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Carpal tunnel syndrome in the workplace. Triggers, coping strategies, and economic impact: A qualitative study from the perspective of women manual workers

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ABSTRACT

Background: Carpal tunnel syndrome (CTS) may lead to significant work limitations, especially in female manual workers. There is scarce evidence on the perspective of female manual workers with CTS.

Purpose: To explore the perspective of female workers who suffer from CTS regarding triggers, coping strategies, and economic impact.

Study design: A qualitative phenomenological study was conducted involving 18 manual workers with CTS diagnosed by the neurology service of a public hospital.

Methods: Purposive sampling was applied, and data were collected using in-depth interviews and researchers' notes. An inductive thematic analysis was applied to identify themes reflecting the participants' experience. Guba and Lincoln criteria were applied to establish the trustworthiness of the data.

Results: The mean age of participants was 40.06 years (SD 9.86). Four themes were identified: (a) coping with work limitations; (b) work activities that aggravate symptoms; (c) relationships at work; and (d) the economic burden of CTS. The effect of work on CTS, daily constraints, work situations that trigger the symptoms, and the strategies used by participants to adapt to their work are described. In addition, they recounted how relationships with managers and coworkers are modified and how CTS affects family finances.

Conclusions: The findings describe aggravating factors among working women, coping strategies used, and the social and occupational impact of CTS.

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Introduction

Carpal tunnel syndrome (CTS) is the most common peripheral neuropathy in the general population, which is closely related to a wide variety of leisure activities and occupations.¹ CTS affects 3%–6% of the adult population and is most prevalent between the ages of 40 and 60.² It is estimated that 4%–5% of the world's population suffers from CTS, with an incidence of 9.2% in women compared to 6% in men.² Spain has an incidence of 4.2 cases per 100,000 workers, where 62.8% of women suffer from the condition, leading to a high economic burden for companies.³

Risk factors are differentiated between systemic and mechanical or occupational.² The occupational factors associated with CTS are

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the presence of activities involving the monotonous use of the hand flexors, exposure to vibrations or occupational and/or environmental cold, forced flexion or extension positions, or wrist deformities.^{2,4}

The presence of symptoms is progressive, beginning with pain, worsening nocturnal paresthesia, atrophy of the thenar muscles, loss of strength, and decreased fine motor coordination in advanced stages of the condition.^{1,5} It is important to understand that pain signals are processed differently in men and women,⁶ furthermore, in the case of CTS there is greater muscle atrophy and edema among women.⁷

Previous qualitative studies report that work duties are the main cause of pain and emotional stress for patients with CTS. In the long term, this can lead to disability. The perception of suffering from the disease is conditioned by a myriad of economic, cultural, or psychosocial circumstances.^{8,9}

The published evidence on the qualitative perspective of women with CTS is scarce, and in the case of manual workers, practically non-existent. Qualitative methodologies can provide relevant clinical information that can assist with the treatment and follow-up of these patients.¹⁰ Also, qualitative research can be used to explore patients' priorities, needs, and concerns.¹¹ Therefore, the aim of this study was to provide information on factors such as work activities that typically aggravate symptoms, work environment limitations, coping strategies, the effect on their socio-occupational relationships and economic impact, from the perspective of the female worker.

Subjects and method

This study has followed the recommendations for qualitative studies in medicine established by The Standards for Reporting Qualitative Research.¹²

Design

A qualitative phenomenological study was conducted based on Husserl's framework.¹³⁻¹⁵ Phenomenology seeks to understand and describe the experiences and perspective of patients in situations of illness, disability, and treatment applications.^{13,16} Phenomenology, which is based on experiences narrated in the first person (interviews), attempts to understand the essence of a phenomenon.^{14,17} Thus, in phenomenology, 2 approaches in particular are influential in health care; (a) descriptive phenomenology has the closest connection with Husserl's original conception of phenomenology and focuses on creating detailed descriptions of the specific experiences of others;^{15,18} and (b) interpretative or hermeneutic phenomenology, which seeks to understand the nature of human beings and the meanings they bestow upon the world by examining language in its cultural context.¹⁹ Husserl indicates the need to "retain" beliefs (bracketing) which, using the phenomenological reduction approach, would enable a critical examination of the phenomena without influence from the researcher's own beliefs.^{14,17,20} In our study, bracketing was achieved by using in-depth interviews as the main data collection tool.^{15,17} In this way, we sought to avoid the researcher's influence on the data and reveal the nature of the phenomenon through the patients' accounts.²¹ The study was approved by the Ethics Committee of University Rey Juan Carlos (code: 0806202014020).

Research team

Six researchers (4 men and 2 women) participated in this study, 4 of whom (PMLM, CFP, JGR, DPC) had experience in qualitative study designs and all were not involved in clinical activity. All members of the research team had no prior relation with the participants. Three investigators (PMLM, CFP, JGR) had clinical and research experience

with neurological patients. Six members were physical therapists, and 1 was a nurse (DPC).

Participants, setting, and sampling strategies

Patients were recruited from the Neurology Service of the Hospital Universitario Fundación Alcorcón, between November 2019 and February 2021. Purposive or intentional sampling was applied, with the aim of recruiting patients who could respond to the proposed objectives.²² Recruitment was terminated when the information obtained from the interviews became repetitive,²² which occurred with patient 18.

Women between the ages of 18-65 were included with a diagnosis of CTS issued by the neurologist, according to clinical and electromyographic criteria. Clinical criteria included paresthesia and/or pain in the territory innervated by the median nerve, a positive Tinel's test and Phalen's test.² The electrodiagnostic criteria considered sensory and motor conduction deficits of the median nerve.²³ The exclusion criteria consisted of previous treatment with surgery and/or steroids, trauma to the upper limb, diagnosis of diabetes mellitus or other diseases that may explain the symptoms, and musculoskeletal disease (rheumatoid arthritis, reflex sympathetic dystrophy, fibromyalgia).

Data collection

Based on the phenomenological design of this study, first person data collection tools (in-depth interviews) and researcher's field notes were used.^{15,17} Two stages of data collection were employed: the first was conducted through unstructured interviews with an opening question: what is your experience with CTS? (participants 1-9). The unstructured interviews revealed some relevant topics that required further study, thus making it necessary to include a second stage of data collection. During the second stage (participants 10-18), a question guide was constructed from the data obtained in the first phase. The question guide was developed based on the accounts given by the initial 9 patients in 3 areas of interest (illness, diagnosis, and treatment). The semi-structured interviews still provided freedom for participants to narrate their experience of CTS without being directed by the researchers' own interests.¹⁵ This guide was applied in the semi-structured interviews. [Table 1](#) shows the semi-structured question guide.

All interviews ($n = 18$) were recorded and transcribed verbatim, with a total duration of 484 minutes. In addition, 18 field notes were also obtained from the researchers, in which they took note of the research process, methodological considerations, and data analysis.²²

Analysis

An inductive analysis was performed.^{24,25} The first step was to identify texts with relevant information. Subsequently, codes were identified and then grouped into clusters with common meanings (categories). These categories were in turn organized by common content in order to identify the themes that described the patients' experience.²⁴ The analysis of each interview was integrated into an analysis matrix,²⁶ which made it possible to identify and define the final topics via meetings between the members of the research team.²² The analysis process is shown in [Figure 1](#).

Rigor

To control the rigor and trustworthiness of the qualitative data, the Guba and Lincoln criteria were applied.¹⁶ [Table 2](#) shows the trustworthiness criteria and procedures.

Table 1
Characteristics of data collection

Theme	Questions
Illness	How would you describe your pain and condition? How much do you know about the disease you have? What aspects of the illness are most relevant to you? What does it mean to you?
Diagnosis	What motivated you to seek medical help? Can you explain the process of your diagnosis? What is your opinion on the time it took to receive a diagnosis of your pain?
Treatment	What treatment(s) have you received, and did it solve your problem? What do you consider to be the most relevant aspect of the treatment you have been prescribed? What do you think of the treatment? Do you adhere to the treatment? Why? What do you expect from the treatments? What are your expectations of a cure?

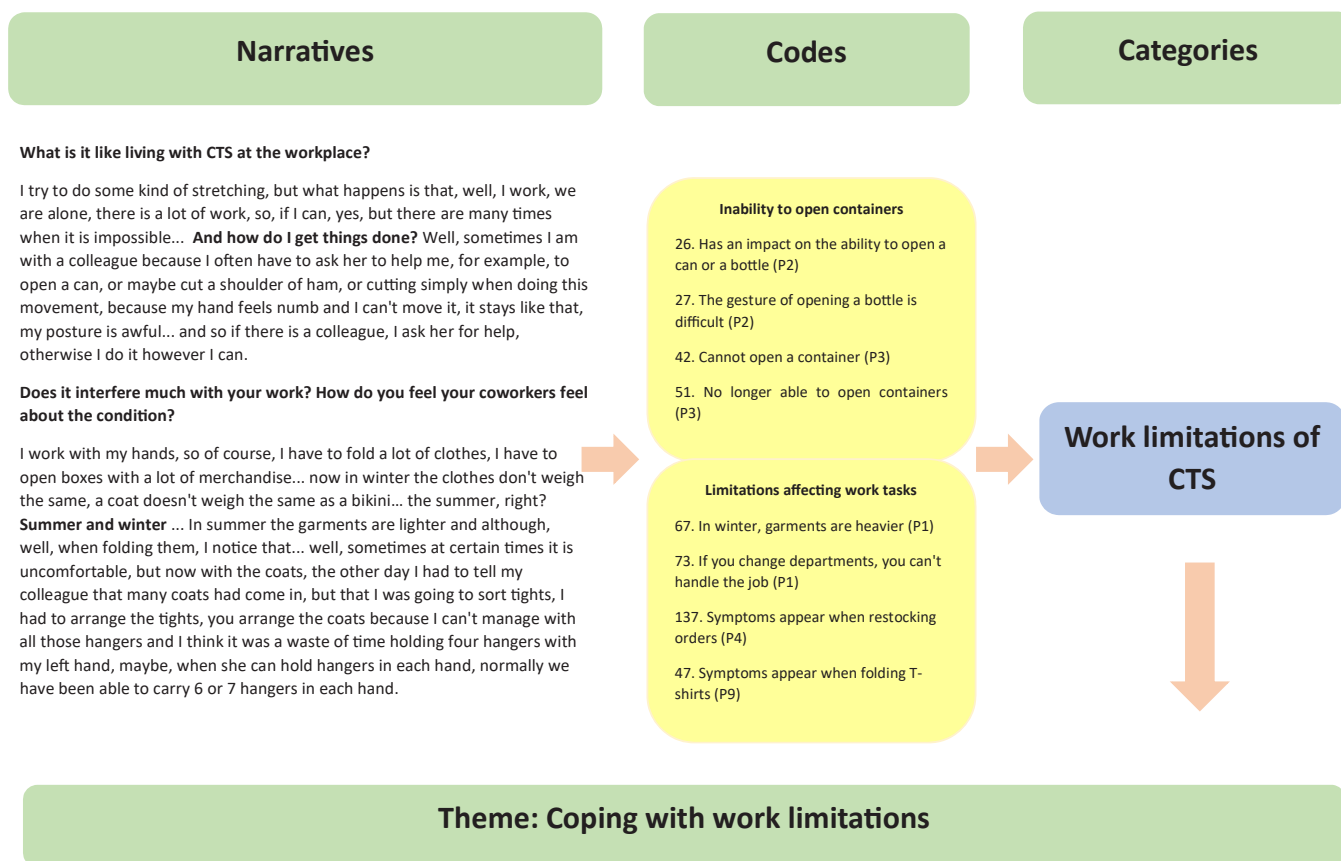


Fig. 1. Example of the data analysis process.

Table 2
Trustworthiness criteria

Criteria	Techniques performed and application procedures
Credibility	Researcher triangulation: each interview was analyzed by 2 researchers. Team meetings were held in which the analyses were compared, and categories and themes were identified. Triangulation of data collection methods: unstructured and semi-structured interviews were conducted, and field notes were kept by the researchers. Patient verification: asking patients to confirm the contents of the interviews. All participants were offered the opportunity to review the recorded interviews. None of the patients made any additional comments.
Transferibility	Detailed descriptions of the study conducted, detailing the characteristics of the investigators, patients, sampling strategies, and data collection and analysis procedures.
Reliability	External investigator audit: an external investigator evaluated the research protocol, focusing on aspects related to the methods applied and the study design. An external researcher specifically verified the description of the coding tree, the main themes, the patient narratives, the identification and traceability of the narratives, and the descriptions of the themes.
Confirmability	Triangulation of investigators, patient verification, and triangulation in data collection. Researcher reflexivity was encouraged through reflective reporting and description of the study.

Results

Data were analyzed from 18 patients diagnosed with CTS, with a mean age of 40.06 years (median 41,5 and interquartile range (IQR) 14,25). The evolution of symptoms was 23.33 months (median 24 and IQR 12). All had nocturnal symptoms, 44.44% ($n=8$) had symptoms when driving, and the mean pain intensity (measured from 0 to 10) at the time of the interview was 4.83 (median 5 and IQR 3). The mean time since CTS diagnosis was 15.11 months (median 12 and IQR 11,75).

See Table 3 for sociodemographic and clinical data.

Four themes were identified: (a) coping with work limitations; (b) work activities that aggravate symptoms; (c) relationships at work; and (d) the economic burden of CTS. The qualitative results are accompanied by excerpts from the narratives obtained during the interview transcripts. These narratives facilitate the traceability and justification of the results and are a requirement in qualitative designs.¹²

Coping with work limitations

The patients acknowledged that the symptomatology accompanied them all day long, and that they worked with numerous symptoms and limitations. Symptoms ranged from minor discomfort such as tingling to pain that limited wrist movement. One participant recounted her experience at work: *"You are working with symptoms, they always accompany you, they are like your shadow. If I could have one thing it would be to not feel anything, at least while working, even if everything reappears afterwards."* (P12).

The patients recognized that they should not work with symptoms or with crises, however, not going to work was not a viable option for many patients. This study included employees and workers who were their own bosses or had their own businesses. Nonetheless, all participants were working with symptoms, that is, none of them stopped working. In the words of a participant who owned a hairdressing salon: *"... I am working with pain, but I have to continue, I am the owner."* (P18).

In addition to the clinical symptoms, CTS interfered with the correct execution of their manual work. These constraints interrupted or limited actions and activities related to each type of work.

Thus, limitations appeared while grasping objects, manipulating clothing, exerting force by performing certain movements, or lifting weights (in jobs such as clothes salesclerks or hairdressers). Other types of limitations included the inability to open objects such as cans, bottles, or jars and the need to apply more energy to be able to do so (in hospitality jobs such as cooks or waitresses and housekeepers). One of the participants, who was a cook, recounted with resignation how she was sometimes unable to open a bottle of oil or peel a clove of garlic: *"Cooking is my world, I've been cooking since I was 16 years old, and now I can't even peel garlic, and sometimes I can't even open a bottle. What kind of cook am I?"* (P10).

Consequently, this led to the development of strategies such as carrying less weight on each trip, picking up lighter items, performing the job in a more efficient manner, more slowly. Another widely used strategy involved using a bandage to limit wrist flexion and thus improve symptoms, even without being instructed or recommended to do so by a health professional. *"... when I fold clothes, I do it like this, or like this and I say excuse me a second and I start to do it more slowly."* (P9).

Work activities that aggravate symptoms

Our participants recounted how each type of job was different, involving different situations, actions, gestures, or activities that triggered symptoms. Therefore, different factors triggered symptomatology. As stated by one of the participants: *"I am an optician, I don't have to do pick and shovel work, but I have symptoms and I do things in my job that trigger pain. To think that because I work at an optician's my hand doesn't hurt is absurd."* (P13).

Among the activities and gestures that triggered pain and symptoms during their work, the following activities stood out: picking up heavy loads quickly, overloading their hands with objects, holding many objects and weights in their arms for prolonged periods of time, working many days in a row without rest, and failing to schedule hand rest during the workday. Thus, a clothing saleswoman described how the activities she performed at work could prolong the symptoms when she returned home: *"... I have more discomfort depending on what I've been doing at work or if I've been holding more or less hangers with coats, or if I've been folding one type of garment or another."* (P1). Another participant, a masseuse, described how

Table 3
Sociodemographic and clinical data

	Age	Gender	Time since diagnosis (months)	Duration of symptoms (months)	Affected side	Pain intensity at the time of the interview	Job	Treatments prior to recruitment
P1	47	Female	48	48	Right	7	Clothing saleswoman	Orthosis, wrist brace, kinesiotaping, and physiotherapy
P2	36	Female	12	18	Bilateral	5	Cook	Rigid wrist support and stretching
P3	43	Female	6	7	Left	6	Household employee	-
P4	24	Female	12	24	Bilateral	5	Store manager	-
P5	35	Female	24	24	Right	5	Odd jobs	Splinting and infiltration
P6	40	Female	7	36	Right	6	Household employee	-
P7	32	Female	12	24	Right	5	Waitress	Splinting and exercise
P8	50	Female	18	24	Bilateral	3	Midwife	Orthosis
P9	22	Female	5	12	Bilateral	5	Clothing saleswoman	Splinting and exercise
P10	54	Female	6	6	Bilateral	8	Services in community of Madrid (kitchens)	Splinting, kerosene baths and exercise
P11	45	Female	18	24	Bilateral	3	Clothing saleswoman	-
P12	43	Female	5	5	Bilateral	6	Household employee	Orthosis, paracetamol and infiltration
P13	32	Female	18	18	Right	3	Optician	Splinting, physiotherapy and exercise
P14	29	Female	12	36	Left	5	Clothing saleswoman	Bandages
P15	47	Female	24	30	Bilateral	6	University administrative staff	Orthosis, physiotherapy, anti-inflammatory and exercise.
P16	56	Female	24	30	Bilateral	3	IT specialist	Splint
P17	49	Female	3	18	Bilateral	3	Masseuse	Orthosis and anti-inflammatories
P18	37	Female	18	36	Bilateral	3	Hairdresser	Orthosis, physiotherapy and medication

working without rest periods affected her: "... I try to schedule appointments that are not so close together, to give myself some time to rest, to stretch my hands. When I have patients scheduled, like yesterday, three in a row, by the end of the day I'm worn out." (P17).

Special consideration was given to exposure to cold from refrigerators or tap water that increases pain and/or numbness. This was especially true for participants who had to enter and leave environments with abrupt temperature changes (cold storage rooms) or where the hands were exposed to high temperatures (washing dishes) or the cold (taking food from the freezer). One participant described her experience as follows: "Just the thought of having to prepare the day's menu and take food out of the freezer makes me sick. I have to wear gloves because the cold gets into my bones and leaves my hands numb for the entire shift." (P2).

The gestures that triggered symptoms included: fine movements requiring greater precision trigger numbness of the fingers. Gripping movements, cutting with scissors or knives, cleaning, scrubbing, or lifting the arm and/or requiring forced flexion of the wrist (folding clothes): "... I'm cutting something and my hand stays in that position, stiff, it's very frustrating and limiting." (P2).

Relationships in the workplace

At first, the women chose to avoid reporting their condition for fear of rejection, change of position, or losing their job. In addition, our participants recounted how they tried to modify their way of working or ways of doing things because they did not want to make their colleagues uncomfortable or ask for help. Many participants recounted how they did not want to "feel like a burden to the rest of the colleagues". In addition, some of the participants also wanted to avoid conflicts with their peers over time because they wanted to help them and take on some of their work. One participant recounted: "At the beginning everyone helps you, but as time goes by people get tired. They have their own obligations; you can't be asking for help and favors all the time." (P14).

Finally, the progression of the symptoms and their increased frequency of onset during any activity forced many participants to notify their situation to their superiors. Consequently, they were forced to ask for help and/or negotiate the conditions and/or adapt their work with colleagues and superiors. An administrative worker recounted her experience of reporting her condition: "There came a time when I felt terrible, I had more and more difficulties, I couldn't move my hand. I spent more time hiding what was happening to me than doing my job. It was unsustainable. In the end I told my boss so she would know why I was late with things." (P15).

In some jobs such as a clothing salesperson, cook, warehouse worker, hairdresser, and cleaner, the most common support received by their coworkers was to avoid tasks that involved carrying weight or gripping large objects with force: "They help me with things like opening cans, cutting ham, because my hand gets numb, and I can't move it." (P2).

Few patients described conflicts with their superiors. In general, most of the participants reported how their bosses made an effort to adapt the work to the patient's disease, preventing the patient from asking for "sick leave" and abandoning work. One participant who worked as a housekeeper reported: "My boss told me not to worry, to keep coming back, not to exert myself, to arrange things the way I wanted, but not to leave." (P6).

The economic burden of CTS

All patients described how finances are a key factor in CTS. Firstly, this can limit their treatment possibilities by not being able to purchase certain devices or products such as medicines, services (physiotherapist,) and/or orthoses: "At the moment I can't afford to

buy the orthosis, I'm waiting a little longer." (P12). Often, patients waited or delayed seeking professional help or treatment. In the end, this wait was prolonged in time, delaying the search for help. Many recounted how the wait was "a temporary fix" until they could afford other services or treatment.

Many participants described how the choice of treatment was determined by its direct or indirect impact on their work and/or financial resources. In addition, many patients reported that they preferred to avoid surgery, because that would mean taking medical leave, leaving their job, and their salary would be reduced. Many participants used similar narratives, such as "it's too expensive", "I can't afford it now", "I can't quit my job", "my family depends on me". Some patients reported not choosing surgery because they were afraid of possible repercussions that would cause them further limitations and problems for returning to work: "... It all depends on your finances, I can't afford to take the risk of a poor outcome after the operation, I must work, I can't take the risk and I can't stop going to work." (P12).

This situation was often reported in patients who were business owners and self-employed. In these cases, agreeing to apply a treatment that may interfere with or jeopardize their business was often rejected or delayed. One participant commented: "Right now? Treatment on standby? what can I do? close everything? How will I feed my children?" (P4) Thus, despite feeling that the symptoms were worsening, they did not consider treatment for fear of requiring medical leave: "Being self-employed, I don't think about taking sick leave at all, even if I feel that I'm dying, I drag myself to the hairdressing salon." (P18).

Discussion

CTS causes limitations in patients who perform manual labor, in the textile sector, in the hotel and catering industry, or as domestic workers. Lee et al.²⁷ described how CTS affects 2.5 times more women than men, and that the profession with the highest risk of suffering CTS was the cleaning and housekeeping sector. Also, manual and repetitive work worsens CTS. Newington et al.²⁸ describe how patients show loss of strength and dexterity at work, leading to poor grips and objects falling from their hands. In many cases, patients use the non-dominant hand as a support for the affected dominant hand.²⁹ Previous studies show different strategies to compensate for clinical CTS during work or to reduce perceived pain, such as reducing the speed of performing manual tasks (eg, folding clothes slowly),^{9,30} the use of bandages or wrist wraps to limit movement and/or wrist flexion,⁹ and scheduling rest periods during the workday.^{9,31} Trillos-Chacón et al.³¹ emphasize the importance of breaks or rest periods as a prevention strategy in the workplace.

One of the mechanisms that triggers CTS symptoms at work is related to the use of compensations due to the ineffectiveness of the pincer grip. This means that the person must apply greater force with the hand, in an attempt to prevent the object from falling and hold it against gravity with greater effectiveness.^{32,33} Another mechanism, described by Wolny et al.³³ is the isolated repetition of a specific activity. Similarly, working in cold environments or at low temperatures worsens and provokes the symptoms of CTS.⁹

Our patients perceive that their finances are affected by CTS, limiting access to treatments and/or devices, affecting their work performance, and potentially affecting their job. Previous studies^{34,35} describe the difficulties of patients with CTS for obtaining medications, splints, and surgical treatments. Moreover, Arcury et al.⁹ in their work on beliefs about CTS in Latino workers, describe how workers expect that their pain and disability will increase and that their future employment and family finances will worsen. They have no other work alternatives, needing to work in order to support their

families, and therefore they tend to hide their illness. Jackson et al.³⁶ conducted a study on the status of CTS in the workplace, pointing out how workers avoided providing information about CTS, and their clinical symptoms in order to avoid repercussions in their jobs (shift or job changes, dismissal).

Our results show that workers avoided communicating their illness, as they did not want any conflicts at work, and therefore they delayed seeking help. King et al.,³⁷ in a paper on the presence of cumulative trauma disorders in workers with CTS and their occupational impact, described how employees who worked with pain suffered worsening of their symptoms and felt a sense of failure to fulfill their role at work. In addition, these participants delayed reporting symptoms to their employers and peers and tended to isolate themselves from the rest of the group.

Our results can be helpful in clinical practice for the early diagnosis of CTS in female workers. In the presence of symptomatology or complaints such as "I can't move my hand", "my sensitivity is different", "my hand stiffens", "when I pick up heavy objects they fall out of my hands", diagnostic confirmation tests could be applied at an early stage.³⁸ In CTS, Dabbagh et al.³⁸ reported that diagnostic self-report tools consisting of hand diagrams and/or diagnostic questions (eg, combination of Katz hand symptom diagrams (HSD) with either the Phalen's maneuver or the Tinel's sign) provide high accuracy. Moreover, the authors believe that health professionals should set realistic goals with the patient. Based on our results, they should avoid giving unhelpful advice to patients without considering their personal economic conditions. Among the advice to avoid would be to recommend patients to quit their job, buy (expensive) devices, and/or accept a treatment that may result in prolonged sick leave. In addition, specific strategies should be offered for the type of work the patient performs, avoiding very general advice that has limited applicability to the patient's work context (eg, telling an optometrist to avoid picking up weight). The discovery of the gestures or activities that provoke or trigger the symptomatology through the patients' narratives would help the professional to teach the patient alternative movements to develop the same action while avoiding triggers, overloading the contralateral side, or minimizing the clinical symptoms. For example, in hospitality workers, who had wrist pain and lack of strength when opening a jar, one could recommend that they remove the vacuum first, thus decreasing the grip strength needed and making the wrist movement required for opening much easier. In addition, the use of a bandage might be recommended to limit wrist movement.

Moreover, the Academy of Orthopaedic Physical Therapy and the Academy of Hand and Upper Extremity Physical Therapy³⁹ in its CTS practical guidelines reported how professionals could facilitate the adaptation of female workers by (a) identifying postures and/or situations that trigger and increase symptoms, (b) explaining alternative pain relief strategies such as the use of night splints to keep the wrist in a neutral position, and (c) the use of splints intermittently during the workday to reduce symptoms and improve grip strength at the workstation. In addition, the scheduling of short rest periods during the workday could prevent overloading of the hand and the appearance of symptoms.³⁹

One of the strengths of the present study is the absence of qualitative studies of women's perspectives on CTS and its impact on the work environment. However, one of the limitations is that the results cannot be extrapolated to all work contexts due to the nature of the qualitative design.

Conclusions

The present study describes the perspective of manual workers regarding how CTS affects their work environment, leading to work

limitations, requiring them to adapt their work duties, and identifying factors that aggravate their symptoms. Finally, CTS has an economic impact which may hamper their ability to purchase treatments/devices or report their illness at work. The results obtained can help physicians with the early diagnosis of CTS, and in the early recognition of the movements and postures that trigger the occupational symptoms of workers with CTS, thereby addressing prevention. In addition, health professionals could recommend strategies for pain relief and improvement of hand functionality within and outside the work environment.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Paloma Moro-López-Menchero, César Fernández-de-las-Peñas, Javier Güeita-Rodríguez, Stella Maris Gómez-Sánchez, Antonio Gil-Crujeira, Domingo Palacios-Ceña. The first draft of the manuscript was written by Paloma Moro-López-Menchero, and Domingo Palacios-Ceña and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

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