rating Anxiety, Social Phobia Report	Pre-post interventional study	24	Among patients with axillary HH, 50% had social anxiety, 50% had generalized anxiety, 48% reported social avoidance, and 38% were anxious/depressed. Symptoms improved after microwave thermolysis. Pre- and post-treatment DLQI scores were 12.92 and 3.68, respectively.
Kjeldstrup et al. 2020 [28]	Skindex-16, DLQI	Prospective study	98	A Skindex-16 comparison among 98 patients showed that patients with HH scored similarly to patients with psoriasis in the emotion domain and higher than patients with eczema. In the functioning domain, patients with HH scored higher than psoriasis, eczema, and acne, indicating a more significant negative impact of the illness.
Glaser et al. 2018 [30]	Interview	Survey study, qualitative interviews	1985	The top three areas impacted by excessive sweating were daily activity, clothing choice, and work/career.

Table 1 (continued)

Source [citation]	QoL scale	Study manuscript type	Sample (patients with HH)	Effect on QoL
Hamm et al. 2014 [31]	N/A	Review	N/A	Describes the impact of primary HH on physical symptoms, i.e., axillary HH causes staining of clothes and frequent bathing. Palmar HH reportedly affects manual activities and handling objects.
Elalfy et al. 2017 [32]	Keller	Pre-post interventional study	42	Patients with palmo-axillo-plantar HH had elevated Keller scores in all domains plantar (i.e., impairment in tasks such as putting on socks, wearing sandals, and walking barefoot), axillary, and palmar.
Shayesteh et al. 2017 [33]	HDSS, SF-36	Retrospective study	188	5.5% sought medical healthcare help for problems. Lowest SF-36 mental component scores in axillary, palmar, and plantar HSS. HDSS severe in axillary and palmar, mild in plantar and facial.
Schick et al. 2016 [35]	HDSS, DLQI	Pre-post interventional study	30	Prior to radiofrequency thermotherapy, the DLQI score for axillary HH was 16 representing a severe baseline QoL effect. The DLQI score improved to 7 after treatment.
Cohen et al. 2019 [36]	DLQI, HDSS, Odor Scale	Pre-post interventional study	20	Prior to percutaneous radiofrequency, the DLQI score for axillary HH was 11.4 representing a severe baseline QoL effect. The DLQI score improved to 0.4 after treatment.
Abtahi-Naeini et al. 2015 [37]	DLQI	Pre-post interventional study	25	The mean ± SD of the DLQI score before microneedle radiofrequency treatment was 12.96 ± 5.93 denoting severe QoL. The mean DLQI post-treatment was 4.29 ± 2.21.
Zhang et al. 2022 [38]	HDSS, DLQI	Pre-post interventional study	119	Pre-microwave therapy for patients with primary HH had a mean DLQI score of 14, indicating severe QoL that improved to 2.89 following treatment.
Wolosker et al. 2020 [39]	HQLQ	Pre-post interventional study	1658	94% of patients had poor/very poor QoL. Palmar HH was the most severe. QoL improved in 77% of patients after oral oxybutynin.
Wolosker et al. 2014 [40]	HQLQ	Pre-post interventional study	565	65.5% of patients with very poor pre-treatment QoL and 75% patients with poor pre-treatment QoL had improved QoL after oral oxybutynin.
Almeida et al, 2020 [41]	HDSS	Pre-post interventional study	30	Patients with primary HH with HDSS scores of 3 or 4 have a significant improvement in their HDSS scores after oxybutynin treatment.
Wang et al. 2011 [42]	HQLQ	Pre-post interventional study	120	63.3% of patients with palmar HH have very poor QoL pre-sympathectomy.
Dogru et al. 2020 [43]	HQLQ	Pre-post interventional study	165	Among patients with palmar HH, 38.2% have very poor QoL, 45.5% have poor QoL. The patients' mean preoperative QoL score was 86.5 ± 12.5, which improved to 38.8 ± 16.3 post-operatively.
Baroncello et al. 2014 [44]	HQLQ	Pre-post interventional study	51	The average QoL related to primary HH with a score of 0–100 before sympathectomy was 34.6 and after was 77.1.
Kouris et al. 2014 [45]	HDSS, DLQI	Pre-post interventional study	119	Patients with primary HH have a median DLQI of 20, indicating severe QoL, which improved to 3 following treatments with botulinum toxin.
Asfour et al. 2022 [46]	HDSS, DLQI	Pre-post interventional study	40	Patients with axillary HH had a median HDSS score of three and a DLQI score of 13.5 (indicating a very large effect of HH on QoL). The median HDSS and DLQI score improved to one following treatment with botulinum toxin.

Table 1 (continued)

Source [citation]	QoL scale	Study manuscript type	Sample (patients with HH)	Effect on QoL
Ando et al. 2022 [47]	HDSS, DLQI	Pre-post interventional study	15	Patients with head and forehead HH receiving pre-botulinum toxin treatment had a mean HDSS score of 3.13 and a DLQI score of 8.625 (resulting in a very large effect on QoL). This improved significantly following treatment after up to 50 weeks.
Mirkovic et al. 2018 [48]	DLQI	Retrospective study	366	Median DLQI score pre-treatment was 11 for children aged 16–17 years and 12 for children aged younger than 16 years. Scores improved post-botulinum treatment. Examples of physical symptoms were cold hands, wet clothes, and eczema.
Bohaty et al. 2014 [49]	N/A	Review	N/A	HH affects psychosocial and social development. Children report difficulty handling a pen or pencil, keeping school papers dry, riding a bicycle, and using a game controller.
Wolosker et al. 2014 [50]	HQLQ	Pre-post interventional study	45	Prior to starting oral oxybutynin treatment in children aged under 14 years with palmar HH, 57.8% had a very poor QoL vs 40% post-treatment.
Kuijpers et al. 2013 [51]	HDSS, Skindex-29	Pre-post interventional study	100	More than three quarters of patients with palmar and/or axillary HH have poor Skindex-29 scores in the emotions (57.7 ± 18.5) and functioning domain (54.2 ± 18.2). Pre-sympathectomy HDSS score was 3.69 ± 0.47 vs 1.06 ± 0.34 postoperatively.
Morard et al. 2019 [54]	HDSS and 10 question survey	Survey study, cross-sectional	185	Prevalence of primary HH was 20.56% in medical students (185/900). 23.89% had a HDSS score of 3 or 4, 89.20% had a HDSS score of 2–4.
Muthuswamy et al. 2016 [55]	HDSS, DLQI	Survey study, cross-sectional	187	38% of college students had HH. Average DLQI scores for male students were 7.96 and for female students were 7.15, signifying a moderate effect. 35% of students needed appropriate management.
Kouris et al. 2015 [56]	cDLQI	Case series	35	cDLQI scores pre- and post-botulinum in adolescents was 14.65 ± 2.35 and 4.20 ± 1.41, respectively. Social isolation scores improved post-botulinum.
Dobosz et al. 2019 [57]	FACIT	Survey study, cross-sectional	149	Compared with the controls, patients with palmar HH had lower (poor QoL) FACIT scores especially in the emotional well-being and social well-being domains. Pre-sympathectomy scores were 66.57 ± 16.33 vs 91.29 ± 11.13 in the controls. FACIT improved post-surgery to 90.28 ± 11.13.
Augustin et al. 2013 [58]	N/A	Survey study	2340	27% of patients consulted a physician. Excess of sweat increased the risk for fungal, bacterial, or viral infections. Psoriasis was a common comorbidity.

cDLQI Children's Dermatology Quality Life Index, *CH* compensatory hyperhidrosis, *COVID-19* coronavirus disease 2019, *DLQI* Dermatology Quality Life Index, *FACIT* Functional Assessment of Chronic Illness Therapy, *HDSS* Hyperhidrosis Disease Severity Scale, *HQLQ* Milanez de Campos Questionnaire or Hyperhidrosis Quality of Life Questionnaire, *N/A* not applicable, *PHQ-9* Patient Health Questionnaire-9, *SD* standard deviation, *SF-12* Short Form Health Survey 12, *SF-36* Short Form Health Survey 36, *QoL* quality of life

and has been associated with anxiety although overall patient satisfaction was preserved [11]. One study found that patients with compensatory HH had reduced anxiety and depression after treatment with oral glycopyrrolate [23]. Shayesteh et al. examined the QoL in patients ($n = 114$) with primary HH pre- and post-botulinum toxin treatment [24]. Patients reported lower mental component scores in the 36-Item Short-Form Health Survey compared with the general population and compared with physical component scores. However, there were no significant differences in anxiety, depression, or alcohol intake between patients with HH compared to the general population when using a tool specifically evaluation anxiety and depression. The 36-Item Short-Form Health Survey measures patient-centered outcomes such as basic daily function and emotional status, rather than focusing on disease-specific outcomes [25]. A similar study utilized the 12-Item Short Survey Form and found that patients with self-reported HH had reduced mental and physical QoL scores compared with patients without HH [26]. Parrish et al. found, in patients with severe sweating at baseline ($n = 24$), 50% had social anxiety, 50% had generalized anxiety, 48% reported social avoidance, and 38% were anxious/depressed [27]. There was an improvement in social anxiety, anxious/depressive symptoms, and social avoidance after treatment with microwave thermolysis [27].

The psychological impact of HH may be equal or greater to other inflammatory skin diseases including psoriasis and acne [28]. The Skindex poses questions in three domains: physical symptoms, emotions, and functions. It specifies impact via gauging how often the impact occurs (never, rarely, sometimes, often, or all the time during previous 4 weeks). The DLQI addresses functional impairments caused by skin diseases while the Skindex-16 concentrates on the mental and emotional impacts and is more sensitive in detecting mild impairments in QoL [29]. Lessa et al. found that patients with primary severe HH compared with patients without HH diagnosed with other skin conditions, such as psoriasis, pigmentary conditions, or skin infections, had worse QoL as measured by the Skindex-16 in the emotional, symptom, and functional domains [5]. Furthermore, patients had a higher incidence of comorbid social anxiety disorder [4, 5].

3.2 Physical Impacts

Hyperhidrosis has a negative physical impact on patients. Excessive sweating affects activities of daily living such as wearing clothes, hygiene, and running errands. At least 40% of patients with HH report physical discomfort based on focus groups, interviews, and online survey data [4, 7]. In one survey, Glaser et al. found that patients reported three main affected areas: daily activities, clothing choices, and occupation [30]. They found that patients avoided various activities such as shopping because of anxiety and embarrassment. Similarly, in another study of 71 patients, 41% reported that their illness affected their choice of hobbies (such as knitting or yoga) and 50% reported that their activities are restricted by their illness [6].

As HH can affect the face, palms, axillae, and abdominal-lumbar area, symptoms can also be site specific [18]. Patients with primary axillary HH spend more time and energy on their personal hygiene whereas patients with plantar HH often experience more occupational impairment [31]. Patients with primary axillary and inguinal HH have reported staining of clothes, restricting clothing choices, and frequent bathing [31]. Palmar HH reportedly affects manual activities and handling objects such as knitting, driving, opening doors, playing sports, hand shaking, electrical shocks in those with mechanical occupations, and corrosion of commonly touched objects [31]. In one study, patients with plantar HH had impairment of physical tasks such as putting on socks, wearing sandals, and walking barefoot as identified by elevated Keller scores, a tool used to measure pre- and post-operative QoL in patients receiving sympathectomy [17, 32]. Other symptoms of plantar HH include instability of feet using open shoes or heels, sprains, formation of sweat puddles, and a frequent need to change socks [19].

Prior to sympathectomy, primary HH has been shown to impact the functional/social domain score severity as per the HQLQ, which includes tasks such as writing, leisure, or sports [17, 19]. These scores improved after sympathectomy [17, 19]. The HDSS is a four-point scale that ranges from one (never noticeable and never interferes with activities) to four (intolerable and always interferes with activities). Shayesteh et al. reported that individuals with axillary HH have the highest interference from their illness in daily life and HDSS scores followed by palmar HH [33]. The DLQI is a ten-item survey that assesses the impact of on symptoms, daily activity, leisure, work, and treatment [34]. According to Hongbo et al. the DLQI scores can be grouped into 0–1 no effect, 2–5 small effect, 6–10 moderate effect, 11–20 very large effect, and 21–30 extremely large effect [34]. Prior to treatment with microwave thermolysis, radiofrequency, or fractionated micro-needle radiofrequency, the DLQI scores for patients with axillary HH are reported to range from 11.4 to 16, representing a severe baseline QoL effect [27, 35–38]. The DLQI scores improve to between 0.4 and 7 after treatment with microwave thermolysis, radiofrequency, or fractionated micro-needle radiofrequency [27, 35–38].

In a sample of 1658 patients with primary HH, 94% had a poor to very poor QoL, per the HQLQ, with palmar HH being the most severe [39]. In this study, QoL improved in 77% of patients after treatment with oral oxybutynin [39]. Accordingly, oxybutynin has also shown efficacy in patients with baseline impaired QoL [40, 41]. Thirty eight

to 63 percent of patients with primary palmar HH [42–44] and 89.8% of patients with plantar HH have very poor QoL prior to treatment with sympathectomy [19]. In two studies, prior to treatment with botulinum toxin, adults with primary HH had a median DLQI of 20 [45] and 13.5 [46], indicating severe QoL in patients. The DLQI scores improved to three [45] and one [46], respectively, following treatment with chemo-denervation with botulinum toxin. The impact of head and forehead HH has been poorly investigated in the literature. Prior to botulinum toxin treatment, patients head and forehead HH had a mean HDSS of 3.13 and DLQI of 8.625 (indicating a very large negative effect on QoL), which improved significantly following treatment after up to 50 weeks [47].

A common theme in the qualitative literature is patients with HH reporting how time consuming their illness is to manage. Patients report spending 15–60 minutes a day managing their symptoms, and 50–70% report changing their clothes more than twice a day [7]. Physical impacts in children have also been reported. Mirkovic et al. tested the pre- and post-QoL in pediatric patients treated with botulinum toxin [48]. The mean DLQI score for children aged older than 16 years was 12, indicating a severe influence on QoL. Examples of physical symptoms were cold hands, wet clothes, and eczema [48]. Speaking with children, they found that wet cold parts of the body are impractical and uncomfortable [48]. Some difficulties reported by children were handling a pen or pencil, keeping school papers dry, riding a bicycle, and using a computer mouse or video game controller [49]. Prior to starting oral oxybutynin treatment in children under 14 years of age with palmar HH, 57.8% had a very poor QoL versus 40% post-treatment [50].

3.3 Social Impacts

Hyperhidrosis has a significant negative impact on patients' social life and interactions. Seventy-five percent of patients have reported impairment in social life, and emotional and mental health [3]. Excessive sweating can result in embarrassment, anxiousness, sadness, anger, and feelings of hopelessness [6]. Patients with HH may have difficulty in most aspects of social relationships such as physical contact, personal relationships, and intimacy [1, 7]. Patients report distress from a lack of being able to hide their symptoms and low self-esteem from worrying about other peoples' perceptions of them. They may exhibit avoidance behaviors, evading social situations, limited career opportunities, poor intimacy, or altered personal relationships because of their symptoms [2]. More than three quarters of patients with palmar and/or axillary HH have poor Skindex-29 scores in the emotions and functioning domain [51]. This shows how HH can impact social and professional performance and create emotional stress [51]. Based on a survey sent to patients, the most common reported psychosocial effects were embarrassment (33.3%), followed by shame (25.0%), and discomfort (16.7%) [6]. Patients reported having distress when entering enclosed environments and shaking hands [6]. The Work Limitation Questionnaire is a 25-item tool that quantifies the impact of disease on employment and measures the loss in work productivity as a percent reduction relative to controls [52]. As per the Work Limitation Questionnaire, a sample of patients with palmar HH had a mean productivity loss of 7.24%, which corresponded to a significant financial loss [52].

Shayesteh et al. conducted interviews with male patients and found that a commonly reported theme was feeling filthy and struggling to control or hide symptoms [1]. Patients had issues preparing for a sweat attack, withdrawing from close contacts, and worrying about other people's perceptions [1]. One major social theme was the lack of understanding from others causing stigma and poor mental health [1, 10]. In contrast to the study with men, women with primary HH are negatively affected by societal expectations of women and gender norms [53]. Female patients felt that their symptoms were not seen as feminine by society, and had a negative impact on the "female image" [53]. Kamudoni et al. similarly found that three quarters of participants had challenges in social situations resulting in social avoidance [7]. Patients were more self-aware and had reduced self-confidence [7]. Like the study by Shayesteh et al., patients had trouble hiding their symptoms and report feeling disgusting [1, 7].

Few studies exist examining the social impact of HH on pediatric and young adult patients. Some of our own are not immune with HH affecting 20.56–38% of medical students [54, 55]. Teenagers can feel especially embarrassed in social situations because of the social pressures of their age group during a critical time in social identity development. Kouris et al. found that the children's DLQI and social isolation scores in adolescents with primary axillary and palmar HH were elevated at baseline, and improved after treatment with botulinum toxin [56]. Hyperhidrosis has also been shown to affect psychosocial and social developmental in pediatric patients [49]. Prior to sympathectomy, patients with primary HH have elevated HQLQ scores in the "personal life" domain, denoting difficulty in intimate touching and holding hands [17, 19]. This improved following sympathectomy [17, 19]. One study utilizing the Functional Assessment of Chronic Illness Therapy questionnaire on patients with palmar HH versus controls found that patients with palmar HH before sympathectomy had poor scores in the emotional well-being and social well-being domains [57].

Chronic stress has also been reported in patients with HH. As per Gross et al., in a comparison of patients with HH to patients without HH, patients with HH were in a state of

higher chronic stress as assessed by the Trier survey, reporting a "lack of social recognition", social overload, work demands, and chronic worrying [10].

3.4 Medical Impacts

Hyperidrosis is associated with other comorbidities, which may contribute to worsening QoL. For example, Augustin et al. found that patients with HH frequently experienced psoriasis and onychomycosis [58]. Patients are found to have an increased risk of cutaneous disease with fungal (such as tinea pedis, candida, and onychomycosis), bacterial (especially pitted keratolysis), or viral infections (especially verruca) [15, 58]. Excess sweat creates an environment suitable for skin barrier disruption, colonization, and infection [58]. Furthermore, primary focal HH increases the site-specific risks of dermatophytosis and vulgar/plantar warts [31]. Excess sweating of the hands can also cause soreness, crackled skin, and eczema [7]. One study found an association between focal HH with migraine, asthma, and atopic dermatitis [13]. Hand eczema was associated with local rather than generalized HH [13]. Generalized HH was linked to hypertension and obesity, which has been shown in other studies. However, it is not clear why this association exists, albeit theories include excess cortisol from stress through activation of the sympathetic nervous system [13]. Hyperhidrosis has also been found to be associated with alexithymia, fatigability, asthenia, and self-forgetfulness [31]. Each of these physical symptoms themselves impact QoL and morbidity in a way that is not yet well studied or reported in the literature.

3.5 Barriers to Treatment

A significant barrier to treating HH is the lack of patients seeking out medical care. A survey of 1958 patients revealed that 48.9% of patients sought treatment after 10 or more years after the onset of HH [30]. Hasimoto et al. found that only 20% afflicted sought a health professional [6]. Heiskanen et al. found that patients had a delayed diagnosis more than 10 years in 36.8% of the patients [13]. Most patients try to modify their lifestyle and adapt to the problem independently.

The stigma of HH may prevent patients from seeking treatment [1]. For example, patients have reported negative experiences talking about their symptoms and living in societies that view sweating as "dirty" [1, 10]. Kamudoni et al. conducted a series of patient interviews and surveys on patients attending support groups [7]. Sixty four percent of patients reported unmet healthcare needs such as a lack of access, inadequacy of information, and paucity of psychological support in dealing with HH [7]. One third of participants said that information on HH is inadequate and worry that healthcare practitioner knowledge and public awareness are limited [7]. Participants in the study reported barriers to care leading to a lack of satisfaction with management of their condition including difficulty obtaining accurate diagnosis, poor access to treatment, and a poor patient-doctor relationship [7]. Intervention is integral such as counseling, education, and psychotherapy. Patients stated that getting diagnosed could be humiliating and patients felt that their symptoms were not considered by the physician [7].

4 Discussion

Hyperhidrosis has been shown to impact multiple domains of QoL significantly negatively. The results of each study are summarized in Table 1. Hyperhidrosis sufferers report a decreased sense of well-being, increased anxiety and depression, and functional, social, occupational, and physical impairments.

Distress in social situations stems from embarrassment and discomfort on how others may perceive symptoms. Patients also report a sensation of uncleanliness and feel they cannot hide their symptoms. These symptoms in turn cause social anxiety, reduced self-efficacy, and lead to avoidance behaviours. The stress of symptoms causes further sweating and stress, creating a self-fulfilling cycle. Symptoms in the pediatric population are particularly significant, affecting social and functional development and having potential long-term effects. This is an area that deserves further research [48–50, 56].

Hyperhidrosis can make daily mundane tasks, such as writing or opening doors, considerably difficult. Patients can spend significant time trying to manage their symptoms and caring for personal hygiene. These symptoms can cause patients to modify their behavior and life choices, including hobbies, clothing, and occupation. Axillary followed by palmar HH appear to be the most severe types of HH [33]. Hamm et al. also revealed that axillary HH was more severe than palmar HH [59]. In contrast, another qualitative study utilizing interviews showed that the overall impacts of palmar, plantar, and axillary HH were similar [7]. More high-powered studies are needed to characterize the differences in QoL by the location of symptoms and should include other forms of HH such as craniofacial and plantar.

Evidence supports the association of HH with an increased risk of cutaneous infections and atopic dermatitis, though QoL measures have a larger detriment on patient function. Other associated comorbidities have been reported such as migraine, asthma, obesity, self-forgetfulness, asthenia, and fatiguability. Overall, the association between HH and these comorbidities should be studied further, and more research is crucial to understanding how these comorbidities affect QoL. It is reasonable to conclude that physicians should monitor for these associated conditions in patients

with HH to tailor their treatments. Furthermore, early treatment of underlying HH may prevent the development or exacerbation of these conditions in the future.

Hyperhidrosis is a relatively understudied disease compared to its high prevalence in the general population. Literature reveals that the QoL of HH is comparable to other chronic diseases such as psoriasis, eczema, kidney failure, and rheumatoid arthritis [6]. A Skindex-16 comparison among 98 patients showed that patients with HH scored similarly to patients with psoriasis in the emotion domain and higher than patients with eczema [28]. In the functioning domain, patients with HH scored higher than psoriasis, eczema, and acne, indicating a more significant negative impact of the illness [28]. In another study by Hamm et al., the DLQI scores of patients with palmar and axillary HH were comparable to other dermatologic diseases such as inpatient eczema and psoriasis [59]. Despite this, the severity of HH and its impact on QoL are not reflected in the volume of research.

This discrepancy translates clinically as well. A lack of provider awareness of the severity of the disease limits access to effective treatment. Patients with HH are often underdiagnosed and many patients do not seek treatment. Diseases such as psoriasis, acne, and eczema present with well-defined visible lesions, and are quite familiar to patients and providers. In comparison, HH might present as a less visible intermittent illness, and affected patients might be missed by clinicians. Patients may also be less likely to self-report symptoms because of the stigma and embarrassment surrounding the illness or a belief that no treatments exist. There is also a prevailing belief, exacerbated by spotty insurance coverage, that HH is not a distinct medical condition, and thus nothing can be done to treat it [2]. Patients are rarely aware of their condition and sparingly seek medical attention [16]. One study reported low percentages of patients receiving prescription topical or oral treatments and patients who underwent surgery [14]. Baseline scores of depression or anxiety were associated with a 23% lower odds ratio of receiving HH treatment as well as increasing age and male sex [14]. Despite there being many treatments such as antiperspirants, oral and topical anticholinergics, botulinum toxin, microwave thermolysis, radiofrequency, and sympathectomy that improve QoL, there is a lack of knowledge and comfort regarding treatment options in the medical community.

Our results also demonstrate that although there is an interest in exploring the QoL in patients with HH, the studies use a variety of different tools and instruments to determine this impact with little consistency. Most extant studies identify the QoL in patients pre- and post-treatment, but there is a significant lack of prospective and retrospective studies identifying QoL independently. The results included in this paper are based solely on qualitative data, which are subject to interpretation and subsequent limitations. However, QoL is health index that is inherently subjective and entirely comprises a patient's reported life experience. Objective measurement tools of HH through filter paper gravimetric testing are variable and intermittent given the nature of primary focal HH. Last, selection bias might be present in the pre-treatment population, which might be more likely to report very severe disease in comparison to the average patient with HH.

5 Conclusions

In summary, HH has a profound physical and mental impact on patients. Existing literature as reviewed in this paper indicates that HH is in fact a significantly impactful and distressing illness that warrants equal attention as other more well-known skin conditions. Despite this, patients are less likely to be diagnosed and treated. A lack of adequate volume of research has also been demonstrated. Contributing factors include a lack of understanding and knowledge amongst patients and providers, stigma, and embarrassment. Alongside improving medical education about HH amongst dermatologists and primary care providers, patient education is also key to successfully treating this disease. There is great scope here for further research and education about HH, and thus an opportunity for a positive impact on patients' lives.

Declarations

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