

Navigating Pain: A Qualitative Study of Opportunities and Barriers to Type 2 Diabetes Self-Management in Rural Communities

Kristen Allen-Watts

kristenallen@uabmc.edu

University of Alabama at Birmingham

Kennedy Butler

Virginia Tech

Paula Revolte

University of Alabama at Birmingham

Clementine Atkinson

University of Alabama at Birmingham

Shelicia Morton-Ford

University of Alabama at Birmingham

Amber W. Kinsey

University of Alabama at Birmingham

Kelly N.B. Palmer

University of Alabama at Birmingham

Ethel Johnson

University of Alabama at Birmingham

Nicole E. Werner

Vanderbilt University Medical Center, Vanderbilt University

Misty Hawkins

Indiana University Bloomington

Andrea Cherrington

University of Alabama at Birmingham

Burel R. Goodin

Washington University in St Louis

Stephanie Anne Shelton

University of North Carolina at Chapel Hill

Jessica T. Chambliss

University of Alabama at Birmingham

Taylor L. Taylor

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Abstract

Background

Rural adults in the southern U.S. experience disproportionate burdens of type 2 diabetes (T2D) and chronic pain (CP; ≥ 3 months), with structural and economic inequities limiting access to effective management of both conditions. This study explores factors shaping diabetes self-management among rural adults with diagnosed T2D and CP.

Methods

Participants were recruited from the Risk Underlying Rural Areas Longitudinal (RURAL) Cohort in Appalachian and Mississippi Delta regions. Eligible participants had T2D, and pain was assessed using a pain measure that included past-week pain severity, chronic pain duration (≥ 3 months), pain locations, and pain interference ratings. Focus groups were held at the Selma Public Library, a central and accessible location for participants from both counties. Audio recordings were transcribed verbatim and analyzed using deductive thematic analysis. Coding drew on Social Cognitive Theory (SCT) constructs. Inter-coder consistency checks and consensus procedures ensured rigor.

Results

Two semi-structured focus groups (N = 18) were conducted with rural adults. Most participants (12/18) had chronic pain, five reported having pain, and one reported no current pain. Pain emerged as a central disruptor, impeding exercise, sleep, household tasks, and overall capacity to manage T2D. Psychosocial stress, financial strain, medication burden, and limited access to healthy foods in rural environments further undermined self-care. Facilitators highlighted resilience and resourcefulness: reframing pain and creative distraction (pain resilience/adaptive coping), mobilizing social support from family, coworkers, churches, and community networks, movement as therapy to relieve pain and sustain functioning, use of alternative remedies amid constrained access to multimodal pain care, and reliance on faith and spiritual beliefs to manage pain and stress.

Conclusions

Findings underscore the complex interplay between pain, including CP, and diabetes self-management in rural settings. For rural adults with both conditions, self-care is shaped by intersecting structural, social, and psychological factors. Experiences of pain varied, with some participants reporting worsened pain during physical activity and others experiencing relief, suggesting differences in nociceptive versus neuropathic pain commonly associated with T2D. Interventions should leverage local social networks,

reduce food and medication burdens, and strengthen self-efficacy using culturally responsive strategies tailored to rural Southern communities.

INTRODUCTION

Diabetes mellitus is a chronic metabolic condition characterized by insulin resistance and impaired glucose metabolism [1, 2]. In the U.S., approximately 38.4 million adults are living with diabetes, and approximately 90–95% have type 2 diabetes (T2D), a condition strongly influenced by behavioral and lifestyle factors such as diet, physical activity, and obesity [3–6]. T2D disproportionately affects rural populations in the Southern U.S., where structural and economic barriers, including poverty, geographic isolation, limited healthcare access, and social norms, contribute to a higher prevalence of T2D and poorer quality of life [7–9]. Nearly 80% of rural counties are medically underserved, and the closure of more than 100 rural hospitals over the past decade has forced many residents to travel farther for care [10–12]. Economic hardship and food insecurity further impede diabetes self-management, often leading individuals to delay or forgo essential treatments [13, 14].

Diabetes self-management—daily behaviors such as eating a healthy diet, engaging in regular physical activity, monitoring blood glucose, and adhering to medication regimens—is central to achieving glycemic control and preventing complications. While these strategies are effective in improving glycemic outcomes, medication adherence, and quality of life [15–17], their implementation in rural settings remains challenging due to resource limitations, transportation barriers, cultural considerations, and competing demands.

Pain adds another layer of complexity for individuals with T2D. Approximately 60% of people with diabetes experience chronic pain [18, 19], and national data show that 28–31% of rural adults report chronic pain compared to 17–20% of their urban counterparts, with rural residents disproportionately affected by high-impact pain that interferes with daily functioning [20–22]. Chronic pain can substantially disrupt diabetes self-management by limiting physical activity and increasing emotional distress [18, 23, 24]. Conversely, poorly controlled T2D can exacerbate chronic pain severity [25–27], creating a vicious cycle in which each condition fuels the other. Despite the burden of both conditions, access to multimodal pain management, such as physical therapy, behavioral interventions, or integrated care models, is limited in many rural communities, leading to greater reliance on medication-based approaches [28, 29].

Although prior research has documented the burden of T2D and pain [30, 31], few have explored the lived experiences and perspectives of patients managing both conditions [23, 32–34], particularly in the rural South. To address this gap, this study explored barriers and facilitators to diabetes self-management among rural adults living with T2D and pain, including chronic pain, with attention to individual, social, and contextual factors that shape care in resource-limited settings. These findings can inform the development of more responsive, contextually grounded interventions for a population often overlooked in standard T2D care models.

METHODS

Theoretical framework

The focus group protocol was informed by Social Cognitive Theory (SCT) to examine how barriers and facilitators shape self-management among individuals living with T2D and pain. SCT emphasizes the dynamic interaction of personal, behavioral, and environmental determinants of health behavior [35–37].

Personal factors—such as beliefs, knowledge, emotions, and expectations—may support self-management through confidence and positive attitudes or hinder it through diabetes distress, negative beliefs, and emotional exhaustion [38–40]. Environmental factors, including family, social networks, and community resources, can act as facilitators when they provide encouragement and practical support, but become barriers when social stress or resource scarcity limits access to care [38, 39, 41]. Behavioral factors reflect the actions individuals take in response to these influences; adaptive coping strategies and movement-based behaviors can promote resilience, while medication burden or avoidance behaviors can impede progress [36–38, 42].

The focus group protocol was designed to capture these dynamics by asking participants to describe their experiences managing both conditions, including challenges, successes, and the roles of social and psychological influences. Questions were aligned with SCT constructs, such as self-efficacy, social support, and perceived barriers, allowing us to identify how these factors operate in rural Southern contexts to either enable or obstruct diabetes self-management. Follow-up questions and targeted probes were incorporated throughout the discussion to elicit richer detail and deepen understanding of participants' experiences. The focus group protocol was developed for this study. The full protocol is provided as a supplementary file.

Recruitment and participants

Participants were recruited from the Risk Underlying Rural Areas Longitudinal (RURAL) [43] Cohort Study, a multi-site project examining the rural health penalty in the Appalachian and Mississippi Delta (AMD) regions [44, 45]. The RURAL study characterizes biological, behavioral, environmental, and social exposures at both individual and community levels using a prospective design and community engagement strategies methods. Our study was intentionally aligned with RURAL's design and engagement framework to build on established relationships, leverage existing infrastructure, and ensure contextual relevance. Recruitment focused on two Alabama counties—Dallas and Wilcox, as both were existing RURAL study sites.

To identify potential participants, one of the co-authors—a clinical research nurse coordinator (Morton-Ford) for the RURAL study—used de-identified RURAL data to contact adults with diagnosed T2D. Because these individuals had previously engaged with the coordinator as part of the parent study, they were familiar with her and the study team, which facilitated rapport and trust. During outreach, potential

participants were asked whether they would be interested in participating in an additional study. Those who expressed interest were recontacted with available dates and times for the focus groups.

Eligible participants were required to have participated in the parent RURAL study and to meet diagnostic criteria for diabetes, defined as blood glucose ≥ 200 mg/dL on an oral glucose tolerance test. We did not collect data on duration of diabetes, noted as a limitation. Pain was not an inclusion criterion; instead, participants were screened for pain after agreeing to participate. Pain was assessed using a pain measure used in large epidemiologic cohorts. Participants reported (1) pain severity over the past week, (2) presence of pain lasting ≥ 3 months (chronic pain), (3) locations of chronic pain, (4) average pain severity on a 0–10 numeric rating scale, and (5) pain interference with general activity and enjoyment of life (0–10). These items are adapted from validated population-based pain assessments. Neither neuropathic nor non-neuropathic pain was assessed, noted as limitation.

Setting

Focus groups were held at the Selma Public Library, a central and accessible location for participants from both counties. Participants arrived approximately 30 minutes before the scheduled start time to consent, complete a brief sociodemographic questionnaire, and the pain measure. Sessions were facilitated by the Principal Investigator of the Diversity Supplement (Allen-Watts), the clinical nurse coordinator (Morton-Ford), and a co-leader of the RURAL Community Advisory Board (Johnson), all of whom were present to support discussion and ensure a comfortable environment. In addition, graduate research assistants (Butler, Revolte, and Atkinson) were present during each session to take detailed field notes and assist with observational documentation. Each focus group session lasted approximately one hour. Because the sessions were held during lunchtime, participants were provided with a healthy boxed lunch and received an incentive for their participation.

Data analysis

Audio recordings were transcribed verbatim by Landmark and Associates[46] The coding team (Allen-Watts, Butler, Revolte, and Shelton) and analyzed the transcripts using deductive thematic coding[37, 47] informed by SCT. Our analysis focused on identifying barriers and facilitators of T2D and pain, chronic pain, and self-management within the SCT's framework.

To ensure rigor, the coding team independently read and re-read all transcripts to establish familiarity with the data. The team developed a primary codebook, drawing directly from SCT subconstructs—self-efficacy, collective efficacy, value expectations, opportunities/barriers, social support, observational learning, normative beliefs, and knowledge [37, 41]. Guided by insights that emerged during application of the primary codebook, the team then developed a secondary, sequential codebook to capture additional psychological and psychosocial risk factors.

We implemented inter-coder consistency checks throughout coding to minimize bias and enhance reliability. The coding team resolved discrepancies through until reaching consensus. After coding was complete, we synthesized themes to describe how SCT constructs shaped participants lived experiences and how these constructs functioned as barriers or facilitators to managing both conditions in rural contexts. We did not conduct member checking.

RESULTS

Participant Characteristics

Demographic characteristics are summarized in Table 1. Two focus groups were conducted with a total of 18 participants. Most participants were women between the ages of 55 and 65 (61%). Approximately half of the sample (n = 9) had completed an associate degree or technical training, and 44% (n = 8) were married. Regarding household income, 50% reported annual incomes below \$30,000. Additionally, insurance coverage varied: 11% were insured through employment, 11% purchased insurance independently, 28% were covered by Medicare or Medicaid, 11% reported another insurance type, 28% reported multiple forms of coverage, and 11% were uninsured. Most participants (12/18) had chronic pain, five reported having pain, and one reported no current pain.

Table 1
Participant Characteristics (N = 18)

Variables	n (%)
Age	
35–44	1 (5.6)
45–54	6 (33.3)
55–65	11 (61.1)
Gender	
Male	7 (38.9)
Female	11 (61.1)
Education	
Less than high school	3 (16.7)
Completed high school or GED	5 (27.8)
Some college, but no degree	1 (5.6)
Associates, or technical school +	9 (50.)
Marital Status	
Single, never married	5 (27.8)
Married	8 (44.4)
Living as married/ with romantic partner	2 (11.1)
Separated	1 (5.6)
Divorced	2 (11.1)
Income	
< \$30,000	9 (50.0)
\$30,000 - \$49,999	3 (16.7)
\$50,000	5 (27.8)
\$50,000 - \$99,000	1 (5.6)
Insurance	
Through Employment	2 (11.1)
Self-Purchased	2 (11.1)
Medicare/Medicaid	5 (27.8)

Variables	n (%)
Other	2 (11.1)
Multiple Types	5 (27.8)
Uninsured	2 (11.1)

Major Themes

Analysis revealed eight major themes— five opportunities and three barriers influencing diabetes self-management in the context of pain, including chronic pain (see Table 2).

Opportunities highlighted resilience and resourcefulness. *Pain resilience and adaptive coping* included strategies such as reframing pain (“mind over matter”) and engaging in creative activities for distraction and emotional well-being. *Social support* from family, friends, coworkers, and community networks provided encouragement and accountability, helping participants sustain self-management behaviors. *Alternative remedies for relief* illustrated the use of unconventional approaches—such as pickle juice, mustard, herbal oils, and vinegar—often adopted out of desperation to alleviate severe pain. *Movement as Therapy* emphasized the importance of staying active, with participants noting that prolonged sitting worsened pain and that movement was essential for relief and overall well-being. Finally, *Faith-Based Coping as a Source of Strength* emerged as a salient theme. Participants described relying on faith and spiritual beliefs to manage pain and stress, emphasizing trust in God and surrendering control as strategies for coping. These practices provided emotional comfort and motivation to persist with daily activities despite physical limitations.

Barriers centered on the disruptive role of pain and psychosocial challenges. *Pain as a central disruptor* was the most prominent theme, with participants describing pain as so severe it interfered with basic tasks such as exercising, household chores, sleeping, and even getting out of bed. This constant limitation compounded the difficulty of managing diabetes, leaving participants struggling to balance two demanding conditions. *Psychosocial stress and environmental barriers to healthy eating* reflected how family issues, financial strain, and rural food environments undermined self-care. Stress often led to emotional eating, while limited access to healthy foods reinforced feelings of frustration and loss of control. *Medication burden* added another layer of complexity, as participants reported being overwhelmed by multiple prescriptions, side effects, and the cumulative demands of treatment.

Table 2
Representative Quotes of Major Themes

Major Themes	Representative Quotes
Opportunities	
Pain resilience and adaptive coping	"But, uh, as, uh, my pain level, I try to think of it as strength. I keep my mind like it ain't that bad. "I can deal with that. Uh, still keep doin' what you're doin'. I didn't think of it as mind over matter. I just thought of it as it's pain, you have other pains. It'll be okay. You just keep goin'. It's hard. It's hard to manage because I have where my spine is crooked and it sits on the sciatic nerve, which goes up and down my left side, so tryin' to balance the pain of that and the diabetes is rough. It's hard, but if you're not real strong-minded, it'll get you." And you've got to have that happy medium, or I do. I craft a lot, and that keeps my mind busy and keeps it off the pain
*Social support	"And also, my coworkers keep an eye on me too, because when I got bored, and I don't have anything goin' on. And so my coworkers pay attention to me, I guess, to keep me in track." "Let me also say, to say this too, [another participant] and I are friends, and we met at the Y. And it also help accountability. The people at the Y, if I don't show up, they want to know where you—what—you know [unintelligible]. We wanna know where you at, what happened, why you're not there."
Alternative Remedies for Relief	"And the dill pickle juice thing come about, I have—I've always had bad, bad leg cramps and can't even walk 'em out without being bad. And there's no amount of medication that would help. And not even Tylenol or anything. So I was messing around in the refrigerator and somebody had told me about the mustard and about the dill pickle juice. And-and I'm goin', well, that is just the grossest thing I believe I have ever heard of in my life, but I was in pain. I mean it was severe. So I downed me some of that. And it went away, just immediately. I could sleep, I could go to bed." "Yeah, compression socks, and that helps 'cause when I get up in the morning, I can feel the—just extending, so I put the socks on immediately and that control the swelling during the day. " But the pain is-is—you know, there, and if my legs start bothering me, said I'm having neuropathy, the neuro—if the le—my legs start bothering me, I put on the compression socks just throwin' this out there. I use frankincense oil and not really helps with inflammation and pain. I can use it and maybe in an hour, it's gone. Chick Fil A lemonade does a real good of-of—I drink some of that. We don't have Chick Fil A here. And that would—you know, I drink it, the next thing, my-my-my glucose, you know, it drops down even lower with that. Apple cider vinegar with the mother, that helps. And the cinnamon and the turmeric
*Specific to T2D, only.	

Major Themes	Representative Quotes
Opportunities	
Faith-Based Coping as a Source of Strength	"When I say I need two knee replacements and all of that, I just keep going. I just says it's just God just giving it extra strength because, other than that, I just go. I've been dealing with pain so long. I ignore it and keep moving." "The Lord tells us, if we trust in him, we can't be stressing out about any of the things we don't have any control over. It took me 61 years to get to the point that God controls everything. I have no control over anything." "...but I don't worry about it because I give it to God."
Movement as Therapy	"But I had to get up every morning and go to the Y and move in order to keep from hurting. I spend the first 30minutes there in the car what I call my meditation time. And then I get up and move. Just like this morning, I really didn't wanna go. But when I'm laying down, my back is hurting me. And it's like my sister said Saturday, you said you-you the busiest disabled person I ever know 'cause I go from one activity to the next. And everybody, like you keep moving, you keep doin'. I said this is—this is my therapy." "Long as I'm moving and doin' somethin', I feel okay, and I don't feel the—feel the pain. But now if I can't move and I can't go and I can't do that, I would feel every pain in the world. " "I do it [exercise] in the morning, one to keep from making excuses, 'cause like you said— I go ahead and pay for the Y 'cause I got to go and do it and get it over with, 'cause if I don't, it ain't happening." Um, you know what is—when I—when I start, everybody like why you go so early. I get there at 5:30. I had to put in my mind, this is my job. I no longer work. if I don't find somethin' else to do, somebody else gonna find somethin' for me to do and then I'll never do it. And then I won't feel as—like I said, I have to move to keep me feeling good. When I don't move for me, I don't feel good.
Barriers	
Pain as a central disruptor	"It hurts so bad sometimes that I can't get up and exercise, even though I know I should" "Like right now I feel now pain. But once I get to moving, my hips are hurt, my feet are hurt, my knees are hurt, you know." "You know, the neuropathy in my feet is-it-it just- we can't do nothing when you're hurting, you know?" "That is where the pain gets so intense so you can't sweep your floor. You barely can walk to the bathroom. You can't do your kitchen. You can't go outside and play with the little kids that come around that's the part that's challenging to me." "I have a knot that comes up in my back and sits there and how long it gonna stay, I don't know... it makes everything seem like you can't do it."
*Specific to T2D, only.	

Major Themes	Representative Quotes
Opportunities	
*Psychosocial Stress and Environmental Barriers to Healthy Eating	First thing in the mornings are tough for me because when I get up, it's like I have to get up, almost balance myself, just to get to movin'. I wouldn't say it was poor circulation, but I notice during the night when I lay—when I sleep, I get—I have pain in the hip and then I have to flip over because if I'm layin' on one side, I feel like the Tin Man. I gotta grease up before I can start movin" "My husband got diagnosed with cancer and I'm an emotional eater, so I've been off of it and binging and stressed, and you know." "I would exercise and really watch what I ate and check my—you know, monitor myself real good, uh, but I had a accident and then set it up 'cause I was stressed out, and because I was stressed out, she went ahead and put me on it" "It's been a challenge because I guess I was up and down at one point 'cause when [redacted] closed, I was out of work and it caused me to sit home. I was at home and as a man who has worked since he was 16, it was hard every mornin' watchin' my wife get up and leave, go to work. I'm in the house all day and it's like you're snackin' all day and you're eatin' what you shouldn't eat." "The biggest challenge for me with managing my diabetes was—we're in the South. It's either fried or it's fried. I noticed that had a lot to do with my cholesterol, my diabetes, and everything like that. Bread, you gotta have bread with every meal, that kinda stuff." It's a change, a culture change for anyone that's dealing with it, I feel like. "One of my biggest challenges is I have a lot of food allergies and so it's really hard for me to navigate both the diabetes and the food allergies. I haven't really mastered that yet. I'm still trying." And-and that's when you start trying to still figure out, okay, I take some. I exercise. I watch what I eat. But stress is a real factor in a lotta things
Medication burden	"I became diabetic, they automatically put me on cholesterol medicine. And I'm like but my cholesterol is not high. But we had to put you on that because of the fact that it will cause it to come down. But they had to take me off of it because it caused me—it-it had me cramping so bad." "I feel more control when I've—when they first told me that I had diabetes, 'cause I was trying everything and doin' everything I could to keep from getting on medication. And once I got—once they handed the, you know, medication, it was like I don't care what I did it just didn't-didn't work. And-and even though I kept doin' what I was doin' before, it's like it wouldn't pull that number at all, you know, once I got on the medicine. And it felt like the medicine is hinder—is kinda hindering me from progress. And it's like I can try, but it ain't moving the numbers like it was before I got on the medication." I think mine is I've been on different pain medications for so long that tryin' to balance the medication too—with your diabetes medication, a lot of times I noticed that the doctors that I go see don't wanna change pain medications to see if it—something is affecting each other, but so I think a lot of times mine is your—with my pain is they'll take me off the medication because it's
*Specific to T2D, only.	

Major Themes	Representative Quotes
Opportunities	been workin' pretty good, but now I said it's not, so they're tryin' to find the right medications group. "I think when you're on a lot of medications and stuff, that causes a lot of different things for your body, like side effects and all that stuff. The pain for your knee is now here, but now you got stomach pain 'cause you're taking pills or now your kidneys are hurtin' 'cause you're taking more pills. I think the medication, mixin' medications is very hard to manage, so it makes it hard to manage the pain." And the medication sometimes it can be 6 and \$700. So I'm not gonna take that I'm still on the pill, but the right pill that I should be on, it costs too much.
*Specific to T2D, only.	

OPPORTUNITIES:

Theme One: Pain resilience and adaptive coping

Participants living with pain or chronic pain demonstrated resilience through adaptive coping strategies that enabled them to maintain daily functioning and adhere to self-management routines despite persistent discomfort. These coping strategies reflect high self-efficacy and adaptive behavioral responses within SCT. A common approach was reframing pain as a challenge rather than a limitation, often expressed through the phrase “mind over matter.” This mindset served as a cognitive tool for strength, allowing individuals to redirect their attention away from pain and toward meaningful activities. By integrating this perspective into daily life, participants reported feeling empowered to transform pain into a source of motivation rather than distress. For example, one participant stated:

But, uh, as, uh, my pain level, I try to think of it as strength. I keep my mind like it ain't that bad.

Others stated:

And you've got to have that happy median, or I do. I craft a lot, and that keeps my mind busy and keeps it off the pain

I can deal with that. Uh, still keep doin' what you're doin'. I didn't think of it as mind over matter. I just thought of it as it's pain, you have other pains. It'll be okay. You just keep goin'.

It's hard. It's hard to manage because I have where my spine is crooked and it sits on the sciatic nerve, which goes up and down my left side, so tryin' to balance the pain of that and the diabetes is rough. It's hard, but if you're not real strong-minded, it'll get you.

Theme Two: Social support

Participants emphasized the importance of social support in promoting adherence to diabetes self-management routines. Peer relationships emerged as influential; for instance, one participant described forming a friendship with another individual at a local gym. This connection created a sense of shared responsibility, motivating both to maintain their self-management behaviors. Similarly, workplace connections were mentioned as influential, with coworkers providing encouragement and helping participants stay committed to their self-management goals.

And also, my coworkers keep an eye on me too, because when I got bored, and I don't have anything goin' on. And so my coworkers pay attention to me, I guess, to keep me in track.

Let me also say, to say this too, [another participant] and I are friends, and we met at the Y. And it also help accountability. The people at the Y, if I don't show up, they want to know where you—what—you know [unintelligible]. We wanna know where you at, what happened, why you're not there.

Theme Three: Alternative remedies for relief

Participants often used Complementary and Alternative Medicine (CAM) alongside prescribed medications, though some substituted due to cost. Participants described turning to alternative remedies to manage both diabetes and pain or chronic pain, often using these strategies in place of conventional treatments. Home-based remedies—such as drinking lemonade, dill pickle juice, or incorporating cinnamon—were also used to help alleviate pain or lower A1c levels. Others relied on physical aids like compression socks to reduce pain at its onset. Additionally, some participants used essential oils, such as frankincense, which they believed helped with inflammation and pain relief. For example, one participant shared:

And the dill pickle juice thing come about, I have—I've always had bad, bad leg cramps and can't even walk 'em out without being bad. And there's no amount of medication that would help. And not even Tylenol or anything. So I was messing around in the refrigerator and somebody had told me about the mustard and about the dill pickle juice. And-and I'm goin', well, that is just the grossest thing I believe I have ever heard of in my life, but I was in pain. I mean it was severe. So I downed me some of that. And it went away, just immediately. I could sleep, I could go to bed.

“Yeah, compression socks, and that helps ‘cause when I get up in the morning, I can feel the—just extending, so I put the socks on immediately and that control the swelling during the day.”

But the pain is-is—you know, there, and if my legs start bothering me, said I'm having neuropathy, the neuro—if the le—my legs start bothering me, I put on the compression socks.

Just throwin' this out there. I use frankincense oil and it really helps with inflammation and pain. I can use it and maybe in an hour, it's gone.

Chick Fil A lemonade does a real good of-of—I drink some of that. We don't have Chick Fil A here. And that would—you know, I drink it, the next thing, my-my-my glucose, you know, it drops down even lower with that.

Apple cider vinegar with the mother, that helps. And the cinnamon and the turmeric.

Theme Four: Movement as therapy

Some participants highlighted movement as a critical strategy for managing pain and promoting overall well-being. They described PA not only as beneficial but as essential, noting that prolonged sitting or inactivity often exacerbated pain symptoms. For many, even light forms of movement were perceived as therapeutic, helping to reduce discomfort and improve mood. Several participants framed movement as a form of “therapy,” emphasizing its role in maintaining functional independence and supporting both physical and emotional health. This perspective reflects a proactive approach to self-care, where staying active was viewed as a key component of resilience and symptom management.

But I had to get up every morning and go to the Y and move in order to keep from hurting. I spend the first 30 minutes there in the car what I call my meditation time. And then I get up and move. Just like this morning, I really didn't wanna go. But when I'm laying down, my back is hurting me. And it's like my sister said Saturday, you said you-you the busiest disabled person I ever know 'cause I go from one activity to the next. And everybody, like you keep moving, you keep doin'. I said this is—this is my therapy.

Long as I'm moving and doin' somethin', I feel okay, and I don't feel the—feel the pain. But now if I can't move and I can't go and I can't do that, I would feel every pain in the world.

I do it [exercise] in the morning, one to keep from making excuses, 'cause like you said— I go ahead and pay for the Y 'cause I got to go and do it and get it over with, 'cause if I don't, it ain't happening.

Um, you know what is—when I—when I start, everybody like why you go so early. I get there at 5:30. I had to put in my mind, this is my job. I no longer work.

If I don't find somethin' else to do, somebody else gonna find somethin' for me to do and then I'll never do it. And then I won't feel as—like I said, I have to move to keep me feeling good. When I don't move for me, I don't feel good.

Theme Five: Faith-Based Coping as a Source of Strength

Most participants emphasized the strength and sense of purpose they derived from their spiritual beliefs while navigating the daily challenges of managing diabetes and pain or chronic pain. Faith offered more than comfort—it provided hope, encouragement, and a framework for coping that helped participants remain resilient in the face of persistent physical suffering.

When I say I need two knee replacements and all of that, I just keep going. I just says it's just God just giving it extra strength because, other than that, I just go. I've been dealing with pain so long. I ignore it and keep

moving.

The Lord tells us, if we trust in him, we can't be stressing out about any of the things we don't have any control over. It took me 61 years to get to the point that God controls everything. I have no control over anything.

...but I don't worry about it because I give it to God.

BARRIERS

Theme One: Pain as a central disruptor

While some participants adopted a “mind over matter” approach, viewing pain as something to push through, others described pain as an overwhelming barrier that made routine tasks nearly impossible. Pain emerged as a central disruptor in participants' lives, influencing their ability to engage in essential diabetes self-management behaviors. For these individuals, pain interfered with physical activity—a cornerstone of diabetes care—and extended to basic daily activities such as household chores and even sleep. Several participants emphasized that the severity and persistence of pain not only limited their mobility but also eroded their sense of control, creating a cycle where pain hindered self-care and, in turn, contributed to feelings of frustration and helplessness.

It hurts so bad sometimes that I can't get up and exercise, even though I know I should

Like right now I feel now pain. But once I get to moving, my hips are hurt, my feet are hurt, my knees are hurt, you know.

You know, the neuropathy in my feet is-it-it just- we can't do nothing when you're hurting, you know?

That is where the pain gets so intense so you can't sweep your floor. You barely can walk to the bathroom. You can't do your kitchen. You can't go outside and play with the little kids that come around that's the part that's challenging to me.

I have a knot that comes up in my back and sits there and how long it gonna stay, I don't know... it makes everything seem like you can't do it.

First thing in the mornings are tough for me because when I get up, it's like I have to get up, almost balance myself, just to get to movin'. I wouldn't say it was poor circulation, but I notice during the night when I lay—when I sleep, I get—I have pain in the hip and then I have to flip over because if I'm layin' on one side, I feel like the Tin Man. I gotta grease up before I can start movin

Theme Two: Psychosocial stress and environmental factors to healthy eating

Psychosocial stress and environmental factors emerged as significant barriers to diabetes self-management, particularly in maintaining healthy eating habits. Participants described how stress from work, caregiving responsibilities, and traumatic life events often led to disengagement from core behaviors such as exercise and dietary control. Emotional eating was a common coping mechanism during these periods of heightened stress.

My husband got diagnosed with cancer and I'm an emotional eater, so I've been off of it and bingeing and stressed, and you know.

I would exercise and really watch what I ate and check my—you know, monitor myself real good, uh, but I had a accident and then set it up 'cause I was stressed out, and because I was stressed out, she went ahead and put me on it

Beyond individual stressors, the cultural and environmental context of the rural South compounded these challenges. Participants noted that unhealthy food options were not only readily available but deeply embedded in social norms, making it difficult to adhere to recommended dietary practices. This pervasive food environment created constant temptation and limited access to healthier alternatives. As one participant explained, living in the rural South directly influenced their ability to self-manage:

The biggest challenge for me with managing my diabetes was—we're in the South. It's either fried or it's fried. I noticed that had a lot to do with my cholesterol, my diabetes, and everything like that. Bread, you gotta have bread with every meal, that kinda stuff, so the challenging was overcoming what we've grown to know as we grew up.

It's been a challenge because I guess I was up and down at one point 'cause when [redacted] closed, I was out of work and it caused me to sit home. I was at home and as a man who has worked since he was 16, it was hard every mornin' watchin' my wife get up and leave, go to work. I'm in the house all day and it's like you're snackin' all day and you're eatin' what you shouldn't eat.

It's a change, a culture change for anyone that's dealing with it, I feel like.

One of my biggest challenges is I have a lot of food allergies and so it's really hard for me to navigate both the diabetes and the food allergies. I haven't really mastered that yet. I'm still trying.

"..And-and that's when you start trying to still figure out, okay, I take some. I exercise. I watch what I eat. But stress is a real factor in a lotta things."

Theme Three: Medication burden

Medication burden emerged as a significant barrier to effective self-management, particularly for participants navigating both pain or chronic pain, and diabetes. They described the challenge of managing multiple prescriptions, the financial strain of medication costs, and the physical toll of side effects. For many, the addition of new medications—such as cholesterol-lowering drugs prescribed after a diabetes diagnosis—introduced complications rather than relief. Participant explained,

I became diabetic, they automatically put me on cholesterol medicine. And I'm like but my cholesterol is not high. But we had to put you on that because of the fact that it will cause it to come down. But they had to take me off of it because it caused me—it-it had me cramping so bad.

I feel more control when I've—when they first told me that I had diabetes, 'cause I was trying everything and doin' everything I could to keep from getting on medication. And once I got—once they handed the, you know, medication, it was like I don't care what I did it just didn't-didn't work. And-and even though I kept doin' what I was doin' before, it's like it wouldn't pull that number at all, you know, once I got on the medicine. And it felt like the medicine is hinder—is kinda hindering me from progress. And it's like I can try, but it ain't moving the numbers like it was before I got on the medication.

Participants also reported that pain medications introduced their own challenges, including adverse effects and high out-of-pocket costs, which some participants identified as prohibitive. This interplay between medication complexity, side effects, and financial burden created a cycle of frustration and disengagement, for example, participants shared:

I think mine is I've been on different pain medications for so long that tryin' to balance the medication too—with your diabetes medication, a lot of times I noticed that the doctors that I go see don't wanna change pain medications to see if it—something is affecting each other, but so I think a lot of times mine is your—with my pain is they'll take me off the medication because it's been workin' pretty good, but now I said it's not, so they're tryin' to find the right medications group.

I think when you're on a lot of medications and stuff, that causes a lot of different things for your body, like side effects and all that stuff. The pain for your knee is now here, but now you got stomach pain 'cause you're taking pills or now your kidneys are hurtin' 'cause you're taking more pills. I think the medication, mixin' medications is very hard to manage, so it makes it hard to manage the pain.

And the medication sometimes it can be 6 and \$700. So I'm not gonna take that.

I'm still on the pill, but the right pill that I should be on, it costs too much.

DISCUSSION

To center the perspectives and experiences of individuals with T2D and pain, including chronic pain, this study qualitatively explored opportunities and barriers to managing both conditions in a rural Southern community. Through focus groups, we identified five key opportunities—pain resilience and adaptive coping, social support, alternative remedies, movement as therapy, and faith-based coping—and three major barriers: pain as a central disruptor, psychosocial stress and environmental barriers to healthy eating, and medication burden that shaped participants' daily experiences. To our knowledge, a limited number of studies have examined the intersection of pain and/or chronic pain and diabetes management in rural U.S. settings [48]. This study appears to be the first to qualitatively explore this

relationship, offering critical insights into the individual and contextual factors that affect diabetes care when pain, including chronic pain, is present.

Opportunities for Self-Management

Resilience and Adaptive Coping

Several participants demonstrated resilience by continuing to engage in physical activity, such as walking, despite the challenges posed by pain or chronic pain. Resilience functioned as a protective factor, enabling individuals to sustain self-management behaviors under significant physical and psychosocial strain. This finding aligns with prior research linking resilience to improved coping and reduced pain interference [49–52]. Resilience also emerged as a positive, modifiable factor within the contextual drivers of pain, which include psychosocial influences such as social support, work environment, and life events. Previous research indicates that individuals with strong social support networks, romantic partners, and employment tend to exhibit higher levels of resilience, which correlates with better psychosocial functioning [53, 54]. This bidirectional relationship between resilience and social support was evident in our findings, such that participants who displayed resilience often had access to supportive relationships that facilitated their self-management efforts. Themes of resilience were consistently associated with participants' ability to manage T2D despite the challenges of pain or chronic pain.

Movement as Therapy

The pain experience varied among participants, even in the presence of resilience. Some reported increased pain with physical activity, while others experienced relief. This variation may reflect differences in pain type—nociceptive versus neuropathic—commonly associated with T2D. Nociceptive pain refers to pain arising from actual or threatened damage to non-neural tissue and is caused by activation of nociceptors, typically in response to inflammation or tissue injury [55, 56], and can be exacerbated by exercise due to exercise-induced hyperalgesia [55, 57]. Conversely, when proper exercise techniques are applied, this sensitivity can be reduced [57]. Neuropathic pain, in contrast, is pain caused by a lesion or disease of the somatosensory nervous system, often resulting from nerve damage and characterized by burning, shooting, or electric shock-like sensations [57, 58]. These findings underscore the complexity of pain management and highlight the need for tailored physical activity strategies that account for individual pain profiles.

Alternative Remedies and Complementary and Alternative Medicine (CAM) Use

Several participants also reported using alternative remedies to manage their pain symptoms. CAM is broadly defined as a group of diverse medical and health care practices and products that are not presently considered part of conventional medicine [59]. Home remedies, in contrast, refer to traditional, non-prescription treatments often passed down through families or communities and typically involve readily available household items [60–62]. Examples shared by participants included cinnamon,

turmeric, dill pickle juice, mustard, spices, frankincense oil, and lemonade, which were used either as substitutes for prescription medications or as adjuncts to conventional treatment—often due to concerns about cost, side effects, or perceived ineffectiveness. The use of CAM is well-documented in rural communities, where limited access to healthcare resources may contribute to its prevalence[60, 61, 63–65]. Although participants in this study did not explicitly attribute CAM use to limited healthcare access, one individual cited cost as a reason for substituting home remedies for prescription medication. National data support this trend: the 2011 National Health Interview Survey reported that 5.4% of Americans used CAM to reduce medication costs, and 11.9% of uninsured adults substituted CAM for prescription drugs[66] Given that uninsured rates remain high in the rural South, where Medicaid expansion has not occurred [66, 67], health care professionals should prioritize patient education about CAM and home remedy use. Education is critical to prevent adverse drug interactions, ensure safe integration with prescribed therapies, and reduce potential harm for individuals managing both diabetes pain, including chronic pain.

Faith-Based Coping

Faith emerged as an important coping mechanism for managing pain, chronic pain, diabetes, and stress. Participants described relying on their spiritual beliefs to endure physical limitations and maintain emotional well-being. Expressions such as “I just keep going... it’s just God giving me extra strength” and “I give it to God” illustrate how faith provided a sense of control and resilience in the face of uncertainty. For some, trusting in God was framed as a way to reduce stress and relinquish concerns about factors beyond their control. These faith-based strategies offered emotional comfort, motivation to persist with daily activities, and a framework for coping with pain that participants perceived as beyond their personal control. This finding is consistent with prior research indicating that spirituality and religious coping can buffer psychological distress and promote adaptive responses among individuals with chronic illness [68–70].

Barriers to Self-Management

Pain as a Central Disruptor

Despite these opportunities, pain- most often chronic in nature, frequently disrupted diabetes care. Participants described pain as a central obstacle, limiting mobility and interfering with daily routines. Pain-related limitations often compounded other barriers, creating a cycle of reduced physical activity, increased stress, and diminished self-efficacy. These findings are consistent with prior research indicating that chronic pain is a major barrier to physical activity among individuals with diabetes, particularly in rural settings where resources for pain management are limited [71]. For example, integrated care models for rural populations have highlighted that pain-related functional limitations significantly reduce engagement in physical activity and other self-care behaviors, reinforcing the need for tailored interventions that address pain alongside diabetes management. Additional studies have similarly documented that pain interference predicts lower physical activity, adherence, and poorer

glycemic control in diabetes populations [72, 73]. Interventions should incorporate pain coping techniques and address psychosocial stressors to improve daily functioning and self-management adherence.

Psychosocial Stress and Environmental Barriers

Psychosocial stress—driven by family issues, financial strain, and limited access to healthy foods in the area—emerged as a significant challenge to diabetes self-management. Stress frequently led to emotional eating and reduced physical activity, reinforcing feelings of frustration and loss of control. These findings align with prior research demonstrating that psychosocial factors can influence cognitive and behavioral functioning and exacerbate chronic illness progression [74–77]. Stress is known to affect metabolic function through neuroendocrine pathways, temporarily elevating blood glucose levels as part of the adaptive stress response [76, 78]. For individuals with T2D, chronic stress may contribute to poor glycemic control, decreased adherence to self-management behaviors, and adoption of unhealthy coping strategies such as smoking or alcohol use. Addressing psychosocial stressors and improving access to healthy foods in rural environments is critical for reducing diabetes-related complications and promoting sustainable self-care.

Medication Burden

Medication management emerged as a complex challenge for participants navigating both diabetes and pain or chronic pain. Many described difficulties related to polypharmacy, including balancing multiple prescriptions, managing side effects, and addressing potential drug interactions. These challenges were compounded by the high cost of medications, which influenced treatment decisions and, in some cases, led participants to seek alternative remedies or complementary approaches. These findings are consistent with prior research indicating that polypharmacy and regimen complexity can increase treatment burden and emotional distress among individuals with chronic illness [79–81]. Studies have shown that medication-related challenges, such as adverse effects, cost, and regimen complexity, are associated with lower adherence and poorer health outcomes in diabetes populations [79, 82–84]. However, similar to previous literature, participants in this study demonstrated persistence in maintaining core medication adherence, even when faced with financial and physical strain. This underscores the importance of patient-centered care approaches that address regimen complexity and consider financial barriers to optimize medication adherence and overall self-management.

This study offers several strengths. First, it addresses a critical gap in the literature by examining the intersection of diabetes and pain, including chronic pain, an area with limited existing research, using qualitative methods. This approach provides nuanced insights that are especially valuable given the scarcity of prior work. Second, the focus on a rural Southern population enhances relevance for underserved communities that are often underrepresented in health research. Finally, the qualitative design allowed for a rich, contextualized understanding of lived experiences that quantitative approaches may overlook. However, several limitations should be acknowledged. First, the study did not assess distinctions between pain types (e.g., nociceptive versus neuropathic), which limits interpretation

of pain-related variability. The study also did not collect information on duration of diabetes, which constrains our ability to contextualize participants' self-management experiences by stage of disease. Third, as with all focus group studies, findings may have been influenced by group dynamics, social desirability bias, and participants' willingness to share sensitive information in a group setting. Additionally, while the study identified barriers and facilitators, it did not quantify their relative impact on self-management behaviors; this issue could be addressed in future mixed-methods research.

Conclusions

Our study identified key facilitators and barriers that influence individuals with T2D and pain, including chronic pain, in their ability to engage in self-management in a rural setting. These findings provide a nuanced understanding of the interplay between personal and environmental factors in shaping health behaviors within the context of multimorbidity. The identification of factors such as pain, alternative remedies, resilience, and psychological and psychosocial influences underscores the need for patient-centered research and care. By centering participants' experiences and allowing them to speak freely about their self-management practices, this study offers a foundation for tailoring existing educational programs and self-management regimens to better reflect the lived experiences of patients. Such efforts can inform interventions that are culturally relevant, contextually appropriate, and responsive to the unique challenges faced by individuals managing T2D and pain in rural settings. Additionally, findings underscore the need for policy efforts to expand insurance coverage and improve access to multimodal pain care in rural areas.

Abbreviations

T2D

Type 2 Diabetes

CP

Chronic Pain

SCT

Social Cognitive Theory

AMD

Appalachian and Mississippi Delta

RURAL

Risk Underlying Rural Areas Longitudinal

CAM

Complementary and Alternative Medicine

Declarations

Ethics approval and consent to participate

Ethics approval for this study was obtained from the University of Alabama at Birmingham Institutional Review Board (UAB IRB; Protocol #300011989). All methods were performed in accordance with the relevant guidelines and regulations approved by the UAB IRB. All participants provided informed consent prior to participation.

Consent for publication

Not applicable. This study includes anonymized participant quotations that do not contain identifiable personal data, and therefore, individual consent for publication was not required.

Competing interests

The authors declare that they have no competing interests

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Author Contribution

KAW, AC, BRG, and SJ contributed to the study conceptualization and design. KAW led data analysis and interpretation along with PR, KB, and SAS. KAW drafted the manuscript, and all authors reviewed, revised, and approved the final manuscript.

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Data Availability

The qualitative datasets for this study contain potentially identifiable participant information and cannot be shared publicly. De-identified data excerpts are available from the corresponding author on reasonable request, subject to IRB approval.

References

1. World Health Organization. Diabetes [Internet]. [cited 2025 Dec 15]. Available from: <https://www.who.int/health-topics/diabetes>
2. Chandrasekaran P, Weiskirchen R. Cellular and Molecular Mechanisms of Insulin Resistance. *Curr Tissue Microenviron Rep*. 2024;5(3):79–90. 10.1007/s43152-024-00056-3.
3. Centers for Disease Control and Prevention. U.S. Department of Health & Human Services [Internet]. 2024 [cited 2025 Sep 7]. Type 2 diabetes. Available from: <https://www.cdc.gov/diabetes/about/about-type-2-diabetes.html>
4. Centers for Disease Control and Prevention. National Diabetes Statistics Report [Internet]. 2024 [cited 2025 Sep 8]. Available from: <https://www.cdc.gov/diabetes/php/data-research/index.html>
5. American Diabetes Association. American Diabetes Association [Internet]. 2025 [cited 2025 Sep 7]. Diabetes in America: Prevalence, Statistics, and Economic Impact. Available from: <https://diabetes.org/about-diabetes/statistics/about-diabetes>
6. Dugani SB, Mielke MM, Vella A. Burden and management of type 2 diabetes in rural United States. *Diabetes Metab Res Rev*. 2021;37(5). 10.1002/dmrr.3410.
7. American Diabetes Association. American Diabetes Association [Internet]. 2025 [cited 2025 Sep 7]. Diabetes in America: Prevalence, Statistics, and Economic Impact. Available from: <https://diabetes.org/about-diabetes/statistics/about-diabetes>
8. Dugani SB, Mielke MM, Vella A. Burden and management of type 2 diabetes in rural United States. *Diabetes Metab Res Rev*. 2021;37(5). 10.1002/dmrr.3410.
9. Saslow E, KFF Health News [Internet]. 2019 [cited 2025 Sep 7]. Health Care Deserts: Nearly 80 Percent Of Rural U.S. Designated As Medically Underserved. Available from: <https://kffhealthnews.org/morning-breakout/health-care-deserts-nearly-80-percent-of-rural-u-s-designated-as-medically-underserved/>
10. Saslow E, KFF Health News [Internet]. 2019 [cited 2025 Sep 7]. Health Care Deserts: Nearly 80 Percent Of Rural U.S. Designated As Medically Underserved. Available from: <https://kffhealthnews.org/morning-breakout/health-care-deserts-nearly-80-percent-of-rural-u-s-designated-as-medically-underserved/>
11. NIHCM Foundation. National Institute for Health Care Management (NIHCM) Foundation [Internet]. 2023 [cited 2025 Sep 7]. Rural Health: Addressing Barriers to Care. Available from: <https://nihcm.org/publications/rural-health-addressing-barriers-to-care>
12. NIHCM Foundation. National Institute for Health Care Management (NIHCM) Foundation [Internet]. 2023 [cited 2025 Sep 7]. Rural Health: Addressing Barriers to Care. Available from: <https://nihcm.org/publications/rural-health-addressing-barriers-to-care>
13. Bowen S, Elliott S, Hardison-Moody A. Rural Food Insecurity: A Longitudinal Analysis of Low-Income Rural Households with Children in the South. RSF: The Russell Sage Foundation. *J Social Sci*. 2022;8(3):50–77. 10.7758/RSF.2022.8.3.02.
14. Joseph N. Geospatial Analysis of Food Insecurity and Adverse Human Health Outcomes in the United States. *Geohealth*. 2025;9(2). 10.1029/2024GH001198.

15. Polsook R, Aungsuroch Y, Thontham A. The effect of self-management intervention among type 2 diabetes: A systematic review and meta-analysis. *Worldviews Evid Based Nurs.* 2024;21(1):59–67. 10.1111/wvn.12688.
16. Young-Hyman D, de Groot M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Psychosocial Care for People With Diabetes: A Position Statement of the American Diabetes Association. *Diabetes Care.* 2016;39(12):2126–40. 10.2337/dc16-2053.
17. Batalha APDB, Ponciano IC, Chaves G, Felício DC, Britto RR, da Silva LP. Behavior change interventions in patients with type 2 diabetes: a systematic review of the effects on self-management and A1c. *J Diabetes Metab Disord.* 2021;20(2):1815–36. 10.1007/s40200-021-00846-8.
18. Krein SL, HM, PJD MF, KEA. The effect of chronic pain on diabetes patients' self-management. *Diabetes Care.* 2005;28(1):65–70.
19. Ding M, Ding A, Zhu L, Xie X. The impact of diabetes on chronic pain in different body regions among adults aged 50 and older: a cross-sectional analysis. *Front Public Health.* 2025;13. 10.3389/fpubh.2025.1520735.
20. Sun F, Yang Y, Nahin RL. Development of chronic pain and high-impact chronic pain across the US rural–urban continuum, 2019–2020. *J Rural Health.* 2025;41(2). 10.1111/jrh.70036.
21. Rafferty AP, Luo H, Egan KL, Bell RA, Gaskins Little NR, Imai S. Rural, Suburban, and Urban Differences in Chronic Pain and Coping Among Adults in North Carolina: 2018 Behavioral Risk Factor Surveillance System. *Prev Chronic Dis.* 2021;18:200352. 10.5888/pcd18.200352.
22. Lucas JW, Sohi I. Chronic Pain and High-impact Chronic Pain Among U.S. Adults, 2023., Hyattsville MD. 2024 Nov. Report. 10.15620/cdc/169630
23. Baker MB, Liu EC, Bully MA, Hsieh A, Nozari A, Tuler M, et al. Overcoming Barriers: A Comprehensive Review of Chronic Pain Management and Accessibility Challenges in Rural America. *Healthcare.* 2024;12(17):1765. 10.3390/healthcare12171765.
24. Praphul Joshi NC. Chronic pain self-management: An unmet need among people with diabetes. *Int J Diabetes Res.* 2014.
25. Bair MJ, Brizendine EJ, Ackermann RT, Shen C, Kroenke K, Marrero DG. Prevalence of pain and association with quality of life, depression and glycaemic control in patients with diabetes. *Diabet Med.* 2010;27(5):578–84. 10.1111/j.1464-5491.2010.02971.x.
26. Krein SL, Heisler M, Piette JD, Makki F, Kerr EA. The Effect of Chronic Pain on Diabetes Patients' Self-Management. *Diabetes Care.* 2005;28(1):65–70. 10.2337/diacare.28.1.65.
27. Elafros MA, Andersen H, Bennett DL, Savelieff MG, Viswanathan V, Callaghan BC, et al. Towards prevention of diabetic peripheral neuropathy: clinical presentation, pathogenesis, and new treatments. *Lancet Neurol.* 2022;21(10):922–36. 10.1016/S1474-4422(22)00188-0.
28. Baker MB, Liu EC, Bully MA, Hsieh A, Nozari A, Tuler M, et al. Overcoming Barriers: A Comprehensive Review of Chronic Pain Management and Accessibility Challenges in Rural America. *Healthcare.* 2024;12(17):1765. 10.3390/healthcare12171765.

29. Harris K, Lopera-Escobar A, Luscombe G, Ferreira P, Mesa-Castrillon C. Is low-value care for persistent musculoskeletal pain more common in rural than urban areas? A scoping review. *BMC Health Serv Res.* 2025;25(1):65. 10.1186/s12913-024-12132-3.
30. Krein SL, Heisler M, Piette JD, Makki F, Kerr EA. The Effect of Chronic Pain on Diabetes Patients' Self-Management. *Diabetes Care.* 2005;28(1):65–70. 10.2337/diacare.28.1.65.
31. Ding M, Ding A, Zhu L, Xie X. The impact of diabetes on chronic pain in different body regions among adults aged 50 and older: a cross-sectional analysis. *Front Public Health.* 2025;13. 10.3389/fpubh.2025.1520735.
32. Kalyani RR, Allende-Vigo MZ, Antinori-Lent KJ, Close KL, Das SR, Deroze P, et al. Prioritizing Patient Experiences in the Management of Diabetes and Its Complications: An Endocrine Society Position Statement. *J Clin Endocrinol Metab.* 2024;109(5):1155–78. 10.1210/clinem/dgad745.
33. Abu-Saad K, Daoud N, Kaplan G, Ziv A, Cohen AD, Olmer L, et al. Comparing Patient Perspectives on Diabetes Management to the Deficit-Based Literature in an Ethnic Minority Population: A Mixed-Methods Study. *Int J Environ Res Public Health.* 2022;19(22):14769. 10.3390/ijerph192214769.
34. Kim K, Rendon I, Starkweather A. Patient and provider perspectives on patient-centered chronic pain management. *Pain Manage Nurs.* 2021;22(4):470–7. 10.1016/j.pmn.2021.02.003.
35. University of Pennsylvania. Health Behavior and Health Education | Part Three, Chapter Eight: Key Constructs [Internet]. [cited 2025 Dec 15]. Available from: <https://www.med.upenn.edu/hbhe4/part3-ch8-key-constructs.shtml>
36. Lorig KR, Holman HR. Self-management education: History, definition, outcomes, and mechanisms. *Ann Behav Med.* 2003;26(1):1–7. 10.1207/S15324796ABM2601_01.
37. The Social Cognitive Theory. The Social Cognitive Theory [Internet]. 2022 [cited 2025 Dec 15]. Available from: <https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/BehavioralChangeTheories5.html>
38. Voinov B, Richie WD, Bailey RK. Depression and Chronic Diseases. *Prim Care Companion CNS Disord.* 2013 Apr 4. 10.4088/PCC.12r01468
39. Luo Z, Zhong S, Zheng S, Li Y, Guan Y, Xu W, et al. Influence of social support on subjective well-being of patients with chronic diseases in China: chain-mediating effect of self-efficacy and perceived stress. *Front Public Health.* 2023;11. 10.3389/fpubh.2023.1184711.
40. Upton J. Psychosocial Factors. *Encyclopedia of Behavioral Medicine.* New York, NY: Springer New York; 2013. pp. 1580–1. 10.1007/978-1-4419-1005-9_422.
41. de la Fuente J, Kauffman DF, Boruchovitch E. Editorial: Past, present and future contributions from the social cognitive theory (Albert Bandura). *Front Psychol.* 2023;14. 10.3389/fpsyg.2023.1258249.
42. Ernawati U, Wihastuti TA, Utami YW. Effectiveness of Diabetes Self-Management Education (Dsme) in Type 2 Diabetes Mellitus (T2Dm) Patients: Systematic Literature Review. *J Public Health Res.* 2021;10(2). 10.4081/jphr.2021.2240.
43. The RURAL Cohort Study. The RURAL Cohort Study [Internet]. [cited 2026 Jan 12]. Available from: <https://theruralstudy.org>

44. Centers for Disease Control and Prevention. Prevalence of self-reported diagnosed diabetes among adults, by county metro status and region. *Prev Chronic Dis* [Internet]. 2024 [cited 2025 Dec 15];21(240221). Available from: https://www.cdc.gov/pcd/issues/2024/24_0221.htm
45. Barker LE, Kirtland KA, Gregg EW, Geiss LS, Thompson TJ. Geographic Distribution of Diagnosed Diabetes in the U.S. *Am J Prev Med*. 2011;40(4):434–9. 10.1016/j.amepre.2010.12.019.
46. Landmark Associates Inc. The LAI [Internet]. [cited 2026 Jan 12]. Available from: <https://www.thelai.com/>
47. GetThematic. Coding qualitative data: A guide for researcher [Internet]. [cited 2025 Dec 15]. Available from: <https://getthematic.com/insights/coding-qualitative-data>
48. Smalls BL, Adegboyega A, Ortiz C, Combs E, Azam T, Westgate PM, et al. Assessing Chronic Pain Among Adults Diagnosed with Diabetes Residing in Rural Appalachia. *J Appalach Health*. 2024;6(3):79–92. 10.13023/jah.0603.07. PubMed PMID: 39534733.
49. Desai G, J TS, SK G, Bajaj LMGRG. Disentangling comorbidity in chronic pain: A study in primary health care settings from India. *PLoS ONE*. 2020;15(11):e0242865. 10.1371/journal.pone.0242865.
50. Foley HE, Knight JC, Ploughman M, Asghari S, Audas R. Association of chronic pain with comorbidities and health care utilization: a retrospective cohort study using health administrative data. *Pain*. 2021;162(11):2737–49. 10.1097/j.pain.0000000000002264.
51. Cleveland Clinic. Neuropathic pain [Internet]. [cited 2025 Dec 15]. Available from: <https://my.clevelandclinic.org/health/diseases/15833-neuropathic-pain>
52. Steiger K, Herrin J, Swarna KS, Davis EM, McCoy RG. Disparities in Acute and Chronic Complications of Diabetes Along the U.S. Rural-Urban Continuum. *Diabetes Care*. 2024;47(5):818–25. 10.2337/dc23-1552.
53. Gonzalez CE, Okunbor JI, Parker R, Owens MA, White DM, Merlin JS, et al. Pain-Specific Resilience in People Living With HIV and Chronic Pain: Beneficial Associations With Coping Strategies and Catastrophizing. *Front Psychol*. 2019;10. 10.3389/fpsyg.2019.02046.
54. Chng Z, Yeo JJ, Joshi A. Resilience as a protective factor in face of pain symptomatology, disability and psychological outcomes in adult chronic pain populations: a scoping review. *Scand J Pain*. 2023;23(2):228–50. 10.1515/sjpain-2021-0190.
55. Zilliox L, Russell JW. Treatment of Diabetic Sensory Polyneuropathy. *Curr Treat Options Neurol*. 2011;13(2):143–59. 10.1007/s11940-011-0113-1.
56. Cooper MA, Kluding PM, Wright DE. Emerging Relationships between Exercise, Sensory Nerves, and Neuropathic Pain. *Front Neurosci*. 2016;10. 10.3389/fnins.2016.00372.
57. Medical News Today. Medical News Today [Internet]. 2017 [cited 2025 Dec 15]. What to know about neuropathic pain. Available from: <https://www.medicalnewstoday.com/articles/319895>
58. Liberman O, Peleg R, Shvartzman P. Chronic pain in type 2 diabetic patients: A cross-sectional study in primary care setting. *Eur J Gen Pract*. 2014;20(4):260–7. 10.3109/13814788.2014.887674.

59. National Center for Biotechnology Information. Chronic pain: Evaluation and management. StatPearls [Internet]. 2019 [cited 2025 Dec 15]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK518811/>
60. Tabish SA. Complementary and alternative healthcare: Is it evidence-based? International Journal of Health Sciences (Qassim) [Internet]. 2008 [cited 2025 Dec 16];2:V–IX. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3068720/>
61. Barish R, Snyder AE. Use of Complementary and Alternative Healthcare Practices Among Persons Served by a Remote Area Medical Clinic. Fam Community Health. 2008;31(3):221–7. 10.1097/01.FCH.0000324479.32836.6b.
62. Herron M, Glasser M. Use of and Attitudes Toward Complementary and Alternative Medicine Among Family Practice Patients in Small Rural Illinois Communities. J Rural Health. 2003;19(3):279–84. 10.1111/j.1748-0361.2003.tb00574.x.
63. Ramkissoon S, Pillay BJ, Sibanda W. Social support and coping in adults with type 2 diabetes. Afr J Prim Health Care Fam Med. 2017;9(1). 10.4102/phcfm.v9i1.1405.
64. Freitas D, Boué F, Benallaoua M, Airinei G, Benamouzig R, Le Feunteun S. Lemon juice, but not tea, reduces the glycemic response to bread in healthy volunteers: a randomized crossover trial. Eur J Nutr. 2021;60(1):113–22. 10.1007/s00394-020-02228-x.
65. etre A, GLB. &. Medical News Today [Internet]. 2025 [cited 2025 Dec 16]. Is it healthy to drink pickle juice? Available from: <https://www.medicalnewstoday.com/articles/318618>
66. Wang CC, Kennedy J, Wu CH. Alternative Therapies as a Substitute for Costly Prescription Medications: Results from the 2011 National Health Interview Survey. Clin Ther. 2015;37(5):1022–30. 10.1016/j.clinthera.2015.01.014.
67. Tolbert J, CS BC. & DA. Kaiser Family Foundation [Internet]. 2024 [cited 2025 Dec 16]. Key facts about the uninsured population. Available from: <https://www.kff.org/uninsured/key-facts-about-the-uninsured-population>
68. Love O, Peter D, Julie S. Systematic review: Perceptions of type 2 diabetes of people of African descent living in high-income countries. J Adv Nurs. 2022;78(8):2277–89. 10.1111/jan.15266.
69. Ong CY, Lee WCD, Low SG, Low LL, Vasanwala FF. Attitudes and perceptions of people with diabetes mellitus on patient self-management in diabetes mellitus: a Singapore hospital's perspective. Singap Med J. 2023;64(7):467–74. 10.11622/smedj.2022006.
70. Linmans JJ, Kottner JA, Spigt M. How motivated are patients with type 2 diabetes to change their lifestyle? A survey among patients and healthcare professionals. Prim Care Diabetes. 2015;9(6):439–45. 10.1016/j.pcd.2015.02.001.
71. Smalls BL, Adegboyega A, Ortiz C, Combs E, Azam T, Westgate PM, et al. Assessing Chronic Pain Among Adults Diagnosed with Diabetes Residing in Rural Appalachia. J Appalach Health. 2024;6(3):79–92. 10.13023/jah.0603.07. PubMed PMID: 39534733.
72. Wackström N, Koponen AM, Suominen S, Tarkka IM, Simonsen N. Does chronic pain hinder physical activity among older adults with type 2 diabetes? Health Psychol Behav Med. 2020;8(1):362–82.

- 10.1080/21642850.2020.1807350.
73. Elayyan B, Abuhailima D, Al-Jabi SW, Zyoud SH. Association of medication adherence and glycemic control with pain severity among patients with diabetes mellitus: a cross-sectional study from Palestine. *BMC Endocr Disord*. 2025;25(1):180. 10.1186/s12902-025-02000-4. PubMed PMID: 40670997.
74. Wojujutari AK, Idemudia ES, Ugwu LE. Psychological resilience mediates the relationship between diabetes distress and depression among persons with diabetes in a multi-group analysis. *Sci Rep*. 2024;14(1):6510. 10.1038/s41598-024-57212-w.
75. Kalra S, Jena B, Yeravdekar R. Emotional and psychological needs of people with diabetes. *Indian J Endocrinol Metab*. 2018;22(5):696. 10.4103/ijem.IJEM_579_17.
76. Lloyd C, Smith J, Weinger K. Stress and Diabetes: A Review of the Links. *Diabetes Spectr*. 2005;18(2):121–7. 10.2337/diaspect.18.2.121.
77. Upton J. Psychological Factors and Health. *Encyclopedia of Behavioral Medicine*. Cham: Springer International Publishing; 2020. pp. 1763–5. 10.1007/978-3-030-39903-0_1562.
78. Sharma K, Akre S, Chakole S, Wanjari MB. Stress-Induced Diabetes: A Review. *Cureus*. 2022 Sep;13. 10.7759/cureus.29142.
79. Wang CC, Kennedy J, Wu CH. Alternative Therapies as a Substitute for Costly Prescription Medications: Results from the 2011 National Health Interview Survey. *Clin Ther*. 2015;37(5):1022–30. 10.1016/j.clinthera.2015.01.014.
80. Barish R, Snyder AE. Use of Complementary and Alternative Healthcare Practices Among Persons Served by a Remote Area Medical Clinic. *Fam Community Health*. 2008;31(3):221–7. 10.1097/01.FCH.0000324479.32836.6b.
81. Kumar N, Unnikrishnan B, Thapar R, Mithra P, Kulkarni V, Holla R, et al. Distress and its effect on adherence to antidiabetic medications among Type 2 diabetes patients in coastal South India. *J Nat Sci Biol Med*. 2017;8(2):216. 10.4103/0976-9668.210008.
82. National Library of Medicine (US). Complementary and alternative medicine. In *Collection Development Guidelines of the National Library of Medicine*. In: National Library of Medicine (US) [Internet]. 2018 [cited 2025 Dec 16]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK518811/>
83. Diabetes In Control. National Library of Medicine (US [Internet]. 2025 [cited 2025 Dec 16]. Will diabetes medications get more expensive in 2025? Available from: <https://www.diabetesincontrol.com/will-diabetes-medications-get-more-expensive-in-2025/>
84. Thomas K, Nilsson E, Festin K, Henriksson P, Lowén M, Löf M, et al. Associations of Psychosocial Factors with Multiple Health Behaviors: A Population-Based Study of Middle-Aged Men and Women. *Int J Environ Res Public Health*. 2020;17(4):1239. 10.3390/ijerph17041239.

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