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A narrative review of the socioeconomic burden associated with generalised pustular psoriasis

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Abstract

Generalised pustular psoriasis (GPP) is a rare, chronic and life-threatening inflammatory skin disease characterised by widespread eruption of sterile pustules. With the approval of a GPP flare treatment in several countries occurring only recently, the socioeconomic burden associated with GPP is not well established. To highlight current evidence for patient burden, healthcare resource utilization (HCRU) and costs associated with GPP. Patient burden results from serious complications including sepsis and cardiorespiratory failure causing hospitalization and death. HCRU is driven by high hospitalization rates and treatment costs. The mean duration of a GPP hospital stay ranges from 10 to 16 days. A quarter of patients require intensive care, and the mean intensive care stay is 18 days. In comparison to patients with plaque psoriasis (PsO), patients with GPP have: a 64% higher score on the Charlson Comorbidity Index; higher hospitalization rates (≤36.3% vs. ≤23.3%); lower overall quality of life, and higher symptom scores for pain, itch, fatigue, anxiety and depression; direct costs associated with treatment 1.3- to 4.5-fold higher; higher rates of disabled work status (20.0% vs. 7.6%); and increased presenteeism (i.e. worse impairment at work), impaired daily activities, and medically related absenteeism. Current medical management and drug treatment utilising non-GPP-specific therapies impose a significant patient and direct economic burden. GPP also imposes an indirect economic burden by increasing work productivity impairment and medically related absenteeism. This high level of socioeconomic burden reinforces the need for new therapies with proven efficacy in the treatment of GPP.

KEYWORDS
inflammation, inflammatory skin diseases, psoriasis

1 | INTRODUCTION

Generalised pustular psoriasis (GPP) is a rare, heterogeneous, chronic and potentially life-threatening autoinflammatory skin disease, characterised by episodes of widespread eruption of sterile, macroscopic pustules that occur with or without symptoms and signs of systemic inflammation.[1,2]

The aberrant activation of the interleukin-36 pathway in patients with GPP causes an inflammatory reaction and widespread eruption of pustules. Flares, the acute phase of GPP involving widespread pustules, skin lesions and erythema,[3] typically last 2–5 weeks,[4] but may persist longer than 3 months and may be accompanied by systemic symptoms such as fever, pain, and fatigue.[5–7] While the most dominant cutaneous symptoms are pustules, erythema and scaling,

GPP can also have serious life-threatening complications that include sepsis, acute renal failure, neutrophilic cholangitis, congestive heart failure and acute respiratory distress syndrome.[5,8,9]

GPP (ICD-10 code, L40.1) is an orphan disease,[10] so estimates of prevalence are sparse in the literature. Prevalence estimates published since 2000 range from approximately 1.8 per 1 000 000 people in France[11] to 459 per 1 000 000 people in Germany[12]; however, the wide range reflects not only potential differences related to geographical region and ethnicity, but also to the study setting and GPP identification algorithm, and the majority of prevalence estimates are between 70 and 140 per 1 000 000 persons.[13–16] The reported mean age at diagnosis ranges between 45 and 50 years.[6,13,17] Historically, GPP has been viewed as a subset of plaque psoriasis (PsO) (*psoriasis vulgaris*, ICD-10 code L40.0), but more recent literature recognises GPP has a distinct aetiology and pathophysiology.[18,19]

Prompt systemic, disease-modifying therapy is essential to control flares and life-threatening complications.[20] Prior to the recent approvals of spesolimab in the US, Japan, the EU, and China, there were no GPP-specific treatments approved for the treatment of GPP flares (US, EU, and China) or for the improvement of acute symptoms of GPP (Japan).[21–23] Although other immunomodulatory therapies, including biologics, and topical and systemic therapies have been used in the treatment of GPP, their utilization is based mainly on use in routine care in patients with plaque PsO or non-randomised study results from single-arm trials in Japan.[21] Additionally, strong evidence of the efficacy and safety of these other treatments in patients with GPP is limited, in part due to the lack of studies, the study designs, and the small number of patients.[21]

The availability of evidence for the socioeconomic burden of rare diseases is correlated to the availability of specific therapies to treat such diseases.[24] Thus, with the only recent approvals in the US, Japan, the EU and China of the first therapy approved for the treatment of GPP flares (US, EU and China) and improvement of acute symptoms of GPP (Japan), the socioeconomic burden of illness associated with GPP has not yet been well characterised. This review aims to highlight the available evidence for the patient burden, healthcare resource utilization (HCRU), and the costs (direct and indirect) associated with GPP.

2 | GPP PATIENT BURDEN

Patients with GPP experience considerable burden resulting from the widespread inflammation of the skin and systemic manifestations of flares. The clinical course of GPP is heterogenous and can be characterised as a relapsing disease with recurrent flares or a persistent disease with intermittent flares.[1,2] Even in periods of dormancy, pustular lesions can persist.[4,7] Symptoms, such as generalised rashes of subcorneal and Kogoj's spongiform pustules, skin lesions and erythema and severity may vary with each flare within an individual patient.[3,4,25,26] Flare severity is categorized by the Japanese Dermatological Association (JDA) in the JDA-GPP severity criteria as mild, moderate or severe as determined by cutaneous and systemic symptoms along with abnormal white blood cell, C-reactive protein and serum albumin values[3]; however, aside from this categorisation, there is no international consensus on severity thresholds in GPP.

It has been estimated that patients with GPP experience 0–1 flare per year.[7,27,28] In a French cohort study of patients with GPP ($N = 569$), a total of 811 flares were reported throughout the study period of 2012–2015. This corresponds to a mean of 1.4 flares per person and 0.4 flares per person per year.[27] A rate of 0.88 flare episodes per patient per year was reported in a US cohort study from 2015 to 2020, while the majority of patients had one GPP flare in the average follow-up time of 2 years.[28] GPP flares have a duration of days to months and range in severity from mild to life-threatening.[7,18,21]

Several factors can trigger GPP flares including infections, stress, corticosteroid use/withdrawal, other drugs (e.g. methotrexate, TNF inhibitors, non-steroidal anti-inflammatory drugs, traditional medicine), pregnancy, menstruation, hypocalcemia associated with hypoparathyroidism and sunlight.[2,5,7,11,26,29,30] In 2023, Kamiya et al. reported stress, infection and certain drugs as the most common triggers for exacerbations of pustular psoriasis in patients in Japan.[31] GPP flares also occur without a known trigger. Idiopathic flares have been reported in 15% of patients by Choon et al. and 57% of patients by Zheng et al.[5,29] Even when initial flares have known triggers, subsequent flares can occur without known causes.[2]

Almost all patients present with erythematous pustular lesions that are mostly generalised, but can begin in localised areas such as the trunk or limbs.[5,29] Scalp involvement, nail damage, uveitis, cheilitis, geographic tongue and bilateral leg edema have also been observed in affected patients.[5,29] Alongside the discernible skin symptoms, patients experience symptoms consistent with systemic inflammation such as high fever (45%–96%),[3,5,26,28] pain (61%–97%),[5,28] and general malaise/fatigue (58%).[3,26] Laboratory analysis in patients with a GPP flare show characteristic elevated erythrocyte sedimentation rate, positive c-reactive protein, leukocytosis, hypoproteinemia, hypocalcemia and elevated immunoglobulin G or A levels.[20]

GPP flares can have serious complications, such as sepsis, and renal, hepatic, respiratory and heart failure causing hospitalisation and mortality.[11,26,32] Mortality associated with GPP flares ranges from 2% to 16%.[5,11,16,27,33] Choon et al. reported a mortality rate of 7%, with 2% of deaths resulting from sepsis and multiorgan failure during the first episode of GPP, and 3% of deaths occurring in subsequent GPP flares also due to sepsis.[5]

GPP presents with a very high burden of comorbidities including other autoimmune diseases, arthritis, hypertension, peptic ulcer disease, osteoporosis, hyperlipidemia, diabetes mellitus, psoriatic arthritis, obesity and asthma.[5,23,28,34–39] In a study utilising the Swedish National Patient Register, 70% of the identified GPP cases ($N = 1093$) had any selected comorbidity compared with 63% of the matched plaque PsO controls (1:3) and 46% of the matched general population controls (1:5).[38] In particular, comorbid nephritic non-hypertensive disease, Crohn's disease, chronic renal failure, type 1- and type 2 diabetes, and peptic ulcer disease were all more likely to occur within GPP cases than plaque PsO controls.[38] Compared to the general population, Crohn's disease, type 2 diabetes, peptic ulcer disease, celiac disease, sinusitis and stroke occurred more frequently

within the GPP population.[38] Additionally, a large proportion of patients have a history of or concomitant diagnosis of PsO (plaque PsO or other types).[5,28,29,32,36]

In another comparison of a GPP population ($N=975$) to a matched plaque PsO population ($N=2915$), more patients with GPP experience comorbid autoimmune conditions (32.6% vs. 25.4%) and metabolic conditions (37.0% vs. 30.5%) (all comparisons $p<0.001$).[23] GPP patients had a 64% higher score on Charlson Comorbidity Index (CCI) (mean [standard deviation (SD)] 0.467 [1.02] and 0.284 [0.76], respectively).[23] The increase was even greater between the GPP population ($N=982$) and the matched general population ($N=2946$) where the CCI score was more than double for the GPP population (0.470 [1.01] and 0.208 [0.77], respectively).[23] Within a GPP population, patients with flares documented in their electronic healthcare records were significantly more likely to experience a higher burden of comorbid conditions than those without documented flares over the study observation period (34% higher mean CCI score: 2.80 vs. 2.09, respectively).[28]

The severe symptoms and serious complications of GPP have a negative impact on the patient's quality of life (QoL). Overall QoL and symptom scores for pain, itch and fatigue were higher in patients with GPP than in patients with plaque PsO indicating the greater negative impact of GPP (Table 1).[35] The impact on QoL extends into the quiescent phase as shown by a reported mean score of 12.4 (range 1–28) for the Dermatology Life Quality Index (DLQI) for patients out of the acute GPP phase (score > 10 indicates severe QoL impairment).[5]

New research suggests GPP is associated with considerable emotional burden. An analysis of US healthcare claims found patients with GPP ($N=975$) compared to matched plaque PsO controls ($N=2915$) were more likely to be diagnosed with an anxiety disorder (15.4% vs. 11.6%) or with depression (10.4% vs. 7.3%) (both comparisons $p<0.001$).[23] In the CorEvitas Registry (previously Corrona) study, a higher proportion of the 60 patients with GPP had a history of clinician-reported anxiety (28.3% vs. 17.1%) and clinician-reported depression (31.7% vs. 17.1%) compared to the 4848 patients with plaque PsO.[35] In the same study but using an EQ-5D-3L score, patients with GPP reported symptoms of anxiety and depression more than patients with plaque PsO (Table 1), demonstrating the negative impact GPP has on the psychosocial aspects of patients' QoL.[35] Further research suggests patients with GPP can experience feelings of shame, anger and worry that can impact daily activities and their social life.[40]

3 | ECONOMIC BURDEN

The full economic impact of GPP is not well known. Studies post-2020 suggest GPP is associated with significant HCRU, direct costs, as well as indirect costs, such as lost productivity. Before 2020 there was no published literature on the direct and indirect costs of GPP.[40] Since 2020, four population-based studies reporting on the economic burden, including direct costs, for patients in the US ($n=990$ with GPP),[23] Sweden ($n=914$),[41] and Japan ($n=718$ and $n=110$)[34,42] have been published. All four analysed patients with GPP with two matched controls: patients with plaque PsO, and the general population.

3.1 | Healthcare resource utilization

HCRU is higher in the GPP population than in the plaque PsO and general populations.[13,23,34] This is driven by increased inpatient, outpatient and drug costs.[23,34,41,42]

TABLE 1 Summary of PRO measures for patients with GPP and plaque PsO.

	GPP		plaque PsO	
PRO measure[a]	***N***	**Mean (SD)**	***N***	**Mean (SD)**
Patient Global Assessment	60	45.6 (31.2)	4882	35.9 (30.1)
Pain VAS	60	33.1 (34.2)	4883	21.5 (29.0)
Itch VAS	60	47.7 (36.8)	4887	35.4 (34.3)
Fatigue VAS	60	42.6 (31.2)	4885	29.5 (28.4)
EQ-5D-3L	60	***n* (%)**	4833	***n* (%)**
Walking		21 (35.0)		1106 (22.9)
Self-care		13 (21.7)		289 (6.0)
Usual activities		26 (43.3)		1252 (25.9)
Pain and discomfort		42 (70.0)		2298 (47.5)
Anxiety and depression		23 (38.3)		1245 (25.8)

Abbreviations: GPP, generalised pustular psoriasis (with or without plaque PsO); PRO, patient-reported outcomes; PsO, psoriasis only (no reports of other types of psoriasis in registry data); SD, standard deviation; VAS, visual analog scale.

Source: Lebwohl et al.[35]

[a]Higher scores on Patient Global Assessment, visual analog scale and EQ-5D-3L indicate worse symptoms/impairment.

3.1.1 | Inpatient stays

In a survey of dermatologists, more than half (59%) indicated that hospitalisation was somewhat common, very common or always required for patients with GPP.[7] In the US, an inpatient stay rate of 0.026 per patient per month (PPPM) in the GPP population was significantly higher than the rate of 0.006 PPPM in the plaque PsO population, and 0.006 PPPM in the general population ($p < 0.001$).[23] The percentage of patients with GPP requiring hospital admission ranges from 22.0% to 36.3% and is higher than that observed in patients with plaque PsO and the general population, which range from 6.4% to 23.3% and 5.0% to 11.8%, respectively.[34,41,42] The number of hospital admissions due to GPP increased over the years from 180 (2000) to 291 (2013) to 286 (2016).[40]

Inpatient visits for patients with GPP and documented flares were threefold that of patients with GPP and no documented flares in their electronic health record (44% and 15%, respectively). Similarly, emergency department visits in patients with GPP and documented flares were twice that of those without (47% and 24%, respectively).[28]

The mean duration of a hospital stay ranges from 10 to 16 days.[5,27,29,40] Length of hospital stays increased for subsequent flares, with the mean (SD) stay for the first flare 11.0 (10.2) days increasing to 13.4 (12.9) days for the second flare.[27] A quarter of patients require intensive care unit admission with a mean duration for intensive care stay of 18 days.[27]

Sepsis or unspecified bacterial infection is the most common cause of hospitalisation occurring in 5%–10% of patients.[32,37] Other reported reasons for hospital admission include essential primary hypertension, gastro-oesophageal reflux disease, cellulitis, acute lymphangitis and atopic dermatitis.[32,34,37]

3.1.2 | Outpatient visits

Outpatient visits were also significantly higher in the GPP population than in the plaque PsO and general populations.[23,41] In Sweden, 76.2% of GPP patients required outpatient visits compared to 68.4% of plaque PsO ($p < 0.001$), and 46.6% of the general population ($p < 0.001$).[41] In the US, mean PPPM outpatient visit rates of 1.7 versus 1.3 versus 0.6 ($p < 0.001$) and mean 12-month outpatient visits of 24.9, 21.0 and 13.1, for patients with GPP, plaque PsO and the general population, respectively, have been reported.[23,37]

3.1.3 | Treatment utilization

Non-biologic therapies are used more often than biologic therapies.[16,26,34] In Germany between 2005 and 2019, 86 patients with GPP received 201 treatment courses with methotrexate (20.9%) and acitretin (13.9%) being the most common treatments received by patients.[26] In this sample of patients, more than half of the treatment courses (58.7%) resulted in a partial or non-response.[26] The most frequent reasons reported for treatment discontinuation across all treatment types were ineffectiveness (38.0%) and adverse events (36.4%).[26]

Topical corticosteroids (35%), oral dermatological therapies (methotrexate, cyclosporine, tacrolimus) (13%), and oral corticosteroids (11%) were the most common treatments used during flare episodes in the US from 2015 to 2020.[28] Additionally, opioids were prescribed in 21% of flare episodes.[28] Overall, the use of biologics to treat GPP flares was low in the US (<10% patients)[28]; however, of those patients who were prescribed biologics, almost all (>94%) had a comorbid autoimmune condition (i.e. plaque PsO or other psoriasis, psoriatic arthritis, rheumatoid arthritis, inflammatory bowel disease or uveitis) for which biologic treatment is indicated.[28]

In a survey of 131 medical institutions in Japan from 2017 to 2020, 77.3% of patients with pustular psoriasis received topical therapy including corticosteroids, vitamin D_3, a combination of both, tacrolimus, or other topical treatment. Among the patients included in this study, 20.7% had ≤10% affected body surface area (BSA), and 69.0% had >10% affected BSA. The same study reported 58.4% of patients received oral medication, 44.0% received biologics and 9.6% received phototherapy.[31] In another retrospective analysis of hospitals in Japan, 1516 patients with GPP were identified that were treated with biologics (19%), oral agents (63%) and corticosteroids only (18%).[16] Patients with GPP treated with biologics had significantly less in-hospital morbidity (5.4% biologics vs. 8.2% oral agents vs. 12% corticosteroids only, $p = 0.02$), respiratory complications (1.7% vs. 3.7% vs. 8.8%, $p < 0.001$), and mortality (1.0% vs. 3.7% vs. 9.1%, $p < 0.001$).[16]

Pharmacy HCRU, defined as prescription fills, was significantly higher in the GPP population compared to the plaque PsO population (mean [SD]: 3.22 [2.9] PPPM vs. 2.63 [2.5] PPPM, $p < 0.001$).[23] The use of multiple therapies (combinations of topical corticosteroids, systemic steroids, TNF inhibitors and interleukin inhibitors) was higher in patients with GPP than in those with plaque PsO,[34] whereas the use of topical corticosteroids and other topical non-steroidal medications was higher in patients with GPP than in the general population but similar to patients with plaque PsO.[34,41] Compared to patients with plaque PsO in the CorEvitas Registry, patients with GPP had more experience with both off-label biologics (60.0% vs. 45.6%) and non-biologic systemic therapies (56.7% vs. 39.5%).[35] In addition, while both patients with GPP and plaque PsO had similar rates of ≥2 previous off-label biologics (25.0% vs. 21.8%), a higher proportion of patients with GPP had experience with ≥2 previous systemic therapies (15.0% vs. 6.7%).[35]

3.2 | Direct costs

The direct costs associated with treating GPP are substantial, ranging from 1.3- to 4.5-fold higher than direct costs associated with treating plaque PsO, and 3.1- to 7.9-fold higher than the general population (Table 2).[13,23,34,42] Individually, total costs for inpatient stays, physician visits, and drugs were all significantly higher in the GPP population than the plaque PsO population ($p < 0.001$).[41]

TABLE 2 Summary of published direct costs associated with GPP compared to plaque PsO and the general population.

Study				GPP vs. plaque PsO		GPP vs. general population
Direct costs	Country, year	GPP	plaque PsO	Cost ratio (95% CI)	General population	Cost ratio (95% CI)
Total direct costs PPPM[23]	US, 2019	$3175	$2031	1.35 (1.22, 1.50) $p<0.05$	$518	5.58 (3.73, 8.36) $p<0.05$
Total annual direct costs, mean (95% CI)[41]	Sweden, 2015	$5595 (4942-6248)	$3124 (2870-3376)	1.8 (NR) $p<0.001$	$1780 (1587-1974)	3.1 (NR) $p<0.001$
Total annual direct costs, mean (SD)[42]	Japan, 2015–2019	$9536 (13732)	$2116 (5111)	4.5[a]	$1202 (3236)	7.9[a]
All-cause hospitalisation costs, mean (SD)[34]	Japan, 2014–2019	$12 442 (15982)	$6472 (12509)	1.9[a]	$2175 (6613)	5.7[a]

Note: prices adjusted for inflation to 2019 values using https://www.worlddata.info/, and costs converted from local currency to US dollar for ease of comparison.

Abbreviations: CI, confidence interval; GPP, generalised pustular psoriasis; NR, not reported; PsO, psoriasis; SD, standard deviation.

Source: cited in table.

[a]Calculated from reported costs, the study did not perform statistical analysis.

Patients can have several flares per year or flare on a yearly basis.[27] Some patients have ongoing symptoms in the quiescent phase that require treatment resulting in ongoing baseline costs.[4,7] Petrilla et al. demonstrated that baseline direct costs substantially increase over 12 months for patients with GPP: baseline $4205, increasing to $5253 at 6 months, and $10 647 at 12 months follow-up.[36]

3.3 | Indirect costs

There is limited evidence that describes the impact that GPP has on patients' ability to work and participate in daily activities. Two recent studies suggest there is an indirect burden of illness associated with GPP.[35,43]

In a US CorEvitas study based on the existing psoriasis registry, 60 patients with GPP were compared to patients with 4894 patients with plaque PsO.[35] A higher percentage of patients with GPP had a disabled work status compared to patients with plaque PsO (20.0% vs. 7.6%).[35] Based on the Work Productivity and Activity Impairment (WPAI) questionnaire, patients with GPP had higher presenteeism (i.e. reduced productivity at work; mean 28.6 vs. 12.5; median 24.0 vs. 0) and percentage of daily activities impaired (mean 31.9% vs. 17.1%; median 20.0% vs. 3.0%) compared to patients with plaque PsO.[35]

Also in the US, medically related absenteeism, leave of absence and costs of absenteeism were compared in a working population of patients with GPP, plaque PsO, and non-GPP controls.[43] Patients with GPP had a higher day per month medically related absenteeism (rate ratio [95% CI] 2:1 [1.7, 2.6]), higher odds of medically-related absenteeism (odds ratio (OR) [95% CI]: 40.8 [5.5, 301.4]), higher odds of leave of absence (OR [95% CI]: 8.5 [1.04, 69.2]) and higher monthly absenteeism costs (mean difference: $83 [2019 USD], $p=0.001$) than non-GPP controls. The GPP and plaque PsO populations were comparable when analysed for these same outcomes.[43]

4 | DISCUSSION

GPP is a heterogeneous disease that is different from plaque PsO.[9,44] Moreover, the current guidance for the diagnosis and treatment of GPP is limited and not standardised.[2,20,44] Due to the potential for sepsis, cardiorespiratory failure, renal failure or other complications that can lead to death, a prompt diagnosis and systemic treatment initiation are essential.[5,8,9,20] Patients frequently require hospitalisation regardless of severity level.[7,27,34,41,42]

Despite being a distinctly different disease from plaque PsO, the current treatment paradigm for GPP relies on treatments used to treat plaque PsO. Their use is based on limited evidence of efficacy and treatments such as retinoids, cyclosporin and methotrexate have important safety considerations and do not offer rapid resolution of flares.[20] The off-label use of TNF inhibitors and interleukin-12/23 inhibitor (ustekinumab) has also induced paradoxical pustular eruptions in patients with autoimmune diseases including plaque PsO.[45–48]

Our understanding of the socioeconomic burden associated with GPP is beginning to increase with recent studies making a comparison to patients with plaque PsO and highlighting the increased burden of comorbidities and symptoms including pain, itch and fatigue.[23,35] Increased HCRU and direct costs for the treatment of patients with GPP compared to plaque PsO were also evident.[34,41,42]

Recent studies have shown GPP is associated with psychosocial burden.[23,35,37] GPP is an unpredictable disease with severe life-threatening complications. Although known causes of previous flares may be avoided, future flares may result from different triggers or are idiopathic.[5,29] The combination of discernible skin symptoms, comorbidities and the unpredictable nature of the disease, provide a potential rationale as to why recent literature suggests patients with GPP have higher rates of documented anxiety and depression, as well as higher scores on PROs measuring anxiety and depression than patients with plaque PsO.[23,35,37]

The higher cost of treating GPP compared to plaque PsO is driven by hospital and treatment costs.[23,34,41,42] The prevention of life-threatening complications requires prompt treatment and a high level of HCRU, including intensive care.[5,27,29,40] Hospital admissions for GPP have increased in recent years in Germany.[40] While the exact reason for this is unknown, is it cause for further exploration and suggests that more therapies approved for the treatment of GPP flares are needed.

The use of biologics for the treatment of GPP is increasing albeit without economic evaluations nor regulatory approvals as treatments for GPP flares or acute symptoms of GPP.[16,21,23] Drugs for the treatment of rare diseases typically have higher costs and higher data uncertainty driven by the lower number of patients; as such frameworks and thresholds established for the assessment of costs per quality-adjusted life years might fall short for rare and orphan diseases such as GPP.[49–51] The cost burden is primarily mitigated by accelerated and sustained therapeutic success.[5,23,52]

Not specific to GPP, the mean (range) annual treatment costs across 20 non-oncological orphan medicines in Germany was €296 881 (€27 811 to €1 647 627).[53] Per capita spending on drugs used to treat rare diseases has been estimated to range from €1.32 (Latvia) to €20.23 (France) across Europe.[53] For Sweden, the per capita spending on rare disease drugs was €11.23. In 2015, Löfvendahl et al. estimated the mean annual total all-cause drug treatment costs for GPP at €1933.[41,53] Spesolimab, the first drug targeting the aberrant IL-36 signalling in GPP, has been recently approved for the treatment of GPP flare in the US, EU and China and for the improvement of acute symptoms of GPP in Japan. Future studies to understand the impact of targeted, disease-specific treatment on the socioeconomic burden of GPP are warranted.

5 | CONCLUSION

In conclusion, the clinical manifestations of GPP and associated severe comorbidities put patients at risk of life-threatening complications and potential mortality. Unsurprisingly, patients' QoL is significantly impacted, even in comparison to other autoimmune diseases. Current medical management and drug treatment utilising non-GPP-specific therapies are associated with high hospitalisation rates and costs that impose a significant direct economic burden. GPP also imposes an indirect economic burden by increasing work productivity impairment and medically related absenteeism. This high level of socioeconomic burden reinforces the need for new therapies with proven efficacy in the treatment of GPP. Spesolimab is anticipated to reduce the overall burden of GPP, but remains to be evaluated.

AUTHOR CONTRIBUTIONS

All authors (Thomas M. Zimmermann, Patrick Hofmann and Gretchen R. Chiu) were involved in the planning/conduct of study, collecting and/or interpreting data, drafting manuscript and provided approval to submit this work for publication.

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The authors are employees of Boehringer Ingelheim (BI).

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The data that support the findings of this study are available from the corresponding author upon reasonable request.

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