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The effects of autoimmune blistering diseases on work productivity: A review☆

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ABSTRACT

This review examines the work productivity in patients with autoimmune blistering diseases (AIBDs). Work productivity and employment are important aspects of a patient's life, which can be affected by diseases. The Work Productivity and Activity Impairment Questionnaire (WPAIQ) is a validated instrument that can measure work productivity and assess the impact of disease on patients' work lives. There is currently a paucity of research that investigates the reason why AIBDs cause such a large impact on work productivity and whether AIBDs affect employment status. Using quality of life (QoL) instruments in conjunction with the creation of an adapted WPAIQ to examine the reasons behind work impairment may further characterize these effects and unveil a deeper understanding of stigmatization in the workplace as a factor of loss of work productivity.

Introduction

Autoimmune blistering diseases (AIBDs) refer to a group of diseases that manifest as blisters due to the action of autoantibodies against adhesion proteins in the skin. The major subtypes of AIBD are pemphigus vulgaris (PV), pemphigus foliaceus (PF), bullous pemphigoid (BP), mucous membrane pemphigoid (MMP), linear immunoglobulin A dermatosis, and epidermolysis bullosa acquista (EBA; Murrell, 2015).

Dermatological diseases can lead to serious issues for patients in their daily lives and adversely affect their quality of life (QoL; Sebaratnam et al., 2012a, 2012b). Few studies have explored and quantified the effect of AIBDs on QoL (Rencz et al., 2015). However, there is an even greater paucity of research that specifically investigates their effect on employment, which remains an integral aspect of life and hence necessitates this literature review. In this review, we will examine the effect of AIBDs on QoL and more specifically on work productivity and whether further studies should be performed to address this issue.

Quality of life

QoL is a broad social concept that can be defined as an "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (World Health Organization Quality of Life Assessment, 1995). AIBDs can severely impact QoL. The disfiguring nature of the disease and especially the visible skin lesions negatively affect self-confidence and limit social capacity (Sebaratnam et al., 2012a, 2012b). Hence, it is conceivable that workplace life and work productivity are also affected. Table 1 summarizes various studies that pertain to QoL and work productivity in patients with AIBDs and other dermatological diseases.

Several assessment tools exist to quantify and measure the impact of disease on QoL and enable the monitoring of the effects of disease and understand the facets of life that are most impacted, which is necessary to provide holistic care (Sebaratnam et al., 2012a, 2012b). These measurement tools generally fall into three categories: generic, skin-specific, and disease-specific.

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The Medical Outcome Study 36-item Short-form (SF-36) survey is an example of a generic instrument that can be used to compare disease populations. The limitations of the SF-36 include its lack of specificity and how some measurements of improvement in QoL are limited on a 0-to-100 scale (i.e., scores over 100 are impossible and hence, further improvement in those specific areas cannot be documented; Chee and Murrell, 2011).

The Skindex is a skin-specific tool that has been refined in the form of multiple questionnaires, including Skindex-29, Skindex-17, and Skindex-16. A study that was conducted by Tabolli et al. (2014) using the Skindex-17 with 213 patients with pemphigus found that patients with active lesions had a worse QoL compared with patients without bullae. For the psychosocial component of the questionnaire, patients with bullae scored 42.4 ± 26.8 compared with patients without bullae who had a mean score of 30.9 ± 23.5 ($p < 0.01$). Higher QoL scores indicate better QoL. Item 13 of the Skindex-17, which measures frustration due to the disease, had a notably large difference between patients with and without active lesions. The authors suggested that the visibility of the lesions along with possible exudation of the bullae fostered stigma toward patients (Tabolli et al., 2014).

The Dermatology Life Quality Index (DLQI) is another example of a skin-specific measurement tool. Ghodsi et al. (2012) investigated 61 patients with PV and found an average DLQI score of 10.98 ± 6.9, which indicates significant impairment. Higher DLQI scores indicate a worse QoL. Itching, burning skin, and mucosal burning were associated with higher DLQI scores (Ghodsi et al., 2012). However, the DLQI has been suggested to be more suited to measure the effects of skin conditions such as eczema or psoriasis (Chee and Murrell, 2011).

The Autoimmune Bullous Disease Quality of Life (ABQoL) questionnaire is the only disease-specific tool used for patients with AIBDs (Sebaratnam et al., 2013). The advantage of disease-specific tools is their ability to capture the small changes in specific diseases, which general tools such as the SF-36 or DLQI may miss. The ABQoL questionnaire targets the facets of QoL that are affected more in patients with AIBDs, which owes to its content validity (Sebaratnam et al., 2013). The ABQoL questionnaire is scored out of 51 points. Above 20 points is considered a high score and indicates worse QoL and below 7 points is considered low.

In the initial validation study, the ABQoL score was 11.5 ± 5.5 for patients with PV and 8.4 ± 5.5 for patients with BP. The ABQoL questionnaire was found to have poor convergent validity with the SF-36 and moderate convergent validity with the DLQI. The Cronbach alpha score was 0.84, which affirms the test's internal consistency (Sebaratnam et al., 2013). The ABQoL questionnaire was also found to be significantly more sensitive than the DLQI in terms of discriminative validity (Sebaratnam et al., 2013). Findings from a study that was conducted in the United States supported the reliability of the ABQoL questionnaire, with a Cronbach's alpha score of 0.90.

In terms of validation across different cultures and languages, the ABQoL questionnaire has also been validated recently in American English (Sebaratnam et al., 2015), Mandarin and Polish. The Chinese study reported the ABQoL scores as 17.23 ± 1.35 for patients with PV and 16.60 ± 2.90 for patients with BP (Yang et al., 2017). The Polish study reported a mean ABQoL score of 16.3 ± 9.9 for all patients, with 17.4 ± 12.4 for patients with PV and 15.7 ± 9.5 for patients with BP (Kalinska-Bienias et al., 2017).

AIBDs are chronic illnesses and patients may require aggressive, long-term treatment. When measuring QoL, discriminating between disease effect and treatment effect can prove to be difficult. The Treatment of Autoimmune Bullous Disease Quality of Life (TABQoL) questionnaire, which is a tool to measure the impact of AIBD treatment, was developed from the pilot ABQoL questionnaire. The TABQoL questionnaire was found to have high convergent validity with the ABQoL questionnaire, moderate convergent validity with the DLQI, and low correlation with the SF-36. The Cronbach alpha score was 0.892, which confirms internal consistency and construct validity. The utilization of the TABQoL questionnaire in conjunction with the ABQoL questionnaire or DLQI may be useful to document changes in QoL due to treatment intensity or side effects (Tjokrowidjaja et al., 2013). The TABQoL questionnaire has been validated in Polish and Mandarin (Kalinska-Bienias et al., 2017; Chen et al., 2017).

Work productivity instruments

As established in the literature, the deleterious effects of AIBDs can unfold in many domains of a patient's life. Measuring work productivity is important to assess the efficacy of treatment and demonstrate whether treatment is helping patients manage their diseases while remaining employed. Having a chronic illness results in days off work and reduced productivity while employed (Prasad et al., 2004). The loss in work productivity in patients with diseases such as psoriasis have been proven to result in an enormous economic burden (Chan et al., 2009). Quantifying loss in work productivity is invaluable to economic evaluations of healthcare (Tang, 2015).

Several instruments exist to calculate loss of work productivity. Prasad et al. (2004) examined six different instruments including the Work Productivity and Activity Impairment Questionnaire (WPAIQ), Work Limitations Questionnaire (WLQ), Health and Work Performance Questionnaire (HPQ), Health and Work Questionnaire (HWQ), Endicott Work Productivity Scale (EWPS), and Health and Labor Questionnaire (HLQ). The researchers concluded that the WPAIQ and WLQ offer more advantages over the other instruments and their psychometric properties (i.e., validity and reliability) have been more comprehensively tested in previous literature (Prasad et al., 2004). Tang (2015) supported this finding but asserted that more extensive psychometric testing does not necessarily substantiate the claim that the WPAIQ and WLQ are superior instruments.

A notable advantage of the WPAIQ is its relatively short recall period of 1 week compared with the WLQ, which has a recall period of 2 weeks and is important to minimize recall bias (Prasad et al., 2004). A limitation of the WPAIQ is its inability to assess task-specific productivity because questions only exist to assess overall reduced productivity (Prasad et al., 2004). A limitation of the WLQ is that it does not measure absenteeism, which is defined as the percentage of work hours missed (Tang, 2015). Absence from work should be an important aspect to consider because that is likely to affect work productivity. Loss of work productivity can be calculated through four measurements as summarized in Table 2.

Work productivity in patients with autoimmune blistering diseases

The literature pertaining to the effects of AIBDs on loss of work productivity is extremely limited. Only one study currently exists in the published literature. Heelan et al. (2015) conducted an observational cross-sectional study in Toronto, Canada, to investigate whether an association exists between greater disease severity of AIBD, work productivity, and QoL. The study used patients who were diagnosed with either PV, PF, BP, MMP, EBA, or lichen planus pemphigoides. The study consisted of 94 patients who completed the DLQI, WPAIQ-Specific Health Problem (SHP), and a pemphigus severity score that was adapted from Herbst and Bystryn (2000).

The study concluded that AIBDs undeniably affect work productivity. The results indicate a moderate effect on DLQI (6.5 ± 7.3). Patients with higher DLQI scores or poorer QoL had more work impairment while working compared with those with lower DLQI scores (33.7 ± 37.11 vs. 12.31 ± 28.62; $u = 146.0$; $p = 0.041$) and more overall activity impairment while working (36.57 ± 39.92 vs. 8.46 ± 19.08; $u = 138.5$; $p = 0.024$; Heelan et al., 2015). The authors hypothesized that greater disease severity would be associated with lower QoL, yet interestingly there was no significant difference observed between the different severity groups and QoL despite confirmation in other studies (Paradisi et al., 2009). The authors acknowledged that this discrepancy could be attributed to the lack of specificity of the DLQI. Notably, the recent development of the ABQoL and TABQoL questionnaires could prove to be valuable tools to assess this association in future studies. Additionally, the WPAIQ-SHP is affected by recall bias because it calls upon patients' memory of the past 7 days; this may affect the overall results of the study.

In the Canadian study by Heelan et al. (2015), 46 of 94 patients with AIBD were unemployed. A possible association between the presence of AIBD and employment status was not discussed. Further research could explore the link between AIBDs and unemployment and whether visible AIBDs can affect employability. The Canadian study confirmed the association between AIBDs and loss of work productivity, but further research must be conducted to elucidate the exact reason why AIBDs result in impairment to improve patient outcomes (e.g., taking less time off work). Studies that examine the specific aspects of the disease in relation to work productivity could illuminate the issue.

Furthermore, the use of the DLQI in an observational cross-sectional study may be unable to capture significant flare-ups of the disease (Heelan et al., 2015). Future studies may benefit from the use of the ABQoL questionnaire to monitor changes in QoL in conjunction with monitoring changes in WPAIQ-SHP scores over time. This would allow for the documentation of the timing of flare-ups of the disease and deduce whether flare-ups correlate with changes in work productivity. By documenting these flare-ups in detail (e.g., measure pain or stigma of visible lesions), researchers may be able to specify which component of the AIBDs result in impairment.

Heelan et al. (2015) acknowledged that the Pemphigus Disease Area Index (PDAI) is more widely used and reliable (Rosenbach et al., 2009). Yet, the researcher chose to use a different severity scoring system that was adapted from Herbst and Bystryn (2000) because he considered the effects of treatment and treatment intensity more than other severity scores. However, it should be noted that using a more widely used severity score could aid comparisons between future studies.

When considering future studies, it should be noted that a prospective study to explore presenteeism in arthritis evaluated four work productivity instruments (WLQ, HPQ, HLQ, and WPAIQ) and concluded that the instruments were not comparable (Zhang et al., 2010). The implication is that future studies that examine work productivity in patients with AIBDs and utilize a different instrument may not be effectively compared with Heelan et al.'s (2015) study given the lack of synergy among the different instruments. Zhang et al. (2010) suggested the development of a standardized, disease-specific work productivity tool to circumvent this issue.

Work productivity in other dermatological diseases

The WPAIQ-SHP is a validated tool (Reilly et al., 1993) that has been used in other areas of dermatology such as psoriasis. A study that was conducted in Canada with regard to psoriasis and work productivity in 81 patients reported absenteeism of 5.1% ± 12.5, presenteeism of 16.5% ± 2.4, and total work productivity impairment (TWPI) scores of 19.4% ± 26.0 (Chan et al., 2009), which signifies that psoriasis has a large impact on work productivity. A limitation of this study was its relatively small sample size.

In a larger, randomized, controlled trial, the effects of adalimumab on work productivity in 1212 patients with psoriasis was examined, and the results showed similar findings for baseline TWPI scores including adalimumab (18.3% ± 23.8) versus placebo (17.9% ± 23.7). Baseline total activity impairment (TAI) was reported as adalimumab 26.7% ± 27.2 versus placebo 26.5% ± 28.9. This study also associated increased disease severity with greater amounts of work and activity impairment (Kimball et al., 2012). However, the study had very strict inclusion and exclusion criteria, which possibly resulted in a study population that did not accurately reflect the general population.

A study that examined the effects of etanercept in patients with moderate-to-severe psoriasis reported slightly higher baseline TWPI scores and TAI results of 23.7 ± 23.7 and 31.4 ± 26.5, respectively. This study also reported presenteeism of 22.7 ± 23.2 (Vender et al., 2012). These slightly higher results could be due to the fact that patients had moderate-to-severe psoriasis. A study that examined the effects of adalimumab on sleep outcomes in patients with psoriasis reported baseline absenteeism of 0.8 ± 4.3, baseline presenteeism of 12.0 ± 19.0, baseline TWPI of 12.8 ± 19.7, and baseline TAI of 22.4 ± 24.9 (Strober et al., 2012). These slightly lower findings could be due to the fact that this patient population had previous treatments, which may have lowered their disease severity.

The association between higher disease severity and lower QoL has been established in the literature. Meyer et al. (2010) conducted a study in France and reported higher DLQI scores for patients with severe plaque psoriasis compared with patients with mild psoriasis (8.5 vs. 6.4). Additionally, patients with higher DLQI scores (>10) experienced on average 20.1% work productivity loss compared with patients who had lower DQLI scores (≤10) with 4.2% work productivity loss. Interestingly, more than 19% of patients with severe psoriasis who were employed reported discrimination at work compared with 10% of patients with mild psoriasis (Meyer et al., 2010). This could be due to the visibility of severe plaque psoriasis lesions resulting in stigmatization. This has not yet been established in patients with AIBDs; however, it is plausible that visible bullae could result in similar stigmatization.

A study of 700 patients with psoriasis has examined the effects of symptoms such as itching, scaling, and pain on QoL and work productivity. A greater severity of symptoms was associated with higher DLQI, TWPI, and TAI scores. Moderate-to-severe itching had the greatest impact on TWPI scores but moderate-to-severe pain had the greatest impact on TAI results (Korman et al., 2015).

The WPAIQ-SHP has also been used in patients with atopic dermatitis. A study in Japan with 112 patients reported DLQI scores of 7.8 ± 5.1, absenteeism of 0.5 ± 2.3, presenteeism of 32.6 ± 23.5, TWPI scores of 32.8 ± 23.7, and TAI results of 42.9 ± 25.2. A significant correlation was found between DLQI and TWPI, which is consistent with the results from Heelan et al.'s, 2015 study. DLQI and TAI were also found to be significantly correlated (Yano et al., 2013). A study of 257 patients with chronic hand dermatitis reported DLQI scores of 25 ± 17, absenteeism of 0.3 ± 4, presenteeism of 18 ± 22, TWPI scores of 17 ± 22, and TAI results of 25 ± 25, which confirms that chronic hand dermatitis adversely affects work productivity (Reilly et al., 2003). Notably, chronic hand and atopic dermatitis did not appear to have a large impact on absenteeism, which is surprising given its visibility.

Table 1
Critical appraisal of studies related to QoL and work productivity in patients with AIBD and other dermatological diseases

Reference (Country)	What was assessed? Sample size, disease	Results	Interpretations	Strengths	Weaknesses
Heelan et al., 2015 (Canada)	WPAIQ DLQI n = 94 PV, PF, BP, EBA, LAD, MMP Employed subjects n = 48	DLQI scores 6.5 ± 7.3 Activity impairment for employed people (28.96 ± 37.49) is significantly lower than unemployed people (30.43 ± 36.63). Responders (11.58 ± 24.41) showed significantly less impairment than nonresponders (57.57 ±24.41; $p < 0.001$). Statistically significant difference between disease severity measure and overall activity impairment. Patients in the severe group had significantly more impairment than those in the mild and moderate groups. TAI: people with worse QoL (36.57 ± 39.92) had higher scores compared with people with better QoL (8.46 ± 19.08) No significant difference between DLQI scores and severity groups.	Moderate effect of AIBD on QoL. Patients who are unemployed showed more impairment in daily activities than those who are employed. People with lower QoL tend to have work and activity impairment.	First study in AIBD to assess work productivity Relatively even number of employed and unemployed patients.	Other studies have found an association between DLQI and different disease severity groups. This discrepancy could be attributed to a lack of specificity in the DLQI. Does not explore whether AIBD or disease severity has an impact on employment status.
Chan et al., 2009 (Canada)	WPAIQ n = 81 Patients with moderate-to-severe psoriasis	Absenteeism: 5.1% ± 12.5 Presenteeism: 16.5% ± 2.4 TWPI: 19.4% ± 26.0	Psoriasis has a significant impact on work productivity.	Highlights importance of work productivity by relating to economic burden and calculating financial loss.	Relatively low sample size for patients with psoriasis
Kimball et al., 2012 (United States)	WPAIQ n = 1212 (814 treatment, 308 placebo); patients with moderate-to-severe psoriasis	Baseline TWPI for adalimumab: 17.7 ± 22.8; placebo: 16.8 ± 22.0 Week 16 TWPI for adalimumab: 4.8 ± 22.1; placebo: 15.3 ± 27.6 Baseline TAI for adalimumab: 26.7 ± 27.2; placebo: 26.5 ± 28.9 Week 16 TWPI for adalimumab: 7.9 ± 17.5; placebo 23.2 ± 27.6	Severe psoriasis has a large impact on work productivity. The higher the disease severity, the more work and activity impairment.	Large sample size	Strict inclusion and exclusion criteria may result in participants who do not accurately represent the general population.
Vender et al., 2012 (Canada)	WPAIQ n = 246 Patients with moderate-to-severe psoriasis	Baseline presenteeism of 22.7 ± 23.2 decreased to 6.6 ± 14 at 3 months Baseline TWPI scores of 23.7 ± 23.7 decreased to 8.3 ± 16.5 at 3 months Baseline TAI at 31.4 ± 26.5 decreased to 12.9 ± 22.4 at 3 months	WPAIQ can be used to monitor improvements in work productivity. There was initially a large impact on work productivity.	This study population has less exclusion criteria compared with other studies so it may be more representative of the general population.	
Schmitt and Kuster, 2015 (Germany)	DLQI WLQ n =201 Patients with psoriasis	Mean DLQI scores: 10.8 Presenteeism: 7.6 ± 9.1 Absenteeism: 6.6 ± 15.4 Correlation between DLQI and presenteeism $p < 0.0001$ Correlation between DLQI and absenteeism $p < 0.001$	There is a significant correlation between DLQI and WLQ.		The establishment an equation that relates WPAIQ and DLQI might be more beneficial because the WPAIQ is more widely used than the WLQ.
Strober et al., 2012 (United States)	DLQI WPAIQ n = 152 Patients with psoriasis	Baseline Absenteeism: 0.8 ± 4.3 Presenteeism: 12.0 ± 19.0 TWPI scores: 12.8 ± 19.7 TAI results: 22.4 ± 24.9	Psoriasis has a negative impact on work productivity.	First study to examine the impact of adalimumab on sleep outcomes in patients with moderate-to-severe psoriasis.	Small sample size Short length of the study (16 weeks)
Korman et al., 2015 (United States)	DLQI WPAI n = 700 Psoriasis	Each symptom was categorized as no symptom, mild symptom, or moderate/severe symptom. DLQI itching	There is a general trend in which the greater the severity of the symptoms, the worse QoL	Large sample size. Characterizing specific symptoms and their effects can possibly provide more	The effects of treatment and treatment intensity were not considered in this study.

Table 1 *(continued)*

Reference (Country)	What was assessed? Sample size, disease	Results	Interpretations	Strengths	Weaknesses
	symptoms: itching, pain, and scaling	No symptom: 2.57 Mild: 4.01 Moderate/severe: 7.78 DLQI pain No symptom: 3.91 Mild: 5.78 Moderate/severe: 8.14 DLQI scaling No symptom: 2.68 Mild: 3.75 Moderate/severe: 7.00 TWPI itching No symptom: 6.6 Mild: 12.3 Moderate/severe: 23.7 TWPI pain No symptom: 11.3 Mild: 18.5 Moderate/severe: 22.7 TWPI scaling No symptom: 8.6 Mild 11.5 Moderate/severe: 20.1 TAI itching No symptom: 9.4 Mild: 13.7 Moderate/severe: 26.0 TAI pain No symptom: 12.8 Mild: 21.7 Moderate/severe: 28.0 TAI scaling No symptom: 11.6 Mild: 12.9 Moderate/severe: 22.6	and the greater the work and activity impairment. Pain appeared to have the greatest impact on activity impairment and was associated with worse QoL.	information with regard to treatment.	
Meyer et al., 2010 (France)	DLQI WPAI n = 590 Patients with psoriasis	DLQI scores for patients with severe psoriasis (8.5) versus patients with mild psoriasis (6.4). More than 19% of employed patients with severe psoriasis reported discrimination at work versus 10% for patients with mild psoriasis. Patients with higher DLQI scores (>10) experienced a mean of 20.1% work productivity loss compared with those with lower DQLI scores (≤10) with 4.2% work productivity loss.	Severe psoriasis is associated with lower QoL compared with mild psoriasis.	Large sample size	
Yano et al., 2013 (Japan)	WPAIQ DLQI n = 112 Patients with atopic dermatitis	DLQI scores: 7.8 ± 5.1 Absenteeism: 0.5 ± 2.3 Presenteeism: 32.6 ± 23.5 TWPI scores: 32.8 ± 23.7 TAI results: 42.9 ± 25.2 Association between TWPI and DLQI, TAI and DLQI, both $p < 0.001$	There is a large impact on work productivity. Patients who have poorer QoL are more likely to suffer greater levels of impairment.	First study to discuss impact of disease severity on work productivity in patients with atopic dermatitis.	Low sample size; does not consider the impact of treatment on disease severity or whether treatment intensity affects productivity.
Zhang et al., 2010 (Canada)	HLQ WLQ HPQ WPAIQ n = 212 Patients with osteoarthritis or rheumatoid arthritis	Lost hours for all: Mean (SD) HLQ: 1.6 (3.9) WLQ: 4.0 (3.9) HPQ: 13.5 (12.5) WPAIQ: 14.2 (16.7)	There are several different instruments to assess work productivity. The instruments give varying results and are not comparable.	Large sample size	Does not suggest which instrument is better and should be used.

(continued on next page)

Table 1 *(continued)*

Reference (Country)	What was assessed? Sample size, disease	Results	Interpretations	Strengths	Weaknesses
Reilly et al., 2003 (United States)	DLQI WPAI (adapted for chronic hand dermatitis) n = 257 Chronic hand dermatitis	DLQI scores: 25 ± 17 Absenteeism: 0.3 ± 4 Presenteeism: 18 ± 22 Overall work impairment: 17 ± 22 Activity impairment: 25 ± 25	Chronic hand dermatitis adversely affects quality of life and work productivity. Chronic hand dermatitis does not have a large effect on absenteeism.	Adequate sample size	Does not include disease severity in the study. Previous studies in work productivity have established that greater disease severity is associated with worse work productivity and worse quality of life.
Fattori et al., 2015 (Italy)	SF-12 WPAIQ n = 1,717 Patients with autoimmune arthritis, major depression disorder, psoriasis, inflammatory bowel disease	81% of subjects who experienced workplace bullying had a preexisting medical condition before the bullying started. Patients who experienced bullying had much higher WPAI scores and worse QoL scores compared with those who were not bullied.	Although AIBD was not included in the study, it is conceivable that patients with AIBD also experience workplace bullying, which affects work productivity.	Large sample size	Self-labelling measure of bulling may introduce information bias
Tabolli et al., 2008 (Italy)	SF-36 n = 58 Patients with PV or PF	Physical functioning: 73 ± 2.5 Role physical: 44 ± 40 Bodily pain: 63 ± 32 General health: 48 ± 23 Vitality: 50 ± 23 Social functioning: 61 ± 29 Role-emotional: 49 ± 44 Mental health: 55 ± 22	Psoriasis has a similar SF-36 profile, which is surprising because pemphigus and psoriasis are clinically very different diseases. The similarities may be attributed to the visibility of the lesions or treatment intensity, which is not considered in the SF-36.	SF-36 is a generic health QoL tool and can be more easily compared for impact with other diseases such as psoriasis.	Using a generic health QoL tool is not as accurate as a dermatology-specific (e.g., DLQI) or disease-specific (e.g., ABQOl) tool. The ABQoL is better suited to capture specific details related to AIBD.
Tabolli et al., 2014 (Italy)	Skindex-17 n = 203 Patients with pemphigus	Skindex-17 symptoms scores: with lesions 36.4 ± 27.3 versus without lesions 25.6 ± 24.8 Psychosocial scores With lesions 42.4 ± 26.8 versus without lesions 30.9 ± 23.5	Patients with lesions have worse QoL than patients with lesions. The active lesions can contribute to stigma, which can affect daily living along with the workplace and employment.	Large sample size	Skindex-17 is not as specific as the ABQoL or TABQoL.
Penha et al., 2015 (Brazil)	DLQI n = 84 PF, PV, BP, dermatitis herpetiformis	DLQI 16	There is a large impact on QoL by AIBD. This DLQI score of 16 was compared with other chronic diseases (e.g., leprosy) and found to be higher.	Variety of patients because there were no exclusion criteria.	
Ghodsi et al., 2012 (Iran)	DLQI n = 61 Patients with PV	DLQI scores: 10.98 ± 6.9	PV has a large negative effect on QoL.	Only included patients with newly diagnosed or untreated PV to mitigate the effects of treatment on the results.	Small sample size
Paradisi et al., 2009 (Italy)	Skindex-29 SF-36 n = 126 Patients with pemphigus	Skindex-29 Symptoms: 37 ± 22 Emotions: 37 ± 22 Social functioning: 33 ± 23 SF-36 physical functioning: 73 ± 24role physical: 46 ± 40 bodily pain: 61 ± 28 general health: 49 ± 22 vitality: 53 ± 20 social functioning: 62 ± 24 role-emotional: 50 ± 43 mental health: 57 ± 20	Using both SF-36 and Skindex-29, there is a large impact on QoL.	SF-36, a general health tool, allows comparison with other health conditions. Skindex-29, which is skin-specific, allows for more accurate comparison with other skin conditions.	Small sample size

ABQoL, Autoimmune Bullous Disease Quality of Life; AIBD, autoimmune blistering disease; BP, bullous pemphigoid; c.a., corresponding author; DLQI, Dermatology Life Quality Index; EBA, epidermolysis bullosa acquista; HLQ, Health and Labor Questionnaire; HPQ, Health and Work Performance Questionnaire; LAD, linear immunoglobulin A dermatosis; MMP, mucous membrane pemphigoid; PF, pemphigus foliaceus; PV, pemphigus vulgaris; QoL, quality of life; SD, standard deviation; SF-12; 12-item Short-form; SF-36, 36-item Short-form; TABQoL, Treatment of Autoimmune Bullous Disease Quality of Life; TAI, total activity impairment; TWPI, total work productivity index; WLQ, Work Limitations Questionnaire; WPAIQ, Work Productivity and Activity Impairment Questionnaire.

Table 2
Metrics derived from the WPAIQ-SHP

Measurement	Definition
Absenteeism	Percentage of work hours missed
Presenteeism	Percentage of productivity lost while working
Total work productivity impairment	Sum of absenteeism and presenteeism
Total activity impairment	Impairment in activities outside of work

WPAIQ-SHP, Work Productivity and Activity Impairment Questionnaire-Specific Health Problem.
Heelan et al., 2015; Yano et al., 2013.

Fattori et al. (2015) established a link between workplace bullying and work productivity in a study that used the WPAIQ in patients with one of four chronic conditions, including major depressive disorder, psoriasis, autoimmune arthritis, and inflammatory bowel disease. A total of 81% of patients who experienced workplace bullying had a preexisting medical condition before the bullying started. Patients who experienced bullying had much higher WPAI scores and worse QoL scores compared with those who were not bullied (Fattori et al., 2015). Patients with AIBD were not included in this study; however, it is likely that patients with AIBD may also be targets of workplace bullying, which can further affect work productivity.

The correlation between QoL and work productivity is of note. The association between DLQI and WLQ has been established in a study of patients with psoriasis. Utilizing a linear bootstrap regression analysis, an equation has been established to calculate percentage loss due to presenteeism and absenteeism from DLQI scores, which provides another method to calculate costs that are related to psoriasis (Schmitt and Kuster, 2015). The replication of these results in patients with AIBD would be of interest as well as whether a correlation between WPAIQ and ABQoL or DLQI can be established.

Conclusion

Work productivity remains evident as an important aspect of life that requires further research in adult patients with AIBD. We do not understand which aspects of AIBDs have such a large impact on work productivity. Using ABQoL and TABQoL questionnaires in conjunction with the creation of an adapted WPAIQ to examine the reasons behind work impairment may further characterize these effects and unveil a deeper understanding of stigmatization in the workplace as a factor of loss of work productivity.

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