Market research study

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Combined analysis of 3 cross-sectional surveys of pain in 14 countries in Europe, the Americas, Australia, and Asia: impact on physical and emotional aspects and quality of life

https://doi.org/10.1515/sjpain-2020-0003
Received December 23, 2019; revised April 9, 2020; accepted April 17, 2020

Abstract

Background and aims: Recognition of the biopsychosocial aspects of pain is important for a true understanding of the burden of pain and the necessity of pain management. Biopsychosocial aspects of pain may differ between countries and cultures. Market research methods can be well suited and effective for assessing patient perspectives of pain and biopsychosocial differences. We conducted and combined 3 cross-sectional, international surveys to document the impact of pain on physical and emotional aspects of life, as well as quality of life (QOL).

Methods: Online panelists from 24 countries took part in our surveys in 2014, 2016, and 2017. Fourteen countries (Australia, Brazil, Canada, China, Germany, Italy, Japan, Poland, Russia, United Kingdom, United States, Mexico, Sweden, Saudi Arabia) contributed data in all 3 surveys and comprise the analysis population. A Global Pain Index (GPI) was constructed using 8 questions in 3 categories: Physical (frequency, duration, intensity of pain), Emotional (anxiety, impact on self-esteem, happiness), and Impact on QOL and ability to enjoy life. Each item was scored as the percentage of respondents meeting a prespecified threshold indicative of a substantial pain impact. Scores for the items within each category were averaged to obtain a category score, category scores were averaged to obtain a total score for each survey, and total scores from each survey were averaged to obtain a final combined score. Scores were assessed for the overall population, by individual countries, by age and gender, and by self-identified pain-treatment status (treat immediately, wait, never treat).

Results: Of the 50,952 adult respondents, 28,861 (56.6%) had ever experienced musculoskeletal pain; 50% of those with pain had pain with a multifaceted impact based on the GPI (Physical: 51%; Emotional: 40%; QOL Impact: 59%). Russia (57%) and Poland (56%) had the highest scores; Mexico (46%), Germany (47%), and Japan (47%) had the lowest. GPI score was higher in women (52%) than men (48%), and initially increased with age through age 54 (18–24 years: 45%; 25–34 years: 52%; 35–44 years: 53%; 45–54 years: 54%), after which it decreased again (55–64 years: 51%; ≥65 years: 45%). A majority (65%) of respondents wait to treat their pain, whereas 21% treat their pain immediately and 14% never treat pain. The most common reason for waiting (asked in survey 3 only) was to avoid taking medication.

Conclusions: In this combined analysis of 3 international surveys using a novel biopsychosocial pain assessment tool, pain had a substantial impact on ~50% of respondents' lives, spanning physical (51%), emotional (40%), and QOL effects (59%). Despite the substantial impact, a majority of patients tried to avoid treating their pain.

Implications: Clinicians should take a biopsychosocial approach to pain by asking patients not only about the presence and severity of pain, but the extent to which it affects various aspects of their lives and daily functioning. Patients may also need education about the efficacy and safety of available treatments for self-management of pain. The GPI may be a useful new tool for future studies of the biopsychosocial effects of pain in large populations.

Keywords: musculoskeletal pain; chronic pain; quality of life; biopsychosocial approach; psychological impact; physical impact.

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1 Introduction

Pain is a health condition that substantially impacts quality of life (QOL) [1–3]. Chronic pain can negatively impact usual daily activities, employment, self-care,

Published online June 03, 2020

mobility, sleep, and mental health [3–5]. Patients with pain consume nearly twice the amount of healthcare resources as the general population [1]. The likelihood that an individual will seek healthcare increases with the number of affected pain sites and pain severity [6]. Pain involves not only physical suffering but also psychological and social elements that can influence a person's perception of and response to pain, suggesting that a holistic, biopsychosocial approach is needed to best understand and manage pain [2, 7–9].

Although it is now well documented that pain conditions have negative effects on many aspects of sufferers' lives, more comprehensive population-level assessments across countries are needed for healthcare providers and policy makers to optimize prevention and treatment of pain. The aim of this study was therefore to conduct a combined analysis of 3 international surveys utilizing a novel biopsychosocial pain assessment tool to gain holistic insights into patient perceptions of the physical and psychological impact and consequences of pain on their daily lives. We also sought to identify whether persons with pain seek treatment and the beliefs that may prevent them from doing so. A survey-based market research approach was chosen to allow collection of these perspectives and insights directly from patients in an effective manner.

2 Methods

2.1 International pain surveys

Three 30-min anonymous online surveys were conducted by Edelman Intelligence, an independent global market research and analytics consultancy (105 Victoria Street, London, UK SW1E 6QT, https://www.edelmanintelligence.com), from November 20 through December 22, 2014 (survey 1), September 14 through November 2, 2016 (survey 2), and November 13 through December 21, 2017 (survey 3). Survey questions were developed by GlaxoSmithKline (GSK) Consumer Healthcare in collaboration with Edelman Intelligence. These surveys were developed and conducted in concordance with guidelines for general market research based on the Code of Conduct of the Market Research Society [10].

Participating countries (total of 24) varied from year to year. We limited the current analysis to 14 countries (Australia, Brazil, Canada, China, Germany, Italy, Japan, Poland, Russia, United Kingdom, United States, Mexico, Sweden, Saudi Arabia) that contributed to all 3 surveys so that the surveys could be combined to attain a larger, more robust population for analysis. Results were calculated for the entire international population (i.e. all countries combined) and also for each country individually to allow comparisons between countries. Surveys were written and conducted in English in the United States, United Kingdom, Australia, and Canada; in the rest of the countries, the surveys were translated by native speakers, tested with local affiliates, and conducted in the local language. Translation was performed by an ISO 9001:2015-accredited company using a 4-step process: (1) translation by a specialized native speaker of the target language, (2) proofreading by a second specialized native speaker of the target language, (3) in-depth quality assurance check by a third linguist, and (4) approval by project managers who were also trained linguists specialized in medical translation.

2.2 Population surveyed

Survey invitations were sent to a subset of subjects from large and varied panels of vetted individuals who had signed up to take online surveys. These individuals had previously been recruited to the panels through a series of online methods and registered after a quality check (screening questions) to ensure the validity and authenticity of the respondents. The panelists were nationally representative of the online population for each country based on age, gender, and region. The two supplier/online panel partners Toluna (Ealing Cross, 85 Uxbridge Road, London, UK W5 5TH; https://www.tolunacorporate.com/; supplier for survey (1) and Dynata Ltd (160 Queen Victoria Street, London, UK EC4V 4BF; https://www.dynata.com), formerly known as Survey Sampling International (SSI) (supplier for surveys 2 and 3), selected random members of the panels to receive the survey invitations; random selection was performed automatically in proportion to the necessary demographics needed to achieve the required representation. Invitations directed recipients to the location online where they could participate. Some panel members also accessed the survey through saved links and member pages rather than through an emailed invitation. Quotas were used to ensure national representation based on age, gender, and region for each country's online population. Respondents received an instant incentive (points to be exchanged for vouchers) upon survey completion in a predetermined amount based on the length of the survey.

To be included in the current analysis, respondents had to indicate via a question on the survey that they had, at some time in their lives, experienced pain in their

muscles, tendons, ligaments, or joints. Persons <18 years of age and respondents who worked in, or had a close friend or relative who worked in, market research/marketing, public relations, journalism, television, radio, media, hospitality, education, finance, healthcare, or the pharmaceutical industry were excluded.

For these non-interventional market research surveys, formal review by an Ethics Committee was not deemed necessary. Formal consent was obtained through an opt-in process; therefore, no information was collected from recipients who did not opt to participate.

2.3 The Global Pain Index

The primary outcome of the analysis was the proportion of respondents with impactful pain across one or more specific areas of their life based on a novel biopsychosocial pain assessment tool that we developed, the Global Pain Index (GPI). The GPI was designed to focus on three main areas: physical characteristics of pain (Physical category), emotional impacts of pain (Emotional category), and effects on quality of life (QOL Impact category). These areas have previously been shown to have an important impact on pain sufferers [2–6, 11].

The complete surveys each contained 43–53 pain-related questions. Eight factors based on multiple choice or yes/no survey questions that aligned with the categories of Physical, Emotional, and QOL Impact were chosen for inclusion in the GPI, and survey responses suggesting that the respondent met or exceeded a meaningful degree of pain or level of impact were selected for each question (Table 1). The 3 factors in the Physical category assessed the percentage of respondents with each of the following: pain frequency of at least weekly, pain duration of at least several hours, and more severe pain intensity, defined as a score of 7–10 on the 10-point Faces Pain Scale-Revised. The Faces Pain Scale-Revised is a widely used pain scale considered appropriate for use across many populations, including developing countries and low-literacy populations [12, 13]. The 3 factors in the Emotional category assessed the percentage of respondents who agreed with each (separately) of the following: that pain impacts their self-esteem, is associated with anxiety, and reduces their ability to be happy. The 2 factors in the QOL Impact category assessed the percentage of respondents who said that pain decreases their quality of life and the percentage that said pain impacts their ability to enjoy life.

The GPI was scored via a 3-step process: (1) For each survey, the percentage of respondents from the weighted data set (described below) who met the pre-specified thresholds (described above and in Table 1) for the questions within each category were averaged to obtain a category score, (2) the scores from each category were averaged to obtain a total score, and then (3) the total scores from each survey were averaged to obtain a single final GPI score for the overall population. Survey 2 did not ask about pain intensity, so scores for this factor were imputed by averaging the scores from surveys 1 and 3. This imputation was done for each individual country to obtain country-specific scores. Then, based on an average of the global scores from surveys 1 and 3, the process was repeated to impute the global pain intensity score for survey 2. The rationale for this scoring process was to arrive at a single score representing the percentage of respondents for whom pain had some meaningful impact on one or more major aspects of their life.

To confirm the construct validity of the GPI, we retrospectively calculated Cronbach's alpha (an index of reliability and internal consistency) to evaluate how each of the questions that compose the scale relate to the overall measure. Cronbach's alpha for each item and total score was calculated for each of the 3 surveys individually and combined, and for each individual country as well as the overall population. Cronbach's alpha scores range from 0 to 1, with higher scores indicating better correlation between the items in a test; accepted values have been reported as ranging from 0.70 to 0.95 [14].

Content validity was established through desk research consisting of a review of scientific and medical sources related to pain, including published surveys, case reports, guidelines, pain assessment tools, and country-specific pain Websites. This research, which was designed to further our understanding of attitudes and beliefs related to pain taking into account cultural differences, informed the development and design of the GPI. The design was further informed by ad hoc, in-person interviews with healthcare providers.

2.4 Statistical analysis

2.4.1 Data processing

Answers from each respondent were checked by means of pattern analysis and manual data review to detect and remove poor-quality data (e.g. data from respondents who checked the same answer choice throughout the survey, provided nonsensical answers, or completed the survey in a period considered insufficient for them to have adequately read and completed the survey [i.e. >30% faster than the median duration]).

Table 1: Global Pain Index (GPI) in survey respondents with musculoskeletal pain.

GPI category	GPI factor	Survey question	Survey answer choices (choices in red represent positive answers on the index)	Threshold used to calculate index score (calculated as % of respondents meeting the threshold)
Physical	Frequency	Survey 1: How regularly do you experience pain in your muscles, tendons, ligaments, and joints (e.g. back pain, neck pain, shoulder pain, or osteoarthritis)? Surveys 2 and 3: [With what] frequency do you experience body pain?[a]	– Constantly, every hour of every day (surveys 1 and 3 only) – Several times a day (survey 1 only) – Very regularly, at least once a day – Several times a week (survey 1 only) – Regularly, once a week or more – Several times a month (survey 1 only) – Quite regularly, at least once a month – Occasionally, at least once every 3 months – Rarely, once every 6 months (survey 1: at least once every 3–6 months) – Once a year or less (survey 1 only) – Very rarely, once in the past year (survey 3 only) – I have experienced it in the past, but not in the last year (survey 3 only) – Never	Weekly or more often
	Duration	Survey 1: How long were you in pain for (if not taking any pain reliever treatment)? Surveys 2 and 3: Thinking about the type of body pain you experience most regularly or chronically, how long would you be in pain (if not taking any pain reliever treatment)?	– Constant, practically non-stop – Very long periods of time, it lasted several days – Long periods of time, it lasted several hours – Quite long periods of time, it lasted a couple of hours – Quite short bouts of pain, it lasted at least an hour – Very short bouts of pain, not more than an hour – Extremely short, 10 min maximum	At least several hours
	Intensity	Survey 1: On average, how painful was your pain? Survey 2: Not asked[b] Survey 3: Thinking about the type of body pain you experience most regularly or chronically, on average, how painful is your pain?	Faces Pain Scale–Revised, with 6 faces implying no pain to severe pain, accompanied by ratings of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 [12, 13]	Numeric rating of 7–10
Emotional	Self-esteem	Surveys 1 and 2: Thinking about the impact your pain can have on your general capacity, do you agree with this statement? My pain impacts my self-esteem. Survey 3: Please tell us if you agree or disagree with the following statement regarding the most frequent pain you experience: My pain impacts my self-esteem.	Yes or No	Yes
	Anxiety	Surveys 1–3: Which of these answers best describes how your pain makes you feel?	– Extremely anxious – Very anxious – Quite anxious – Worried but not anxious – A little worried – Not worried at all	Any anxiety
	Happiness	Surveys 1 and 3: Please tell us if you agree or disagree with the following statement regarding the most frequent pain you experience: I cannot be happy when I experience this pain. Survey 2 asked respondents to select from a list the aspects of everyday life that were negatively impacted by body pain. "My happiness" was one of the options.	Yes or No	Yes

Table 1 (continued)

GPI category	GPI factor	Survey question	Survey answer choices (choices in red represent positive answers on the index)	Threshold used to calculate index score (calculated as % of respondents meeting the threshold)
QOL Impact	QOL	Survey 1: In your opinion, does experiencing body pain decrease your quality of life? Survey 2: In your opinion, does your quality of life decrease when you are suffering from body pain? Survey 3: In your opinion, does experiencing your most recent AND/OR most frequent type of body pain decrease your quality of life?	Yes or No	Yes
	Enjoyment of life	Survey 1: Do you agree with the following statement regarding the body pain you experience: My pain impacts my ability to enjoy life. Survey 2 asked respondents to select from a list the aspects of everyday life that were negatively impacted by body pain. "Ability to enjoy life" was one of the options. Survey 3: Please tell us if you agree or disagree with the following statement regarding the most frequent pain you experience: My pain impacts my ability to enjoy life.	Yes or No	Yes

[a]Body pain was defined as "pain that you experience in your muscles, tendons, ligaments, and joints." [b]Pain intensity was not included in survey 2, so these scores were imputed by averaging the scores from survey 1 and survey 3.

2.4.2 Statistical processing

To eliminate potential for bias in the global results due to the varying number of respondents across countries and across the 3 surveys, responses were weighted to ensure that each country and survey was equally represented and had an equivalent degree of influence on the final global score while maintaining the total base size of the 3 surveys. To accomplish this, the total base size ($n = 28{,}861$) was divided by the number of included countries (14) and number of surveys (3), to arrive at an $n = 687.17$ per country per survey. Weighting factors were then calculated for each country in each survey by dividing 687.17 by the actual number of respondents from that country and survey. For example, Australia had 515 respondents in survey 1, 1077 in survey 2, and 1007 in survey 3. Weighting factors applied to results for Australia were therefore calculated as $687.17/515 = 1.33$ in survey 1, $687.17/1077 = 0.64$ in survey 2, and $687.17/1007 = 0.68$ for survey 3. Similar calculations were performed for the other 13 countries. These weighting factors were then applied to each country's survey result before calculating the GPI score for the combined international population.

Subgroup analyses were performed to assess similarities and differences in GPI total and domain scores by individual country, age group (18–24, 25–34, 35–44, 45–54, 55–64, and ≥65 years), gender, and self-identified treatment status. Treatment status categories were based on the following survey question: "When you are in pain, which of the following best describes how you manage the pain episode to get relief? This could be anything from taking a pain relief medication to doing specific stretches targeting the pain or resting in an attempt to relieve your pain." Answer choices consisted of "treat my pain at the very first signs of pain," "wait a little in case it goes away on its own, but treat if it doesn't," "wait for as long as I can until I feel I need to treat it," and "wait for as long as it takes for the pain to go away on its own, I do not take action to treat it." Based on responses, participants were categorized as those who treat their pain immediately, those who wait to treat pain, and those who never treat their pain.

Descriptive statistics were used to analyze the overall combined population from the 3 surveys and each of the subgroups described above. Respondents were not permitted to advance the survey if a question was missing an answer; therefore, survey completers provided answers to all relevant questions and there was no need to impute missing data other than for the pain intensity question from survey 2, as described in Section 2.3.

3 Results

3.1 Survey and analysis population

Of 127,938 people who accessed and started one of the surveys (survey 1, $n=13{,}941$; survey 2, $n=53{,}717$; survey 3, $n=60{,}280$), 29,234 were screened out (survey 1, $n=3379$; survey 2, $n=11{,}537$; survey 3, $n=14{,}318$), and a total of 50,592 respondents (39.5%) completed one of the surveys (survey 1, $n=7079$; survey 2, $n=19{,}008$; survey 3, $n=24{,}505$). Of the 50,952 survey completers, a total of 28,861 (56.6%) said they had ever experienced musculoskeletal pain (survey 1, $n=7046$; survey 2, $n=9589$; survey 3, $n=12{,}226$) and served as the base sample for the analysis.

As described in the Methods, results were weighted to ensure an equivalent number of participants per country per survey ($n=687$), while maintaining the total base size of the 3 surveys ($n=28{,}861$). This weighted sample served as the overall analysis population for the GPI. Demographics for the weighted analysis population are shown in Table 2.

3.2 Overall GPI results

The total GPI score was 50% (Fig. 1), indicating that half of the online population across the 14 countries surveyed felt they had pain that had some substantial, multifaceted impact on their lives. A greater percentage of the overall analysis population met the thresholds pre-defined in the GPI (see Section 2 and Table 1) for the Physical (51%) and QOL Impact (59%) categories of the index compared with the Emotional category (40%) (Fig. 2). Within the Physical category, more respondents had frequent (62%) and long-lasting (65%) pain than intense pain (26%). Sixty-nine percent of respondents said pain reduces their quality of life, and 48% said it impacts their ability to enjoy life. Scores were fairly similar (37%–46%) across the 3 factors in the Emotional category.

Table 2: Demographics, weighted population.

Characteristic	Overall analysis population with musculoskeletal pain ($n=28{,}861$), n (%)
Gender	
Male	14,219 (49)
Female	14,642 (51)
Age, years	
18–24	3,738 (13)
25–34	5,566 (19)
35–44	5,606 (19)
45–54	4,968 (17)
55–64	4,329 (15)
65+	4,653 (16)
Employment status	
Employed	16,834 (58)
Not employed	12,409 (43)
Residence	
Urban	17,774 (62)
Suburban	6,898 (24)
Rural	4,189 (15)

Percentages may not total 100% due to rounding.

3.3 GPI scores by country

Country-specific GPI scores (Fig. 3) demonstrated that 46%–57% of the survey population in each country had a significant level of pain impact. Russia (57%), Poland (56%), the United States (51%), and Australia (51%) had the highest average GPIs, and Mexico (46%), Germany (47%), and Japan (47%) had the lowest. Physical pain category scores trended higher than average in Italy, Poland, United States, Sweden, Australia, and Canada (Table 3) and lower than average in China and Japan (Table 3). The Emotional category scores were above average in Russia, China, and Poland and below average in Germany, Mexico, Sweden, Canada, and Italy. QOL Impact scores were above average in Russia, Poland, and China and below average in the UK, Mexico, Canada, Japan, United States, Sweden, and Saudi Arabia. Scores on the individual factor scores showed greater variations by country (Fig. 4).

3.4 GPI scores by age and gender

Women scored higher than men overall in each of the 3 categories and on each factor in the GPI (Table 4). Overall GPI scores and Physical and QOL Impact category scores increased with increasing age group for age categories within the 18–54 year range, and these scores then decreased again in the last two age categories (55–64

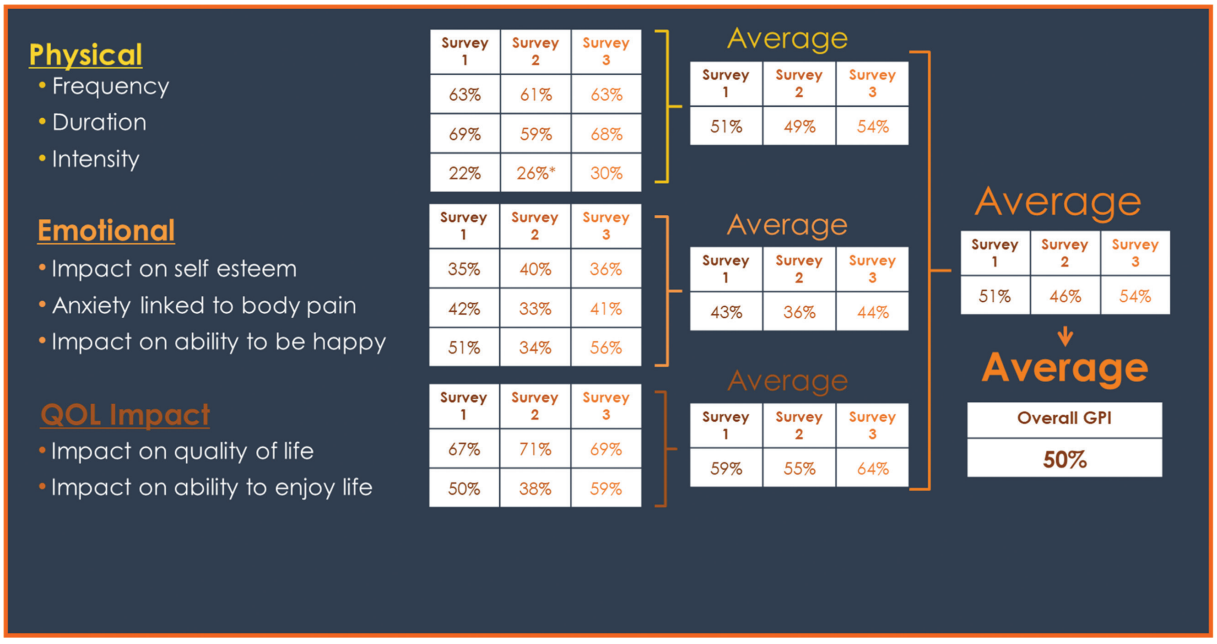

Fig. 1: Global Pain Index (GPI) score calculation. *The second survey did not ask about pain intensity, so survey 2 scores for this factor were imputed by averaging the scores from survey 1 and survey 3.

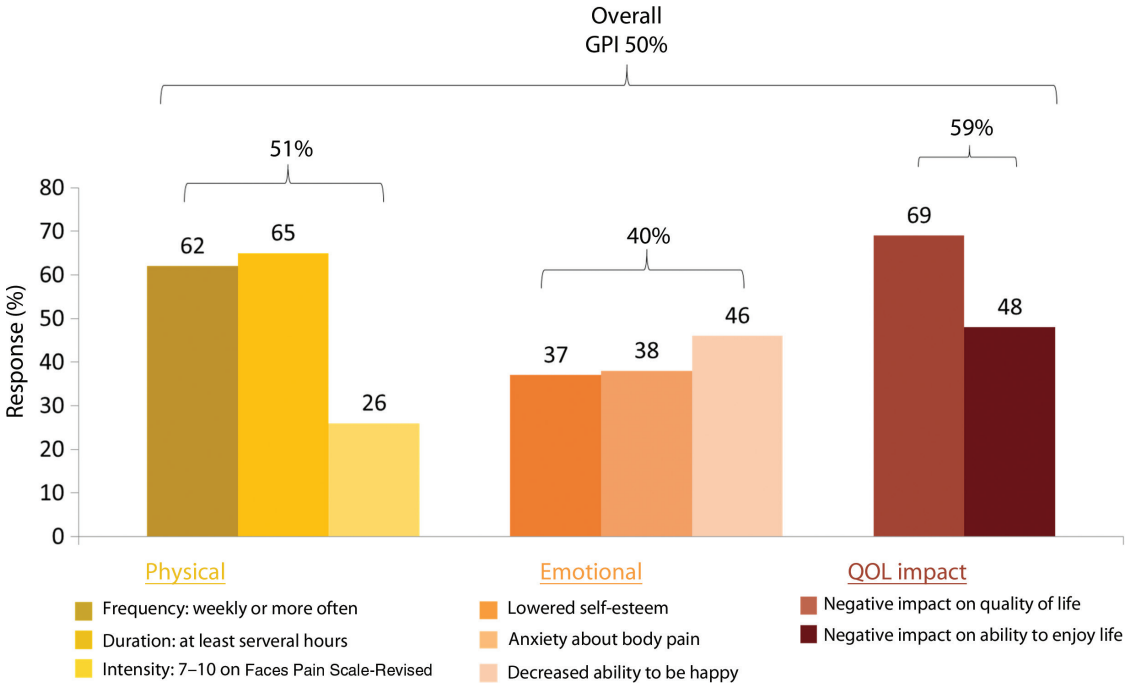

Fig. 2: Global Pain Index (GPI) factor and category scores. Overall population ($n = 28,861$).

and ≥65 years) (Table 4). A similar pattern was observed for all of the individual factors within the Physical and QOL Impact categories, except for pain frequency, which showed continued increases in score with age across all age groups. In the Emotional category, the overall category score and individual factor scores were highest, and similar, in the 25–34 and 35–44 year age groups, and lower in the youngest (18–24 years) and 3 oldest age groups (45–54, 55–64, and ≥65 years) (Table 4). The ≥65-year group had the lowest scores for pain impact on self-esteem and anxiety, and scores comparable to those of the youngest group for pain impact on ability to be happy.

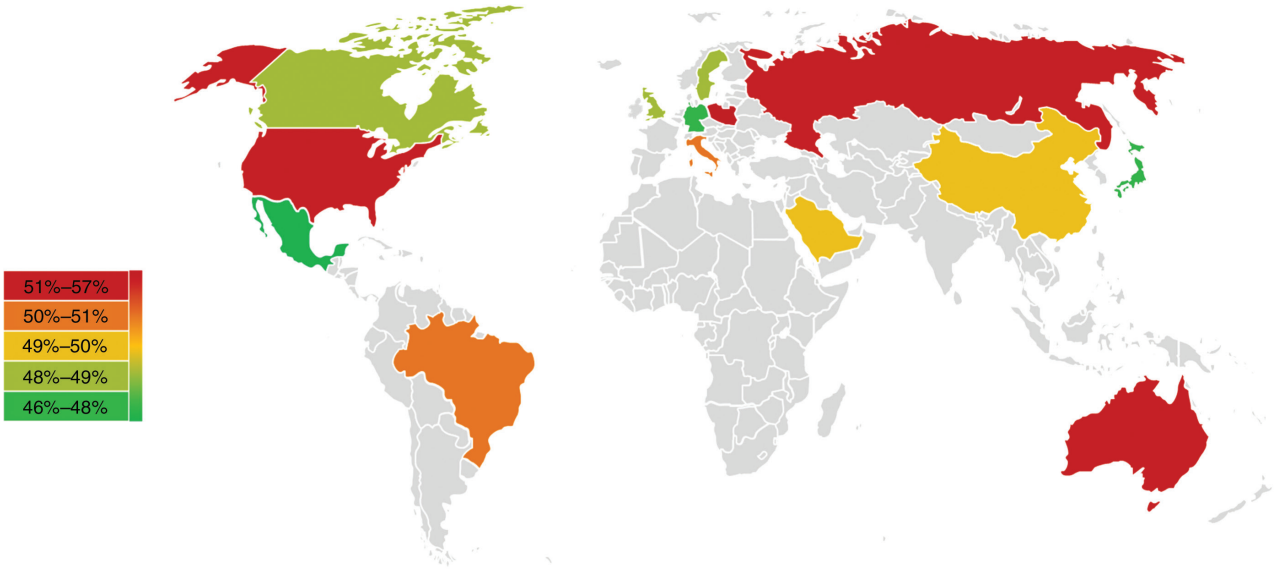

Fig. 3: Global Pain Index (GPI) score by country among the 14 participating countries. GPI scores are categorized by quintiles, with bright green representing the lowest quintile and red representing the highest.

Table 3: Categories driving the overall Global Pain Index (GPI) scores by country, weighted population.

Category (average category score)	Countries with a category score ≥3 points (3%) *higher* than the average[a]		Countries with a category score ≥3 points (3%) *less* than the average[b]	
	Country	GPI category score	Country	GPI category score
Physical (51%)	Italy	55%	China	38%
	Poland	55%	Japan	45%
	United States	55%	–	–
	Sweden	55%	–	–
	Australia	54%	–	–
	Canada	54%	–	–
Emotional (40%)	Russia	50%	Germany	34%
	China	46%	Mexico	34%
	Poland	46%	Sweden	35%
	Brazil	43%	Canada	37%
	–	–	Italy	37%
QOL Impact (59%)	Russia	72%	UK	52%
	Poland	67%	Mexico	52%
	China	65%	Canada	56%
	–	–	Japan	56%
	–	–	United States	56%
	–	–	Sweden	56%
	–	–	Saudi Arabia	56%

[a]Countries with *no* categories ≥3 points *above* average: Germany, Japan, UK, Mexico, Saudi Arabia. [b]Countries with no categories ≥3 points *below* average: Australia, Brazil, Poland, Russia. QOL=quality of life.

3.5 GPI scores by treatment status

A majority (65%) of survey respondents indicated that they wait to treat their pain versus treating immediately (21%) or avoiding treatment entirely (14%) (Table 5). These percentages were relatively consistent irrespective of gender or age. Germany and Sweden had the lowest percentages (14% and 15%, respectively) of immediate treaters, and Mexico and Brazil had the highest percentages (both 28%). Italy had the highest percentage of respondents who

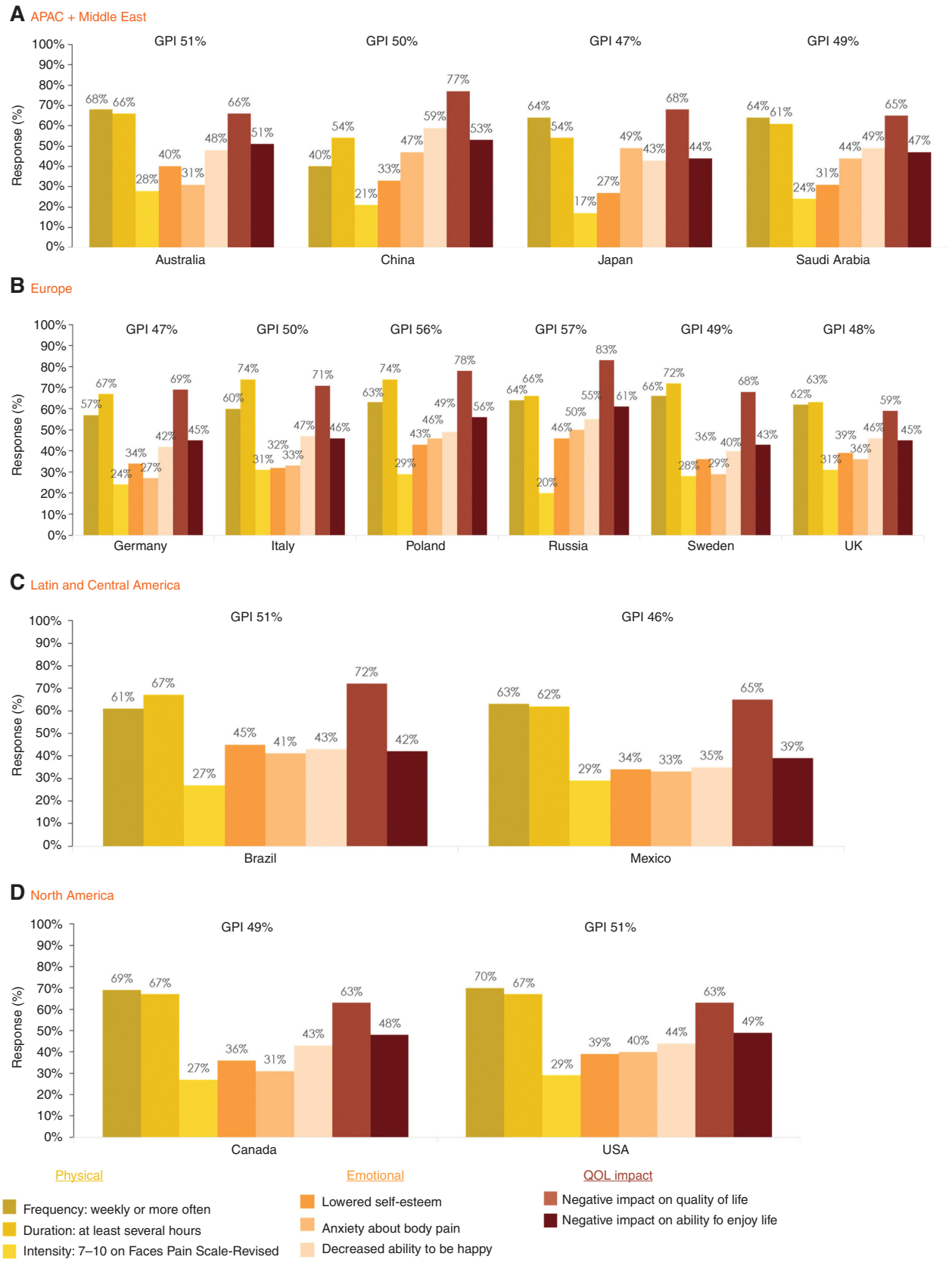

Fig. 4: Global Pain Index (GPI) scores by region and country: (A) Asia-Pacific Countries (APAC) and Middle East, (B) Europe, (C) Latin and Central America, (D) North America.

Table 4: GPI scores by (A) gender and (B) age group, weighted population.

	Gender		Age group (years)					
	Male (*n*=14,219)	Female (*n*=14,642)	18–24 (*n*=3,738)	25–34 (*n*=5,566)	35–44 (*n*=5,606)	45–54 (*n*=4,968)	55–64 (*n*=4,329)	≥65 (*n*=4,653)
Physical category	49%	54%	46%	51%	53%	55%	53%	49%
Frequency	60%	65%	58%	61%	60%	65%	65%	66%
Duration	62%	69%	60%	67%	69%	70%	66%	59%
Intensity	24%	29%	21%	26%	29%	29%	28%	23%
Emotional category	38%	42%	38%	45%	45%	43%	38%	31%
Self-esteem	34%	39%	36%	40%	40%	40%	35%	29%
Anxiety	36%	41%	39%	47%	45%	39%	33%	25%
Happiness	45%	47%	40%	47%	49%	50%	47%	40%
QOL impact category	57%	60%	52%	59%	62%	63%	61%	54%
QOL	67%	71%	61%	69%	73%	73%	71%	64%
Ability to enjoy life	47%	49%	42%	48%	50%	53%	50%	44%
TOTAL GPI SCORE	48%	52%	45%	52%	53%	54%	51%	45%

wait to treat (72%) and Japan had the lowest (57%). Sweden and Japan had the highest percentage (both 22%) of those who never treat their pain, whereas Brazil had the lowest percentage (8%) of never treaters.

Respondents who treat immediately had higher GPI scores overall and higher scores on all of the individual GPI factors other than pain duration compared with those who wait or never treat (Table 5). The GPI score was considerably lower for those who never treat (34%) compared with the immediate treaters (58%) and those who wait (51%), which may account for why those respondents find it less necessary to treat their pain. Over half of never treaters still reported experiencing pain at least weekly, but fewer had long-lasting pain compared with those who wait or treat immediately. Immediate treaters were more commonly diagnosed by a healthcare provider (54%) compared with those who wait (42%) or never treat (28%).

In survey 3, participants who wait to treat were asked their reasons for waiting. Among survey 3 respondents from the 14 countries included in the analysis, the most common reasons had to do with a desire to avoid taking medication (Fig. 5).

3.6 Construct validity of the GPI

In the retrospective analysis of construct validity, Cronbach's alpha was 0.72, 0.63, and 0.78 for the overall GPI in surveys 1, 2, and 3 respectively, and 0.72 for the 3 surveys combined. Scores tended to be a bit lower on survey 2 than the other 2 individual surveys or the overall combined survey. In the analysis of all 3 surveys combined, Cronbach's alpha values were generally consistent across individual questions that compose the index (0.70–0.74) and across countries (0.67–0.76) (Table 6). Thus, the majority of these values fell within the generally accepted level of reliability [14].

Within-category consistency across categories by gender and age further support the construct validity of the GPI (Table 4). For example, men consistently scored lower than women on the individual items, the domain scores, and the overall GPI. Similarly, in the analysis by age category, there was a generally consistent pattern in which the youngest and oldest age groups had scores that were lower on most of the individual items, the domains, and overall GPI than the middle categories.

As noted in the Methods, content validity of the GPI was supported by desk research, which pointed to the fact that pain has meaningful, well-recognized effects on physical well-being, emotional well-being, and QOL [15–18]. These concepts were confirmed during in-person interviews with healthcare providers.

4 Discussion

This analysis, combining results from 3 international surveys, supports the multidimensional nature of pain. It also helps elucidate the impact pain has on people's lives and how they manage their pain. We introduced a novel biopsychosocial pain assessment tool, the GPI, for assessing physical pain characteristics (frequency, duration, and intensity), emotional impacts of pain (impact on self-esteem, anxiety, and ability to be happy), and QOL (impact on QOL and ability to enjoy life). The final score represents a percentage of individuals who met prespecified thresholds (Table 1) indicating that pain had a substantial impact physically, emotionally, and/or on QOL. Higher scores are indicative of a larger percentage of the

Table 5: Profiles of immediate treaters, those who wait to treat their pain, and those who never treat pain.

	Percentage of respondents		
	Treat immediately (*n* = 5,922)	**Wait to treat (*n* = 18,841)**	**Never treat (*n* = 4,098)**
Overall population	21%	65%	14%
By demographic category			
Country			
Australia	20%	66%	15%
Brazil	28%	64%	8%
Canada	19%	68%	14%
China	17%	68%	15%
Germany	14%	69%	17%
Italy	17%	72%	10%
Japan	20%	57%	22%
Poland	21%	68%	11%
Russia	20%	67%	13%
UK	20%	64%	16%
US	26%	63%	11%
Mexico	28%	60%	12%
Sweden	15%	63%	22%
Saudi Arabia	23%	65%	12%
Gender			
Male	21%	64%	15%
Female	20%	67%	13%
Age (years)			
18–24	16%	66%	18%
25–34	21%	68%	11%
35–44	20%	69%	11%
45–54	22%	66%	12%
55–64	21%	63%	15%
65+	21%	59%	20%
Pain diagnosed by HCP	54%	42%	28%
GPI index			
Pain frequency at least weekly	68%	62%	54%
Pain duration of at least several hours	68%	69%	46%
Pain intensity: 7–10 on faces pain scale-revised [12, 13]	36%	25%	15%
Diminished self-esteem	43%	38%	23%
Anxiety about pain	51%	39%	20%
Decreased ability to be happy	56%	46%	32%
Impact on QOL	76%	71%	49%
Impact on ability to enjoy life	58%	48%	31%
Overall GPI score	58%	51%	34%

GPI = Global Pain Index; HCP = healthcare provider; QOL = quality of life.

population meeting such thresholds rather than more intense or frequent pain.

4.1 Multidimensional burden of pain

Half of the respondents with pain met the pre-specified thresholds. This is fairly consistent with a 2009 survey (published in 2016) of randomly sampled middle-aged adults from Chongqing, China, in which 46% reported pain that interfered with normal work activities in and outside the home [19]. An earlier survey conducted in 2003 (published in 2006) in 15 European countries and Israel found that 19% of respondents had moderate/severe chronic pain. A majority of those respondents reported that pain interfered with their daily lives including sleep, exercise, work, and chores, and 21% reported that they had been diagnosed with depression because of their pain [17].

The impacts of pain reported here support previous reports that pain involves not only physical suffering but

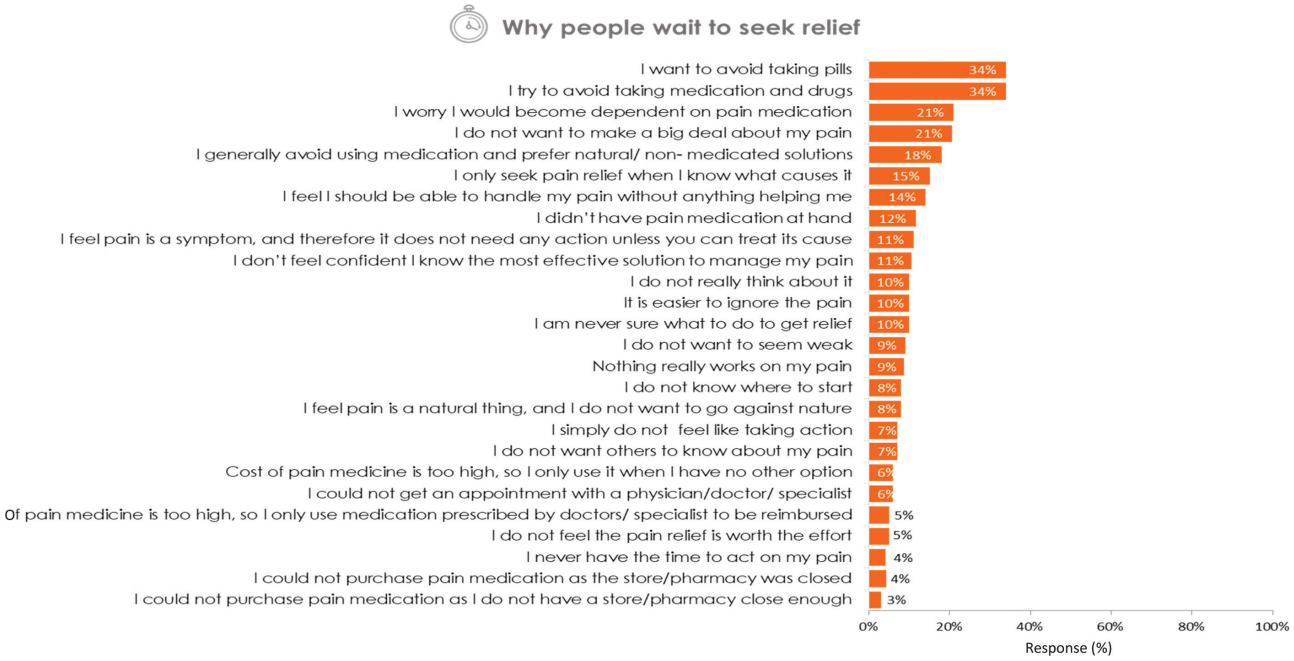

Fig. 5: Reasons respondents waited to seek pain relief ($n = 7{,}887$ in survey 3). Analysis population consists of respondents from survey 3 who were from the 14 countries in the combined analysis and who indicated that they wait to treat their pain. Reasons for waiting were not assessed in survey 1 or survey 2.

Table 6: Cronbach's alpha[a] for GPI and its components in the overall population (combined surveys 1, 2, and 3), globally and for the individual countries surveyed.

GPI factor[b]	Global	Australia	Brazil	Canada	China	Germany	Italy	Japan	Poland	Russia	UK	US	Mexico	Sweden	Saudi Arabia
Frequency	**0.72**	0.74	0.71	0.77	0.73	0.71	0.68	0.73	0.70	0.68	0.76	0.77	0.67	0.74	0.66
Duration	**0.72**	0.74	0.71	0.77	0.72	0.72	0.69	0.74	0.70	0.67	0.76	0.77	0.67	0.74	0.66
Intensity	**0.74**	0.75	0.73	0.77	0.74	0.73	0.71	0.76	0.72	0.69	0.77	0.79	0.70	0.75	0.70
Self-esteem	**0.72**	0.73	0.71	0.75	0.73	0.72	0.69	0.75	0.70	0.68	0.75	0.76	0.68	0.73	0.69
Anxiety	**0.71**	0.73	0.71	0.75	0.68	0.71	0.66	0.71	0.69	0.63	0.76	0.76	0.67	0.73	0.64
Happiness	**0.72**	0.74	0.71	0.75	0.71	0.71	0.67	0.73	0.67	0.65	0.77	0.78	0.68	0.74	0.67
QOL	**0.70**	0.71	0.70	0.74	0.69	0.70	0.66	0.72	0.69	0.64	0.74	0.74	0.66	0.72	0.65
Enjoyment	**0.71**	0.72	0.70	0.75	0.71	0.70	0.67	0.73	0.69	0.68	0.75	0.76	0.67	0.73	0.68
Overall GPI	**0.72**	**0.73**	**0.71**	**0.76**	**0.71**	**0.71**	**0.68**	**0.74**	**0.69**	**0.67**	**0.76**	**0.76**	**0.68**	**0.74**	**0.67**

[a]Cronbach's alpha is an index of reliability and internal consistency. Scores range from 0 to 1, with higher scores indicating better correlation between the items in a test; accepted values have been reported as ranging from 0.70 to 0.95 [14].
[b]Please refer to Table 1 for a detailed description of these factors.
GPI = Global Pain Index.

also has psychological and social components [7–9, 20, 21]. There is a growing recognition that management of pain, particularly chronic pain, requires a holistic approach that addresses patients' pain-related beliefs, thoughts, and behaviors [22, 23]. Beliefs and cognitions about pain (e.g. perception that hurt indicates bodily harm or illness, catastrophizing, fear of movement/activity, expectations regarding recovery) can perpetuate pain and mediate the impact of pain on disability, anxiety, and depression [22–24].

4.2 Interconnections between pain and emotions

There is a complex interplay between pain and anxiety or depression. In our surveys, 38% of respondents indicated that pain causes them anxiety and 46% said pain impacts their ability to be happy. A number of previous investigations documented an increased risk of anxiety and depression among pain sufferers [4, 25–27]. In one

survey, those with anxiety/depression were more likely to have severe and chronic pain [28]. A study from the North West of England found that pain/discomfort and anxiety/depression are the biggest drivers of socioeconomic disparities in health-related QOL [29].

4.3 Subgroup analyses

Our results revealed differences between countries in the percentage of persons meeting the pre-defined GPI category thresholds. In the absence of comparative statistics, it is unknown whether these are meaningful differences. It is possible, but cannot be confirmed from our data, that cultural/social norms influenced respondents' perceptions of pain. We also cannot rule out that language-meaning differences resulting from translation of the surveys from English into local languages influenced some of these differences.

In subgroup analyses by gender, more women experienced pain that was frequent, long-lasting, and/or severe, and more women experienced negative emotional and QOL impacts from pain compared with men. This is consistent with previous reports that pain – including pain that is more frequent, severe, longer-lasting, or chronic – is more common among women [1, 4, 28].

While pain frequency scores increased with age, overall GPI scores generally increased through age 54 years but then decreased in the oldest age categories (55–64 and ≥65 years). Some prior studies have documented increasing pain frequency with age and others have found higher prevalence among adults of working age, with a decline in prevalence among those ≥65 years [1, 28]. Further research is needed to investigate reasons the oldest respondents had lower pain impacts than middle-aged participants. We speculate that older patients have a greater expectation of having pain and therefore a greater level of acceptance of it, or have developed more coping strategies. It is also possible that older persons have reduced pain impacts because of less weight-bearing or occupational activities. We also cannot rule out the possibility of selection bias, because healthy older persons may have been more likely to participate in this online survey than those in poor health who might have had more pain.

4.4 Rationale for waiting to treat pain

Despite the burden posed by pain, 65% of respondents wait to treat their pain, and 14% avoid pain management altogether. The 21% who treat immediately had higher overall GPI scores and higher scores on all 8 factors except pain duration, indicating that a larger proportion of immediate treaters experienced particularly burdensome/impactful pain. Results from the third survey – the only one to assess reasons for these delays – indicate that a desire to avoid medication use was a driving factor behind delayed treatment seeking. Reasons for wanting to avoid medication use were not assessed, and it is unknown whether respondents sought to avoid pain medication specifically or all medication usage.

We are unaware of data elucidating perceptions about pain medications among those who do not use them. In a recent study, 3580 adults purchasing over-the-counter analgesics at one of 202 community pharmacies in Belgium completed the Pain Medication Attitude Questionnaire [30]. Their greatest medication-related concerns pertained to fear of addiction/dependency and side effects [30]. Further exploration of the reasons patients with pain avoid medication use is warranted to differentiate potentially valid concerns from misperceptions.

4.5 Limitations and strengths of the surveys and analyses

There are a number of limitations to the current analysis. Survey respondents may not be representative of the general population of each country in the analysis. It is theoretically possible that persons with pain or impactful pain may have had more interest in accepting the invitation to complete a pain survey, or that those with Internet access or interest in participating in online survey panels are not representative of the larger population. Data were not collected for invitation recipients who did not take the survey, so it is unknown whether survey completers differed from non-completers.

Survey invitations were sent to random samplings of the panel populations, but additional persons accessed the surveys via member sites or saved links; therefore, we were unable to ensure that the survey populations consisted of discrete populations each year. Respondents from surveys 2 and 3 came from the same panel supplier (Dynata), who indicated that 1186 respondents (6% of survey 2) participated in both surveys and therefore had responses on both surveys counted in the overall analysis. It is unknown whether any survey 1 respondents from the Toluna panel were also members of the Dynata panels.

Inclusion criteria called for respondents to have experienced pain at some time in their lives, so some respondents may have had a long recall period. Similar results for the "impact on ability to be happy" (Emotional category)

and "impact on ability to enjoy life" (QOL Impact category) suggest that respondents may not have differentiated well between these 2 questions. The 8 questions, 3 categories, and thresholds for calculating GPI scores were selected by Edelman Intelligence and GSK Consumer Healthcare without the aid of statistical testing (e.g. factor analysis) or established benchmarks to determine thresholds for clinically meaningful responses. Moreover, the construct validity was established retrospectively.

The main strength of this analysis is that it provides insights into people's real-world experiences with and perceptions of pain. To attain patient insights, the surveys and GPI were based on market research in accordance with the Code of Conduct of the Market Research Society [10], with scientific grounding in the human sciences such as sociology and anthropology. To our knowledge, this is the first series of global surveys across a wide range of countries and representative regions to evaluate the impact of pain on people's lives. The last major survey on this topic, which was limited to European countries and Israel, was conducted more than a decade ago [17].

Although the construct validation analyses were conducted retrospectively, the results support the reliability and consistency of the survey. Cronbach's alpha analysis showed that the GPI was reliable and consistent across the 3 individual surveys, across countries, and across the whole aggregated population. Furthermore, the survey questions used to construct the GPI were based on existing pain research, and trends gleaned from the overall GPI were consistent across dimensions, individual items, and subgroups by gender and age.

4.6 Conclusions

In this combined analysis of 3 international surveys using a novel biopsychosocial pain assessment tool, the GPI, 50% of respondents indicated that musculoskeletal pain substantially impacted their lives and well-being, spanning physical, emotional, and QOL effects. Of the 8 factors comprising the index, the ones that affected the most respondents were adverse QOL (69%), pain duration of at least several hours (65%), pain frequency of at least weekly (62%), and adverse impact on ability to enjoy life (48%). Variations in individual factor scores among the 14 participating countries suggest that cultural or other regional differences may affect perceptions of pain and its impact. People who treat pain immediately may be doing so as a result of a greater perceived pain burden/impact. A majority of pain sufferers delay treatment for their pain, with a desire to avoid medication usage as a driving factor.

4.7 Implications

Clinicians should consider a proactive approach to asking patients about the presence and impact of pain and their usual self-management approaches. Improved patient education about true risks and benefits of non-prescription pain medications and non-pharmacologic approaches may be beneficial in relieving some of the burden of pain. Education should also include an explanation of how the efficacy and safety profiles of non-prescription analgesics differ from those of other pharmacologic and non-pharmacologic pain-management strategies, especially in light of the ongoing opioid epidemic in the United States.

Authors' statements

Research funding: Funding for the GPI surveys, data analyses, and manuscript development was provided by GSK Consumer Healthcare S.A., who also participated in the development of the survey questions and GPI. Edelman Intelligence contributed to the surveys and GPI development, conducted the 3 surveys, and performed all data analyses, which were funded by GlaxoSmithKline Consumer Healthcare. Medical writing and editorial assistance was provided by Peloton Advantage, LLC, an OPEN Health company, and was funded by GlaxoSmithKline Consumer Healthcare.

Conflict of interest: JB has acted as consultant for Bayer, GlaxoSmithKline, Mylan, Novartis, Pfizer, and Reckitt Benckiser. He has received payment for speaking from GlaxoSmithKline, Pfizer, and Reckitt Benckiser. TM was an employee of GlaxoSmithKline Consumer Healthcare at the time of study. MH is an employee of GlaxoSmithKline Consumer Healthcare.

Informed consent: Formal consent was obtained through an opt-in process; therefore, no information was collected from recipients who did not opt to participate.

Ethical approval: For these non-interventional market research surveys, formal review by an ethics committee was not deemed necessary.

Availability of data and material

The aggregated data that support the findings of this study are available upon reasonable request from GSK Consumer Healthcare S.A. Requests must include a research proposal describing the objectives of research and its benefits for patients accompanied by a sufficient description of statistical and publication plans. Each request will be reviewed on an individual basis by GSK Consumer Healthcare to assess the ability of the proposal to meet the proposed scientific objectives and relevance to patient care.

Authors' contributions

Martina Hagen, PhD, participated in the design of the surveys and GPI. All authors contributed to the interpretation of the data and development of the manuscript, and all authors reviewed and approved the final manuscript.

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