

Digital CBT-I Platform: Technical Website Blueprint

I. Platform Architecture & Technical Foundation

A. Technology Stack Recommendations

Frontend Framework

- **Primary Choice:** React with TypeScript for type safety and maintainable code
- **Styling:** Tailwind CSS for rapid, consistent mobile-first design
- **State Management:** React Context API or Zustand for lightweight state management
- **Data Visualization:** Recharts for sleep efficiency trends and progress graphs

Backend & Data Layer

- **Authentication:** Secure user authentication with JWT tokens
- **Database:** PostgreSQL for structured health data with proper ACID compliance
- **API Architecture:** RESTful API with clear versioning
- **File Storage:** Secure cloud storage for audio files (relaxation library)

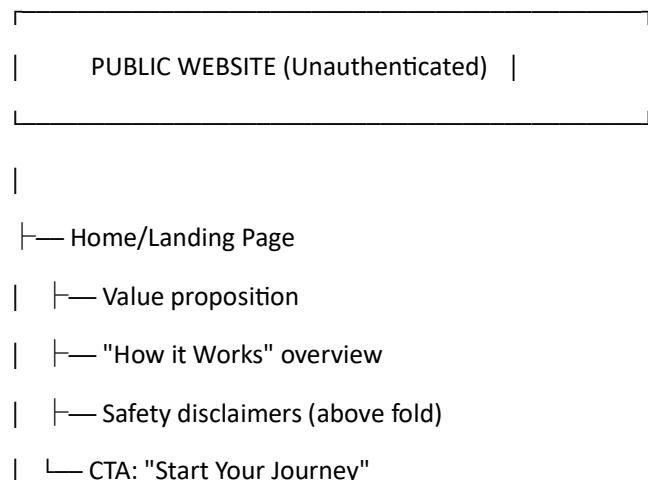
Mobile-First Responsive Design

- Progressive Web App (PWA) capabilities for app-like mobile experience
- Offline functionality for core features (diary entry, audio playback)
- Touch-optimized interfaces with large tap targets (minimum 44x44px)
- Dark mode support (especially critical for nighttime "Can't Sleep?" feature)

B. Core Technical Principles

1. **Performance:** Maximum 3-second load time on 3G connections
2. **Accessibility:** WCAG 2.1 AA compliance minimum
3. **Security:** HIPAA-aligned data handling practices, encryption at rest and in transit
4. **Privacy by Design:** Minimal data collection, anonymous analytics where possible

II. Information Architecture & Site Map



- |
 - | — About CBT-I
 - | | — What is CBT-I?
 - | | — Evidence base
 - | | — What to expect
- |
- | — Privacy Policy (plain language)
- | — Terms of Service
- | — Sign Up / Login

| AUTHENTICATED USER APPLICATION |

- |
- | — ONBOARDING FLOW (Week 0)
 - | | — Step 1: Welcome & Overview
 - | | — Step 2: Safety Screening Questionnaire
 - | | — Step 3: Insomnia Severity Index (ISI)
 - | | — Step 4: 3-P Model Education (video/interactive)
 - | | — Step 5: Sleep Diary Tutorial
 - | | — Step 6: Baseline Week Assignment
- |
- | — MAIN DASHBOARD (Primary Hub)
 - | | — Daily Sleep Diary Entry (prominent CTA)
 - | | — Current Sleep Window Display
 - | | — Weekly Progress Summary Card
 - | | — Quick Access: "Can't Sleep?" Button
 - | | — Current Week's Focus/Task
 - | | — Navigation to all modules
- |
- | — SLEEP DIARY
 - | | — Daily Entry Form (mobile-optimized)
 - | | — Entry History/Calendar View

- | └─ Data Visualization (personal trends)
- |
- | └─ MY PROGRAM
- | ├─ Current Week Overview
- | ├─ Sleep Schedule (Restriction Protocol)
 - | ├─ Current prescribed sleep window
 - | ├─ Visual schedule display
- | └─ Rationale for current window
- | ├─ Stimulus Control Rules
 - | └─ Interactive checklist/reminders
- | └─ Progress to Next Week
- |
- | └─ LEARN (Psychoeducation Hub)
 - | ├─ Week-by-week unlockable modules
 - | ├─ Video library
 - | ├─ Infographics
 - | └─ Key concepts reference
- |
- | └─ TOOLS
 - | ├─ Cognitive Restructuring Workbench (Week 3+)
 - | ├─ New thought record
 - | └─ Previous records library
 - | ├─ Relaxation Library (Week 4+)
 - | ├─ Breathing exercises
 - | ├─ Progressive muscle relaxation
 - | └─ Guided imagery
 - | └─ Can't Sleep? Helper
 - | ├─ Relax (quick audio access)
 - | └─ Reset (SCT reminder)
- |
- | └─ MY PROGRESS
 - | ├─ Sleep Efficiency Trend Graph
 - | └─ ISI Score Comparison

| └— Weekly Feedback Reports Archive

| └— Milestones & Achievements

|

└— SETTINGS & ACCOUNT

 └— Profile

 └— Notification preferences

 └— Time zone settings

 └— Data export

 └— Account deletion

III. Detailed Page Specifications

A. Public Website Pages

1. Landing Page

Purpose: Convert visitors while setting appropriate expectations

Key Sections:

- **Hero Section**

- Headline: "Reclaim Your Sleep: Evidence-Based CBT-I in 6 Weeks"
- Subheadline: Clear value proposition emphasizing proven effectiveness
- Primary CTA: "Start Your Free Assessment"
- **Prominent Disclaimer Box:** "This is a self-help program based on CBT-I principles. It is not a substitute for medical diagnosis or treatment."

- **How It Works** (3-step visual)

1. Assess: One-week baseline tracking
2. Act: Follow personalized sleep schedule
3. Achieve: Build lasting sleep habits

- **Evidence Section**

- Brief statistics on CBT-I effectiveness
- "Based on clinical research" badge

- **Safety Information** (cannot be missed)

- List of contraindications
- Strong encouragement to consult healthcare provider

- **FAQ Accordion**

- Addressing common concerns about sleep restriction

- Time commitment expectations
- Data privacy assurances

Technical Requirements:

- Mobile-responsive hero image/video
 - Fast loading (< 2 seconds)
 - Clear visual hierarchy guiding to CTA
-

B. Onboarding Flow (Week 0)

1. Safety Screening Questionnaire

Critical Requirements:

- **Mandatory completion** before program access
- Progress indicator showing steps
- Clear, jargon-free questions

Question Categories:

Contraindication Screening:

- "Have you been diagnosed with sleep apnea?" (Yes/No/Unsure)
- "Do you have a history of seizures or epilepsy?"
- "Have you been diagnosed with bipolar disorder?"
- "Is your occupation: commercial driver, pilot, heavy machinery operator, or similar?"
- "Are you currently pregnant or nursing?"

Medical Context:

- "Are you currently under treatment for any mental health conditions?"
- "Are you taking any medications that affect sleep?"

Branching Logic:

- Any "Yes" to contraindications → **Stop screen** with message:
 - "For your safety, we recommend consulting with a healthcare provider before starting this program. Here's what to discuss with them: [downloadable sheet]"
 - Option to exit or continue with acknowledgment of risk

Data Storage: Encrypted, with timestamp and version number of questionnaire

2. Insomnia Severity Index (ISI)

Implementation:

- Standard 7-item ISI questionnaire
- 5-point Likert scale for each item

- Clean, one-question-per-screen mobile format
- Progress bar
- Auto-calculation of total score (0-28)

Scoring Display (after completion):

- Score + interpretation:
 - 0-7: No clinically significant insomnia
 - 8-14: Subthreshold insomnia
 - 15-21: Clinical insomnia (moderate severity)
 - 22-28: Clinical insomnia (severe)
 - **Educational messaging:** "This is your starting point. In 6 weeks, you'll retake this assessment to measure your progress."
-

3. 3-P Model Education Module

Format: Interactive micro-lesson (3-4 minutes)

Content Structure:

- Short animated video (90 seconds) explaining:
 - **Predisposing factors** (genetics, temperament)
 - **Precipitating factors** (stress, life events)
 - **Perpetuating factors** (habits and thoughts) ← Emphasis
- Interactive element: User selects which perpetuating factors they recognize in themselves
 - Spending excessive time in bed
 - Worrying about sleep
 - Irregular sleep schedule
 - Using bed for non-sleep activities
- Key takeaway screen: "This program focuses on changing the perpetuating factors—the habits you can control."

Technical: Video hosted on CDN, captions included, mobile-optimized player

4. Sleep Diary Tutorial

Purpose: Train user on accurate, fast diary completion before baseline week

Components:

- Interactive demo diary form with example data pre-filled
- Tooltips explaining each field
- Visual aids (timeline graphic) for "time awake during night"
- Practice submission with feedback

- Emphasis on "estimation is okay—consistency is key"

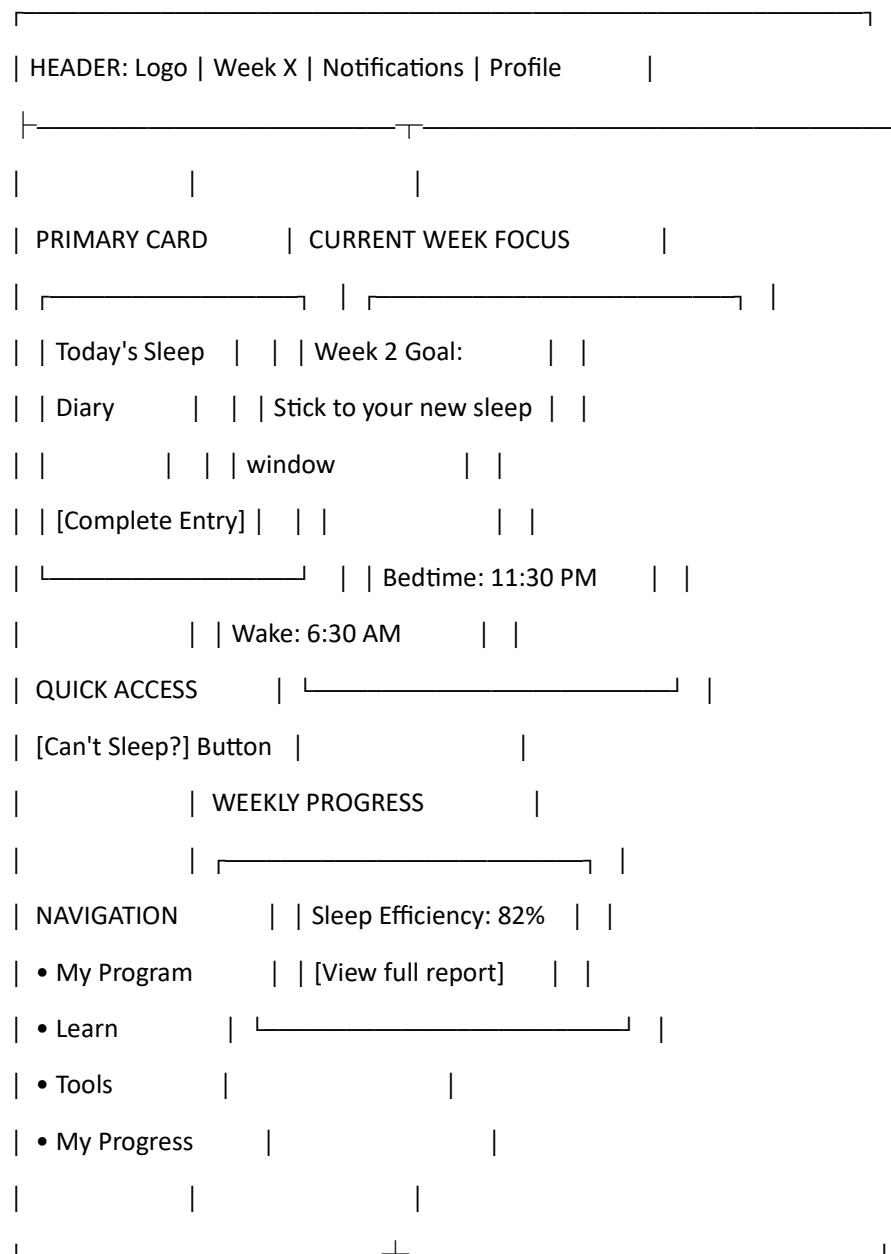
Set Expectation:

- "Complete this every morning for 7 days"
- Reminder setup: User selects preferred reminder time
- SMS/Email/Push notification options

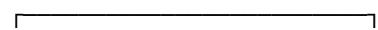
C. Main Dashboard (Authenticated User Hub)

Layout Philosophy: Information hierarchy prioritizing the daily diary and current week's focus

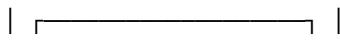
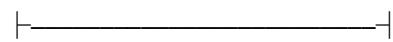
Desktop Layout (1200px+)



Mobile Layout (< 768px)



| ≡ [Logo] Week 2 🎙️👤 |

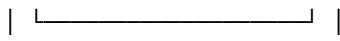


| | Complete Today's | |

| | Sleep Diary | |



| | [Start Entry] → | |



| | 🌙 Can't Sleep? | |



| | Current Sleep Window | |

| | 🕒 11:30 PM - 6:30 AM | |



| | This Week's Focus | |

| | 📅 Maintain schedule | |



| | Progress Snapshot | |

| | 📈 SE: 82% ↑ | |

| | [View details →] | |

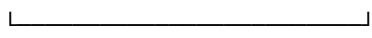


| | [My Program] | |

| | [Learn] | |

| | [Tools] | |

| | [My Progress] | |



Technical Implementation:

- Card-based component architecture
- Lazy loading for below-fold content
- Skeleton screens during data fetch
- Real-time calculation of "days until next adjustment"

D. Sleep Diary Entry Interface

Critical Design Requirement: Complete in < 60 seconds

Mobile-Optimized Form Design

Step 1: Time Inputs (Visual time pickers)

What time did you get into bed last night?

[10 : 45] [PM ▼]

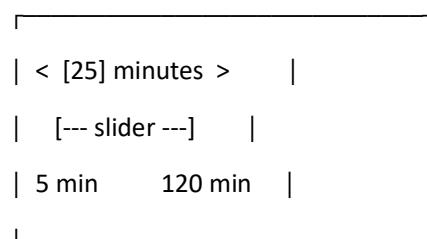
└ Scrollable wheel picker

What time did you try to go to sleep?

[11 : 15] [PM ▼]

Step 2: Sleep Onset

About how long did it take you to fall asleep?

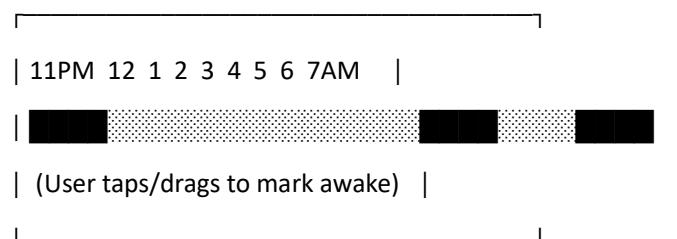


Step 3: Night Awakenings (Innovative visual approach)

How was your night?

Tap the sections when you were AWAKE

[Visual timeline: 11PM to 7AM]



Number of times you woke: [Auto-counted: 2]

Alternative (if timeline too complex for MVP):

How many times did you wake up? [2 ▼]

About how long were you awake total?

[35] minutes [Slider]

Step 4: Morning

What time did you wake up for the day?

[6 : 30] [AM ▼]

What time did you get out of bed?

[6 : 45] [AM ▼]

Step 5: Quality Rating

How would you rate your sleep quality?



1 2 3 4 5

Submission:

- Auto-save draft as user progresses
- "Submit" button with confirmation
- Immediate display: "Entry saved! Your sleep efficiency was 78%"

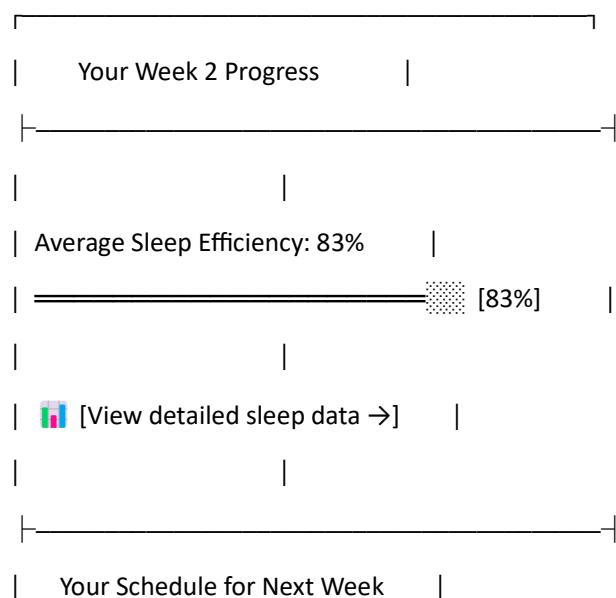
Backend Process:

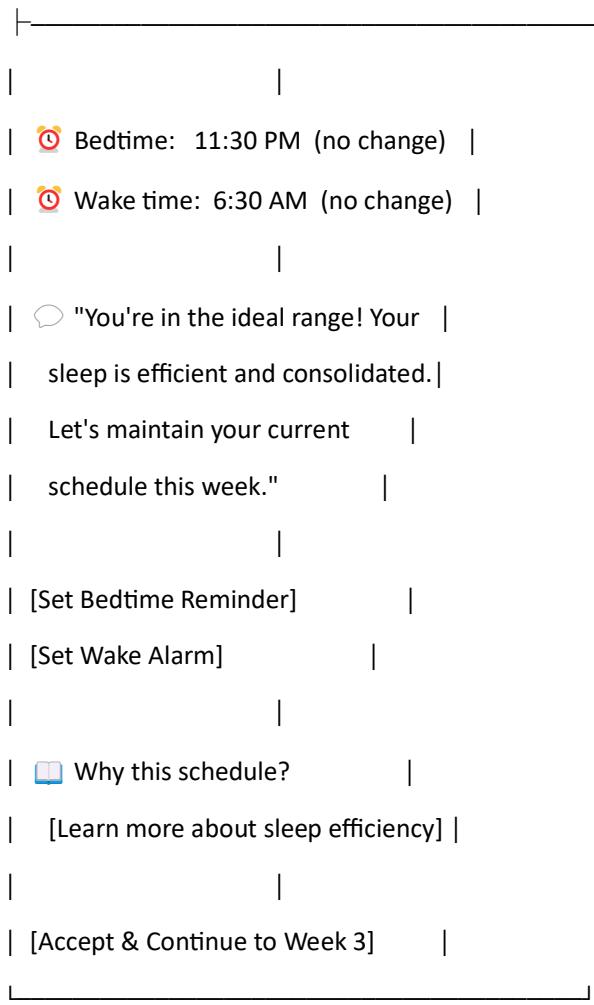
1. Validate inputs (no impossible values)
2. Calculate TIB, TST, SE
3. Store raw data + calculations
4. Update weekly averages
5. Check if 7th entry of week → trigger adjustment algorithm

E. Sleep Restriction Program Interface

Weekly Adjustment Display (Shown every Monday morning or after 7th entry)

Layout:





Technical Logic (Backend):

```

function adjustSleepWindow(weeklyAvgSE, currentPTIB) {
    const MINIMUM_WINDOW = 5.5 * 60; // 5.5 hours in minutes
    const ADJUSTMENT = 15; // minutes

    let newPTIB = currentPTIB;
    let message = "";

    if (weeklyAvgSE > 90) {
        newPTIB = currentPTIB + ADJUSTMENT;
        message = "Great work! Your sleep is very solid...";
    } else if (weeklyAvgSE >= 85 && weeklyAvgSE <= 90) {
        newPTIB = currentPTIB;
        message = "You're in the ideal range...";
    } else if (weeklyAvgSE >= 80 && weeklyAvgSE < 85) {
        newPTIB = currentPTIB;
    }
}

```

```

message = "You are right on track..";
} else if (weeklyAvgSE < 80) {
    newPTIB = Math.max(currentPTIB - ADJUSTMENT, MINIMUM_WINDOW);
    message = "This is normal and expected...";
}

return {
    newPTIB,
    message,
    changed: newPTIB !== currentPTIB
};
}

```

Stimulus Control Rules Page

Visual Checklist Format (Always accessible):

	The 7 Rules for Better Sleep	
	(Stimulus Control)	
1. 🛌 Go to bed only when sleepy		
Not just tired—fighting to stay		
awake sleepy		
2. ✗ Bed = Sleep + Sex ONLY		
No phone, TV, reading, worrying		
3. ⏳ Can't sleep after 15-20 min?		
Get out of bed (no clock-watching)		
4. 💤 Go to another room		
Do something quiet, relaxing,		
unstimulating in dim light		

- | 5.  Return only when sleepy |
- | Repeat as needed all night |
- |
- |
- | 6.  Same wake time EVERY day |
- | Even weekends. No sleeping in. |
- |
- |
- | 7.  Avoid naps |
- | If absolutely needed: <30 min, |
- | before 3 PM |
- |
- |
- | [Download Printable Version] |
- | [Set Wake-Up Alarm] |

F. "Can't Sleep?" Nighttime Helper

Technical Specifications:

- Accessible via large button on dashboard
 - Mobile-only optimized (or responsive)
 - **Auto-activates dark mode** regardless of user settings
 - Very low brightness default
 - Minimal animations to avoid stimulation

Interface (Mobile):

| | | | |

| |  | | |

| | | | |

| It's okay that |

| you're awake. |

| | | | |

| What would help |

| right now? |

| | | | |

| | | | |

	Listen to a	
	calming audio	

	 Reset	
	Remind me	
	what to do	

[x Close]		

"Relax" Path → Direct link to audio library with auto-play option

"Reset" Path → Supportive message:

| |

| The best thing to do |
| now is to get out of |
| bed for a little while. |
| |

| Try: |

| • Reading in another |
| room |
| • Listening to calm |
| music |
| • Gentle stretching |

| |

| Return to bed when you |
| feel sleepy again. |

| |

| This is part of the |
| process. You're doing |

| great. ❤ |

| |

| [Listen to Relaxation] |

| [Close] |

Technical: No analytics tracking during nighttime use (privacy consideration)

G. Cognitive Restructuring Workbench (Unlocked Week 3)

Purpose: Guide users through structured thought challenging

New Thought Record Flow

Step 1: Identify

| What's the thought about sleep that's |

| on your mind right now? |

| |

| [Text area] |

| _____ |

| _____ |

| _____ |

| |

| Or choose a common one: |

| I'll never fall asleep |

| I'll be useless tomorrow without |

| 8 hours |

| I've lost my ability to sleep |

| My insomnia is permanent |

| |

| [Next →] |

Step 2: Challenge (One question at a time, progress indicator)

| Step 2 of 4 ●ooo |

| |

| Your thought: |

| "I'll be useless tomorrow without |

| 8 hours of sleep" |

| |

What evidence do you have that this	
thought is 100% true?	
[Text area]	

[Next →]	

Subsequent questions:

- Have there been times when you thought this and the bad outcome didn't happen?
- What would you tell a friend who had this worry?
- What's a more balanced way to look at this?

Step 3: Reframe

Based on what you've explored, how	
could you reframe this thought?	
Old thought:	
"I'll be useless tomorrow without	
8 hours"	
New, more balanced thought:	
[Text area - pre-filled with AI	
suggestion based on responses]	

"Tomorrow might be challenging if I'm	
tired, but I've managed on less sleep	
before. I'll focus on my most	
important tasks."	

[Save Thought Record]	

Saved Records Library:

- Searchable archive
 - Side-by-side comparison of old vs. new thoughts
 - Ability to review patterns over time
-

H. Relaxation Audio Library (Unlocked Week 4)

Library Interface:

Relaxation Exercises	
Use these when:	
• You need to get out of bed (SCT)	
• Winding down before bedtime	
• Feeling anxious about sleep	
 Diaphragmatic Breathing	
7 minutes	
[ Play] [Download]	
 Progressive Muscle Relaxation	
12 minutes	
[ Play] [Download]	
 Guided Imagery	
10 minutes	
[ Play] [Download]	

Audio Player Requirements:

- Background play capability
- Sleep timer (auto-stop after X minutes)

- Offline playback (downloaded files)
- Very simple controls (play/pause only during playback)
- Low-light interface option

Technical:

- Audio files: MP3 format, optimized for streaming
- Hosted on CDN for fast global delivery
- Transcript available for accessibility

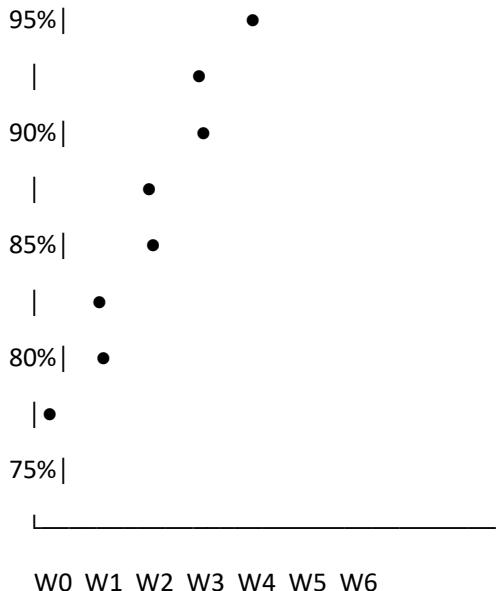
I. Progress Dashboard

Purpose: Visualize improvement and maintain motivation

Key Visualizations:

1. Sleep Efficiency Trend

Sleep Efficiency Over Time



- Week 1: 76% → ● Week 6: 89%

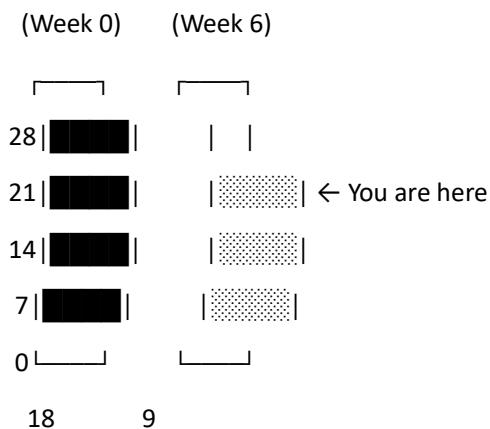
Your sleep efficiency has improved

by 13 percentage points!

2. ISI Score Comparison

Insomnia Severity Index

Baseline Current



✓ Moved from "Clinical Insomnia"
to "Subthreshold Insomnia"

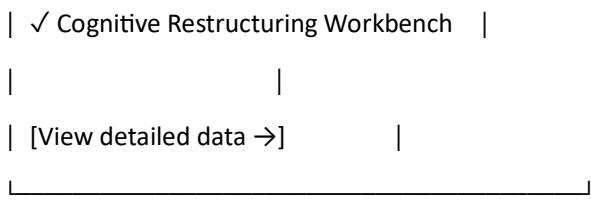
3. Weekly Feedback Reports Archive

Each Report Contains:

- Week number and date range
- Average SE for that week
- Sleep window adjustment made
- Personalized feedback message
- New skills/tools unlocked that week

Example Report Card:

Week 3 Report (Nov 14-20, 2025)
Sleep Efficiency: 84%
Change from Week 2: +5% 
Your sleep window was:
11:30 PM - 6:30 AM (no change)
Feedback:
You're right on track and building
momentum. Your commitment to the
schedule is paying off. Keep it up!
This week you unlocked:



J. Psychoeducation Hub ("Learn")

Organization: Week-based progression with lock/unlock



Lesson Format (Example: Sleep Drive & Circadian Rhythms)

- 1. Video (90 seconds)**
 - Animated explainer
 - Captions/transcript
 - Key visual: Two-process model graph
- 2. Key Takeaways (Bullet points)**
 - Sleep drive builds the longer you're awake
 - Sleep restriction boosts your sleep drive
 - Consistent wake time strengthens circadian rhythm
- 3. Interactive Quiz (3 questions, optional)**
 - Reinforces learning
 - Gamification element
- 4. How This Applies to You**
 - Connects theory to their personal program
 - "This is why your fixed wake time matters"

Technical:

- Progress tracking (completed lessons)
 - Bookmark/favorite capability
 - Search functionality for returning users
-

IV. Technical Implementation Priorities

Phase 1: MVP (Weeks 1-8 of Development)

Must-Have Features:

1. User authentication & security
2. Safety screening & ISI questionnaire
3. Sleep diary (full functionality)
4. SRT algorithm & weekly adjustment
5. Dashboard with current sleep window display
6. Basic progress visualization (SE graph)
7. Stimulus Control rules page
8. "Can't Sleep?" helper
9. Week 0-2 psychoeducation content
10. Notification system (diary reminders)

Infrastructure:

- Database schema for user profiles, diary entries, assessments
 - RESTful API endpoints
 - Admin panel for content management
 - Analytics (anonymous usage tracking)
-

Phase 2: Enhanced Features (Weeks 9-12)

Add:

1. Cognitive Restructuring Workbench
 2. Relaxation Audio Library (3 tracks)
 3. Weeks 3-6 psychoeducation content
 4. Enhanced progress dashboard (ISI comparison, weekly reports)
 5. Data export functionality
 6. Offline mode (PWA capabilities)
-

Phase 3: Polish & Optimization (Weeks 13-16)

1. A/B testing on key interfaces (diary entry, dashboard)
 2. Performance optimization
 3. Accessibility audit & fixes
 4. User feedback integration
 5. Beta testing with target users
 6. Bug fixes and refinement
-

V. Database Schema & Data Architecture

A. Core Data Models

1. Users Table

```
users {  
  id: UUID (primary key)  
  email: VARCHAR(255) (unique, encrypted)  
  password_hash: VARCHAR(255)  
  created_at: TIMESTAMP  
  timezone: VARCHAR(50)  
  onboarding_completed: BOOLEAN  
  current_week: INTEGER (1-6+)  
  program_start_date: DATE
```

```
last_login: TIMESTAMP  
notification_preferences: JSONB  
account_status: ENUM('active', 'paused', 'completed', 'deleted')  
}
```

2. Safety Screening Table

```
safety_screenings {  
    id: UUID (primary key)  
    user_id: UUID (foreign key -> users)  
    screening_version: VARCHAR(10)  
    completed_at: TIMESTAMP
```

-- Contraindication flags

```
has_sleep_apnea: BOOLEAN  
has_seizure_disorder: BOOLEAN  
has_bipolar_disorder: BOOLEAN  
high_risk_occupation: BOOLEAN  
is_pregnant_nursing: BOOLEAN
```

-- Context questions

```
mental_health_treatment: TEXT  
sleep_medications: TEXT
```

-- Risk assessment

```
cleared_for_program: BOOLEAN  
risk_acknowledgment_signed: BOOLEAN  
notes: TEXT
```

```
}
```

3. ISI Assessments Table

```
isi_assessments {  
    id: UUID (primary key)  
    user_id: UUID (foreign key -> users)  
    assessment_week: INTEGER (0 = baseline, 6 = final, etc.)  
    completed_at: TIMESTAMP
```

-- 7 ISI questions (each scored 0-4)

difficulty_falling_asleep: INTEGER

difficulty_staying_asleep: INTEGER

early_morning_awakening: INTEGER

satisfaction_with_sleep: INTEGER

interference_with_functioning: INTEGER

noticeable_impairment: INTEGER

distress_about_sleep: INTEGER

-- Calculated

total_score: INTEGER (0-28)

severity_category: ENUM('none', 'subthreshold', 'moderate', 'severe')

}

4. Sleep Diary Entries Table

sleep_diary_entries {

id: UUID (primary key)

user_id: UUID (foreign key -> users)

entry_date: DATE (unique per user per day)

created_at: TIMESTAMP

updated_at: TIMESTAMP

-- Raw user inputs (all times in user's timezone)

time_got_in_bed: TIME

time_tried_to_sleep: TIME

sleep_onset_latency_minutes: INTEGER

number_of_awakenings: INTEGER

total_time_awake_minutes: INTEGER

final_wake_time: TIME

time_got_out_of_bed: TIME

sleep_quality_rating: INTEGER (1-5)

-- Calculated metrics (computed on save)

time_in_bed_minutes: INTEGER

total_sleep_time_minutes: INTEGER

```
sleep_efficiency_percent: DECIMAL(5,2)
```

```
-- Metadata
```

```
is_baseline_week: BOOLEAN
```

```
program_week: INTEGER
```

```
}
```

5. Sleep Windows Table

```
sleep_windows {
```

```
id: UUID (primary key)
```

```
user_id: UUID (foreign key -> users)
```

```
week_number: INTEGER
```

```
start_date: DATE
```

```
end_date: DATE
```

```
-- Prescription
```

```
prescribed_bedtime: TIME
```

```
prescribed_wake_time: TIME
```

```
prescribed_time_in_bed_minutes: INTEGER
```

```
-- Weekly performance data
```

```
avg_sleep_efficiency: DECIMAL(5,2)
```

```
avg_total_sleep_time: INTEGER
```

```
avg_sleep_onset_latency: INTEGER
```

```
diary_entries_completed: INTEGER (out of 7)
```

```
-- Adjustment logic
```

```
adjustment_reason: ENUM('increase', 'maintain', 'decrease', 'baseline')
```

```
adjustment_message: TEXT
```

```
previous_window_id: UUID (foreign key -> sleep_windows, nullable)
```

```
created_at: TIMESTAMP
```

```
}
```

6. Cognitive Thought Records Table

```
thought_records {
```

```
id: UUID (primary key)
user_id: UUID (foreign key -> users)
created_at: TIMESTAMP
updated_at: TIMESTAMP

-- Thought identification
automatic_thought: TEXT
thought_category: VARCHAR(100) (nullable, for filtering)
```

```
-- Challenge responses
evidence_for: TEXT
evidence_against: TEXT
alternative_perspectives: TEXT
friend_advice: TEXT
```

```
-- Reframe
balanced_thought: TEXT
```

```
-- Metadata
helpful_rating: INTEGER (1-5, nullable, user feedback)
is_archived: BOOLEAN
}
```

7. Content Progress Table

```
content_progress {
    id: UUID (primary key)
    user_id: UUID (foreign key -> users)
    content_type: ENUM('education', 'audio', 'exercise')
    content_id: VARCHAR(100) (e.g., 'week-1-sleep-drive')
```

```
unlocked_at: TIMESTAMP
first_accessed_at: TIMESTAMP (nullable)
last_accessed_at: TIMESTAMP (nullable)
completed: BOOLEAN
completion_date: TIMESTAMP (nullable)
```

```
-- For videos/audio  
playback_progress_seconds: INTEGER (nullable)
```

```
-- For quizzes  
quiz_score: INTEGER (nullable)  
quiz_attempts: INTEGER  
}
```

8. User Notifications Table

```
notifications {  
    id: UUID (primary key)  
    user_id: UUID (foreign key -> users)  
    notification_type: ENUM('diaryReminder', 'weeklyReport', 'milestone', 'system')  
  
    scheduled_for: TIMESTAMP  
    sent_at: TIMESTAMP (nullable)  
    delivery_method: ENUM('push', 'email', 'sms')
```

```
    title: VARCHAR(255)  
    message: TEXT  
    action_url: VARCHAR(255) (nullable)
```

```
    is_read: BOOLEAN  
    read_at: TIMESTAMP (nullable)
```

```
}
```

9. Analytics Events Table (Anonymous)

```
analytics_events {  
    id: UUID (primary key)  
    user_id_hash: VARCHAR(64) (anonymized, for session tracking)  
    event_type: VARCHAR(100)  
    event_category: VARCHAR(100)  
  
    timestamp: TIMESTAMP  
    session_id: VARCHAR(100)
```

```

page_url: VARCHAR(500)
referrer_url: VARCHAR(500)
device_type: ENUM('mobile', 'tablet', 'desktop')

event_properties: JSONB (flexible storage)
user_week: INTEGER (contextual, not identifying)
}

```

B. Key Calculated Fields & Business Logic

Sleep Efficiency Calculation

```

// Executed on sleep diary save

function calculateSleepMetrics(entry) {
    // Time in Bed (TIB)

    const timeInBed = calculateMinutesBetween(
        entry.time_got_in_bed,
        entry.time_got_out_of_bed
    );

    // Total Sleep Time (TST)

    const totalSleepTime = timeInBed -
        (entry.sleep_onset_latency_minutes +
        entry.total_time_awake_minutes);

    // Sleep Efficiency (SE)

    const sleepEfficiency = (totalSleepTime / timeInBed) * 100;

    return {
        time_in_bed_minutes: timeInBed,
        total_sleep_time_minutes: totalSleepTime,
        sleep_efficiency_percent: Math.round(sleepEfficiency * 100) / 100
    };
}

```

Weekly Aggregation (Runs automatically when 7th entry logged)

```

async function calculateWeeklyAverages(userId, weekNumber) {
  const entries = await getWeekEntries(userId, weekNumber);

  if (entries.length < 7) {
    // Not enough data yet
    return null;
  }

  const avgSE = entries.reduce((sum, e) =>
    sum + e.sleep_efficiency_percent, 0) / entries.length;

  const avgTST = entries.reduce((sum, e) =>
    sum + e.total_sleep_time_minutes, 0) / entries.length;

  const avgSOL = entries.reduce((sum, e) =>
    sum + e.sleep_onset_latency_minutes, 0) / entries.length;

  return {
    avg_sleep_efficiency: avgSE,
    avg_total_sleep_time: avgTST,
    avg_sleep_onset_latency: avgSOL,
    diary_entries_completed: entries.length
  };
}

```

Sleep Window Adjustment Logic

```

async function generateNextWeekWindow(userId, currentWeekId) {
  const currentWindow = await getSleepWindow(currentWeekId);
  const weeklyStats = currentWindow.weeklyStats;

  const ADJUSTMENT_MINUTES = 15;
  const MINIMUM_WINDOW_MINUTES = 5.5 * 60; // 5.5 hours

  let newPTIB = currentWindow.prescribed_time_in_bed_minutes;
  let adjustmentReason = 'maintain';

```

```

let message = "";

if (weeklyStats.avg_sleep_efficiency > 90) {
    newPTIB += ADJUSTMENT_MINUTES;
    adjustmentReason = 'increase';
    message = "Great work! Your sleep is becoming very solid. To help you get the rest you need, we'll give you a bit more time in bed. Your new bedtime is now 15 minutes earlier.";
}

} else if (weeklyStats.avg_sleep_efficiency >= 85 &&
    weeklyStats.avg_sleep_efficiency <= 90) {
    // No change
    message = "You're in the ideal range. Your sleep is efficient and consolidated. Consistency is key, so let's maintain your current schedule this week to solidify these gains.";
}

} else if (weeklyStats.avg_sleep_efficiency >= 80 &&
    weeklyStats.avg_sleep_efficiency < 85) {
    // No change
    message = "You are right on track and building momentum. Let's stick with your current schedule for another week to continue strengthening your sleep system.";
}

} else if (weeklyStats.avg_sleep_efficiency < 80) {
    newPTIB = Math.max(
        newPTIB - ADJUSTMENT_MINUTES,
        MINIMUM_WINDOW_MINUTES
    );
    adjustmentReason = 'decrease';
    message = "This is a normal and expected part of the process. To make your sleep more powerful and continuous, we're going to slightly shorten your time in bed. This will build your natural sleep drive, helping you fall asleep faster and stay asleep.";
}

// Calculate new bedtime (wake time stays fixed)
const wakeTime = currentWindow.prescribed_wake_time;
const newBedtime = subtractMinutes(wakeTime, newPTIB);

return {

```

```
prescribed_bedtime: newBedtime,  
prescribed_wake_time: wakeTime,  
prescribed_time_in_bed_minutes: newPTIB,  
adjustment_reason: adjustmentReason,  
adjustment_message: message,  
previous_window_id: currentWeekId  
};  
}
```

VI. API Endpoints Specification

Authentication & User Management

```
POST /api/auth/register  
POST /api/auth/login  
POST /api/auth/logout  
POST /api/auth/refresh-token  
POST /api/auth/reset-password  
GET /api/user/profile  
PATCH /api/user/profile  
DELETE /api/user/account
```

Onboarding

```
POST /api/onboarding/safety-screening  
GET /api/onboarding/safety-screening/:userId  
POST /api/onboarding/isi-assessment  
GET /api/onboarding/status/:userId  
PATCH /api/onboarding/complete
```

Sleep Diary

```
GET /api/diary/entries?start_date=&end_date=  
GET /api/diary/entries/:date  
POST /api/diary/entries  
PATCH /api/diary/entries/:id  
DELETE /api/diary/entries/:id
```

```
GET /api/diary/weekly-summary/:weekNumber  
GET /api/diary/baseline-average
```

Sleep Restriction Program

```
GET /api/program/current-week  
GET /api/program/sleep-window/current  
GET /api/program/sleep-window/history  
POST /api/program/sleep-window/advance (triggered by system)
```

```
GET /api/program/weekly-report/:weekNumber
```

Content & Learning

```
GET /api/content/modules (returns week-unlocked curriculum)  
GET /api/content/modules/:moduleId  
POST /api/content/track-progress
```

Body: { contentId, eventType: 'started' | 'completed' | 'progress' }

```
GET /api/content/audio-library  
GET /api/content/audio/:trackId (returns stream URL)
```

Cognitive Tools

```
GET /api/tools/thought-records  
GET /api/tools/thought-records/:id  
POST /api/tools/thought-records  
PATCH /api/tools/thought-records/:id  
DELETE /api/tools/thought-records/:id
```

```
GET /api/tools/common-thoughts (pre-defined list for quick selection)
```

Progress & Analytics

```
GET /api/progress/dashboard
```

Returns: {

sleepEfficiencyTrend: [],

isiComparison: {},

currentWeek: 3,

weeklyReports: [],

milestones: []

}

```
GET /api/progress/isi-history
```

POST /api/progress/isi-assessment (can be taken any week)

GET /api/progress/export (returns CSV/JSON of all user data)

Notifications

GET /api/notifications

PATCH /api/notifications/:id/read

POST /api/notifications/preferences

DELETE /api/notifications/:id

VII. UI/UX Design System Specifications

A. Design Tokens

Color Palette

```
:root {  
  /* Primary - Calming blue/purple for trust & sleep */  
  --color-primary-50: #f0f4ff;  
  --color-primary-100: #d9e3ff;  
  --color-primary-500: #4f46e5; /* Main brand */  
  --color-primary-700: #3730a3;  
  --color-primary-900: #1e1b4b;  
  
  /* Success - For positive progress */  
  --color-success-50: #ecfdf5;  
  --color-success-500: #10b981;  
  --color-success-700: #047857;  
  
  /* Warning - For attention items */  
  --color-warning-50: #ffffbeb;  
  --color-warning-500: #f59e0b;  
  --color-warning-700: #b45309;  
  
  /* Neutral - For text and backgrounds */  
  --color-gray-50: #f9fafb;  
  --color-gray-100: #f3f4f6;  
  --color-gray-300: #d1d5db;
```

```
--color-gray-500: #6b7280;  
--color-gray-700: #374151;  
--color-gray-900: #111827;  
  
/* Dark mode (nighttime helper) */  
--color-dark-bg: #0f172a;  
--color-dark-surface: #1e293b;  
--color-dark-text: #cbd5e1;  
}
```

Typography

```
:root {  
/* Font families */  
--font-primary: 'Inter', -apple-system, BlinkMacSystemFont, 'Segoe UI', sans-serif;  
--font-display: 'Lexend', var(--font-primary);
```

```
/* Font sizes - Mobile first */  
--text-xs: 0.75rem; /* 12px */  
--text-sm: 0.875rem; /* 14px */  
--text-base: 1rem; /* 16px */  
--text-lg: 1.125rem; /* 18px */  
--text-xl: 1.25rem; /* 20px */  
--text-2xl: 1.5rem; /* 24px */  
--text-3xl: 1.875rem; /* 30px */
```

```
/* Line heights */  
--leading-tight: 1.25;  
--leading-normal: 1.5;  
--leading-relaxed: 1.75;
```

```
/* Font weights */  
--font-normal: 400;  
--font-medium: 500;  
--font-semibold: 600;  
--font-bold: 700;
```

```
}
```

Spacing Scale

```
:root {
```

```
--space-1: 0.25rem; /* 4px */  
--space-2: 0.5rem; /* 8px */  
--space-3: 0.75rem; /* 12px */  
--space-4: 1rem; /* 16px */  
--space-5: 1.25rem; /* 20px */  
--space-6: 1.5rem; /* 24px */  
--space-8: 2rem; /* 32px */  
--space-10: 2.5rem; /* 40px */  
--space-12: 3rem; /* 48px */  
--space-16: 4rem; /* 64px */
```

```
}
```

Shadows & Effects

```
:root {
```

```
/* Elevation */  
--shadow-sm: 0 1px 2px 0 rgba(0, 0, 0, 0.05);  
--shadow-md: 0 4px 6px -1px rgba(0, 0, 0, 0.1);  
--shadow-lg: 0 10px 15px -3px rgba(0, 0, 0, 0.1);  
--shadow-xl: 0 20px 25px -5px rgba(0, 0, 0, 0.1);
```

```
/* Border radius */
```

```
--radius-sm: 0.25rem; /* 4px */  
--radius-md: 0.5rem; /* 8px */  
--radius-lg: 0.75rem; /* 12px */  
--radius-xl: 1rem; /* 16px */  
--radius-full: 9999px;
```

```
/* Transitions */
```

```
--transition-fast: 150ms ease-in-out;  
--transition-base: 250ms ease-in-out;  
--transition-slow: 350ms ease-in-out;
```

```
}
```

B. Component Library

Primary Button

```
<button className="btn-primary">  
  Complete Entry  
</button>
```

```
/* Styles */  
.btn-primary {  
  background: var(--color-primary-500);  
  color: white;  
  padding: var(--space-3) var(--space-6);  
  border-radius: var(--radius-md);  
  font-weight: var(--font-semibold);  
  font-size: var(--text-base);
```

```
/* Touch target minimum 44x44px */  
  min-height: 44px;  
  min-width: 44px;
```

```
  transition: all var(--transition-fast);  
  box-shadow: var(--shadow-sm);  
}
```

```
.btn-primary:hover {  
  background: var(--color-primary-600);  
  box-shadow: var(--shadow-md);  
  transform: translateY(-1px);  
}
```

```
.btn-primary:active {  
  transform: translateY(0);  
}
```

```
.btn-primary:disabled {  
  opacity: 0.5;  
  cursor: not-allowed;  
}
```

Card Component

```
<div className="card">  
  <div className="card-header">  
    <h3>Today's Sleep Diary</h3>  
  </div>  
  <div className="card-body">  
    {/* Content */}  
  </div>  
  <div className="card-footer">  
    {/* Actions */}  
  </div>  
</div>
```

```
/* Styles */
```

```
.card {  
  background: white;  
  border-radius: var(--radius-lg);  
  box-shadow: var(--shadow-md);  
  overflow: hidden;  
}
```

```
.card-header {  
  padding: var(--space-4) var(--space-5);  
  border-bottom: 1px solid var(--color-gray-200);  
}
```

```
.card-body {  
  padding: var(--space-5);  
}
```

```
.card-footer {  
  padding: var(--space-4) var(--space-5);  
  background: var(--color-gray-50);  
  border-top: 1px solid var(--color-gray-200);  
}  
}
```

Form Input

```
<div className="form-group">  
  <label className="form-label">  
    What time did you get into bed?  
  </label>  
  <input  
    type="time"  
    className="form-input"  
    required  
  />  
  <p className="form-help">  
    Your best estimate is fine  
  </p>  
</div>
```

```
/* Styles */  
.form-group {  
  margin-bottom: var(--space-5);  
}  
}
```

```
.form-label {  
  display: block;  
  font-weight: var(--font-medium);  
  margin-bottom: var(--space-2);  
  color: var(--color-gray-700);  
}  
}
```

```
.form-input {  
  width: 100%;
```

```
padding: var(--space-3) var(--space-4);  
border: 2px solid var(--color-gray-300);  
border-radius: var(--radius-md);  
font-size: var(--text-base);  
  
/* Touch-friendly */  
min-height: 44px;  
  
transition: border-color var(--transition-fast);  
}
```

```
.form-input:focus {  
outline: none;  
border-color: var(--color-primary-500);  
box-shadow: 0 0 0 3px rgba(79, 70, 229, 0.1);  
}
```

```
.form-help {  
margin-top: var(--space-2);  
font-size: var(--text-sm);  
color: var(--color-gray-500);  
}
```

Progress Bar

```
<div className="progress-bar">  
  <div  
    className="progress-fill"  
    style={{width: '83%'}}  
    role="progressbar"  
    aria-valuenow="83"  
    aria-valuemin="0"  
    aria-valuemax="100"  
  >  
    <span className="progress-label">83%</span>  
  </div>
```

```
</div>

/* Styles */

.progress-bar {
  height: 32px;
  background: var(--color-gray-200);
  border-radius: var(--radius-full);
  overflow: hidden;
  position: relative;
}

.progress-fill {
  height: 100%;
  background: linear-gradient(
    90deg,
    var(--color-primary-500),
    var(--color-primary-600)
  );
  border-radius: var(--radius-full);
  transition: width var(--transition-slow);
}

display: flex;
align-items: center;
justify-content: flex-end;
padding-right: var(--space-3);
}

.progress-label {
  color: white;
  font-weight: var(--font-semibold);
  font-size: var(--text-sm);
}

Alert/Notice Component
<div className="alert alert-success">
```

```
<svg className="alert-icon">...</svg>
<div className="alert-content">
  <h4 className="alert-title">Entry Saved!</h4>
  <p>Your sleep efficiency was 83%</p>
</div>
</div>
```

```
/* Styles */
```

```
.alert {
  display: flex;
  gap: var(--space-3);
  padding: var(--space-4);
  border-radius: var(--radius-md);
  border-left: 4px solid;
}
```

```
.alert-success {
  background: var(--color-success-50);
  border-color: var(--color-success-500);
  color: var(--color-success-900);
}
```

```
.alert-warning {
  background: var(--color-warning-50);
  border-color: var(--color-warning-500);
  color: var(--color-warning-900);
}
```

```
.alert-icon {
  width: 24px;
  height: 24px;
  flex-shrink: 0;
}
```

```
.alert-title {  
  font-weight: var(--font-semibold);  
  margin-bottom: var(--space-1);  
}
```

C. Responsive Breakpoints

```
/* Mobile first approach */
```

```
/* Small devices (phones, < 640px) */
```

```
/* Base styles - no media query needed */
```

```
/* Medium devices (tablets, 640px - 768px) */
```

```
@media (min-width: 640px) {
```

```
  .container {
```

```
    max-width: 640px;
```

```
  }
```

```
}
```

```
/* Large devices (small laptops, 768px - 1024px) */
```

```
@media (min-width: 768px) {
```

```
  .container {
```

```
    max-width: 768px;
```

```
  }
```

```
/* Show sidebar navigation */
```

```
.sidebar {
```

```
  display: block;
```

```
}
```

```
/* Two-column dashboard layout */
```

```
.dashboard-grid {
```

```
  grid-template-columns: 1fr 1fr;
```

```
}
```

```
}
```

```
/* Extra large devices (desktops, 1024px+) */
```

```
@media (min-width: 1024px) {
```

```
  .container {
```

```
    max-width: 1024px;
```

```
}
```

```
/* Three-column layout for some views */
```

```
.content-grid {
```

```
  grid-template-columns: repeat(3, 1fr);
```

```
}
```

```
}
```

VIII. Security & Compliance Framework

A. Data Protection Measures

Encryption

// At Rest

- All PII and health data encrypted using AES-256
- Database-level encryption enabled
- Encrypted backups stored in separate geographic region

// In Transit

- TLS 1.3 minimum for all connections
- Certificate pinning for mobile apps
- HTTPS everywhere, HSTS headers enabled

// Application Level

- Sensitive fields (email) hashed before storage
- Sleep diary data encrypted at field level
- Encryption keys rotated quarterly

Authentication & Authorization

// User Authentication

- Bcrypt password hashing (cost factor 12)
- JWT tokens with 15-minute expiration

- Refresh tokens with 30-day expiration, stored securely
- Rate limiting on login attempts (5 attempts/15 min)
- Account lockout after repeated failures
- Optional 2FA via TOTP

// Session Management

- Secure, HttpOnly cookies
- CSRF tokens for state-changing operations
- Automatic session invalidation on logout
- Session timeout after 30 minutes of inactivity

// Authorization

- Role-based access control (user, admin)
- All API endpoints require valid JWT
- User can only access own data (enforced at DB query level)

Privacy by Design

// Data Minimization

- Collect only essential fields
- No social media integration
- No third-party tracking scripts
- Anonymous analytics (no IP addresses stored)

// User Control

- Explicit consent for notifications
- Easy data export (CSV/JSON)
- One-click account deletion
 - Hard delete all user data
 - 30-day grace period with account suspension
 - Irreversible after grace period

// Transparency

- Plain-language privacy policy
- In-app privacy dashboard showing:
 - What data is collected

- How it's used
 - Retention period
 - Download/delete options
-

B. HIPAA-Aligned Practices (Not HIPAA-covered, but inspired)

While this self-help app is likely not a "covered entity" under HIPAA, adopting HIPAA-aligned practices builds trust and prepares for potential future clinical partnerships.

Administrative Safeguards:

- Security officer designated
- Employee training on data handling
- Access controls and audit logs
- Incident response plan documented

Physical Safeguards:

- Cloud infrastructure SOC 2 certified
- Data centers with physical security
- Workstation security policies
- Encrypted laptops for team

Technical Safeguards:

- Unique user IDs
 - Automatic logoff after inactivity
 - Encryption at rest and in transit
 - Audit logs for all data access
 - Regular vulnerability scanning
-

C. Content Delivery & Performance

CDN Strategy

- Static assets (images, CSS, JS) served via CDN
- Audio files cached at edge locations
- Geographic distribution for global access
- Automatic compression (Brotli/Gzip)
- Cache invalidation strategy for updates

Performance Budget

Metric	Target	Maximum
First Contentful Paint	< 1.5s	2s
Largest Contentful Paint	< 2.5s	3s
Time to Interactive	< 3.5s	5s
Total Page Size	< 500KB	1MB
API Response Time	< 200ms	500ms
Sleep Diary Submit	< 100ms	200ms

Optimization Techniques

// Code splitting

- Lazy load routes
- Separate bundles for each major module
- Dynamic imports for heavy components

// Image optimization

- WebP format with fallbacks
- Responsive images (srcset)
- Lazy loading below fold
- Placeholder blurring

// Caching strategy

- Service worker for offline functionality
- Cache diary entries locally
- Sync when connection restored
- Background sync for notifications

IX. Testing & Quality Assurance Strategy

A. Testing Pyramid

Unit Tests (70% coverage target)

// Critical business logic

- Sleep efficiency calculations
- Sleep window adjustment algorithm
- Date/time utilities (timezone handling)
- Data validation functions

```

// Example test

describe('calculateSleepEfficiency', () => {
  it('correctly calculates SE for typical night', () => {
    const entry = {
      time_in_bed_minutes: 480, // 8 hours
      sleep_onset_latency_minutes: 20,
      total_time_awake_minutes: 40
    };

    const result = calculateSleepMetrics(entry);

    expect(result.total_sleep_time_minutes).toBe(420); // 7 hours
    expect(result.sleep_efficiency_percent).toBe(87.5);
  });
}

it('enforces minimum 5.5 hour sleep window', () => {
  const result = adjustSleepWindow(75, 330); // 5.5 hours, 75% SE
  expect(result.newPTIB).toBe(330); // Should not decrease below minimum
});
}

```

Integration Tests (20% coverage)

// API endpoint testing

- Authentication flow
- Sleep diary CRUD operations
- Weekly report generation
- Content unlocking logic

// Example test

```

describe('POST /api/diary/entries', () => {
  it('creates entry and calculates metrics', async () => {
    const response = await request(app)
      .post('/api/diary/entries')
      .set('Authorization', `Bearer ${userToken}`)
  });
}

```

```

.send(validDiaryEntry);

expect(response.status).toBe(201);
expect(response.body).toHaveProperty('sleep_efficiency_percent');
expect(response.body.sleep_efficiency_percent).toBeGreaterThan(0);
});

it('triggers weekly adjustment on 7th entry', async () => {
  // Create 6 entries
  for (let i = 0; i < 6; i++) {
    await createDiaryEntry(user, getDateDaysAgo(i));
  }

  // 7th entry should trigger adjustment
  const response = await request(app)
    .post('/api/diary/entries')
    .set('Authorization', `Bearer ${userToken}`)
    .send(seventhEntry);

  expect(response.status).toBe(201);
  expect(response.body.triggers_weekly_adjustment).toBe(true);

  // Verify new sleep window created
  const newWindow = await getSleepWindow(user.id, 2);
  expect(newWindow.toBeDefined());
  expect(newWindow.week_number).toBe(2);
});

});

End-to-End Tests (10% coverage)

// Critical user journeys using Cypress or Playwright

describe('Complete Onboarding Flow', () => {
  it('allows new user to complete full onboarding', () => {
    cy.visit('/signup');
  });
});

```

```

// Registration
cy.get('[data-testid="email-input"]').type('test@example.com');
cy.get('[data-testid="password-input"]').type('SecurePass123!');
cy.get('[data-testid="signup-button"]').click();

// Safety screening
cy.get('[data-testid="sleep-apnea-no"]').click();
cy.get('[data-testid="seizures-no"]').click();
// ... complete all questions
cy.get('[data-testid="screening-submit"]').click();

// ISI assessment
cy.get('[data-testid="isi-q1"]').click({ force: true }); // Select option
// ... complete all 7 questions
cy.get('[data-testid="isi-submit"]').click();

// Verify redirected to baseline week
cy.url().should('include', '/dashboard');
cy.contains('Complete your baseline week');

});

});

describe('Sleep Diary Entry Flow', () => {
it('allows user to complete diary entry in < 60 seconds', () => {
  cy.visit('/dashboard');
  cy.get('[data-testid="diary-entry-button"]').click();

  // Time picker interactions
  cy.get('[data-testid="bedtime-hour"]').select('11');
  cy.get('[data-testid="bedtime-minute"]').select('30');
  cy.get('[data-testid="bedtime-period"]').select('PM');

  // Continue through all fields
  cy.get('[data-testid="next-button"]').click();
}

```

```

// ... fill remaining fields

cy.get('[data-testid="submit-entry"]').click();

// Verify confirmation
cy.contains('Entry saved!');
cy.contains('Your sleep efficiency was');
});

});

```

B. User Acceptance Testing (UAT)

Beta Testing Protocol

Phase 1: Internal Testing (2 weeks)

- Team members and family
- Focus: Major bugs, broken flows, unclear instructions
- Tools: Bug tracking in Linear/Jira

Phase 2: Limited Beta (4 weeks)

- 50-100 external users with insomnia
- Recruitment: Online ads, sleep clinics, patient forums
- Inclusion criteria:
 - Age 18-65
 - Self-reported insomnia for 3+ months
 - English speaking
 - Access to smartphone/computer
- Exclusion: Same as app contraindications

Data Collection:

```

// Quantitative metrics

- Completion rate (% who finish 6 weeks)

- Daily diary adherence rate

- Time to complete diary entry

- Feature usage analytics

- Technical errors/crashes

- ISI score improvement (pre/post)

```

// Qualitative feedback

- Weekly survey (5 questions, 2 minutes)
- Optional open-ended feedback
- Exit interview (30 min, compensated)
- Usability issues log

Beta User Weekly Survey Example:

1. How many days this week did you complete your sleep diary?

[0] [1-3] [4-6] [7]

2. Rate the difficulty of following your sleep schedule:

[Very Easy] [Easy] [Neutral] [Difficult] [Very Difficult]

3. Which feature did you find most helpful this week?

[Sleep Diary] [Sleep Schedule] [Can't Sleep Helper]

[Learning Module] [Thought Record] [Relaxation Audio]

4. Did you experience any technical issues?

[Yes - describe] [No]

5. Additional comments (optional):

[Text box]

C. Accessibility Testing

WCAG 2.1 AA Compliance Checklist

Perceivable:

✓ Text alternatives for non-text content

- All images have alt text

- Audio files have transcripts

- Videos have captions

✓ Adaptable content

- Semantic HTML (headings, landmarks)

- Meaningful reading order

- No reliance on color alone for information

✓ Distinguishable

- 4.5:1 contrast ratio for normal text
- 3:1 for large text and UI components
- Text can be resized to 200% without loss of functionality
- No automatic audio playback

Operable:

✓ Keyboard accessible

- All functionality available via keyboard
- Visible focus indicators
- No keyboard traps
- Skip navigation links

✓ Enough time

- No session timeout during diary entry
- Ability to pause/stop moving content
- Auto-save for forms

✓ Seizures and physical reactions

- No content flashes more than 3 times per second

✓ Navigable

- Clear page titles
- Descriptive link text (no "click here")
- Multiple navigation methods
- Breadcrumbs where appropriate

Understandable:

✓ Readable

- Language declared (lang="en")
- Consistent terminology
- Plain language (6th-8th grade reading level)
- Definitions for technical terms

✓ Predictable

- Consistent navigation across pages
- Consistent identification of components
- No automatic context changes

✓ Input assistance

- Clear error messages
- Labels and instructions for forms
- Error prevention (confirmation for deletion)
- Suggestions for fixing errors

Robust:

✓ Compatible

- Valid HTML/CSS
- ARIA landmarks and roles where needed
- Name, role, value for all UI components
- Status messages announced to screen readers

Testing Tools

Automated:

- axe DevTools (browser extension)
- Lighthouse accessibility audit
- WAVE evaluation tool

Manual:

- Screen reader testing (NVDA, JAWS, VoiceOver)
- Keyboard-only navigation
- Color contrast analyzer
- Zoom testing (up to 200%)

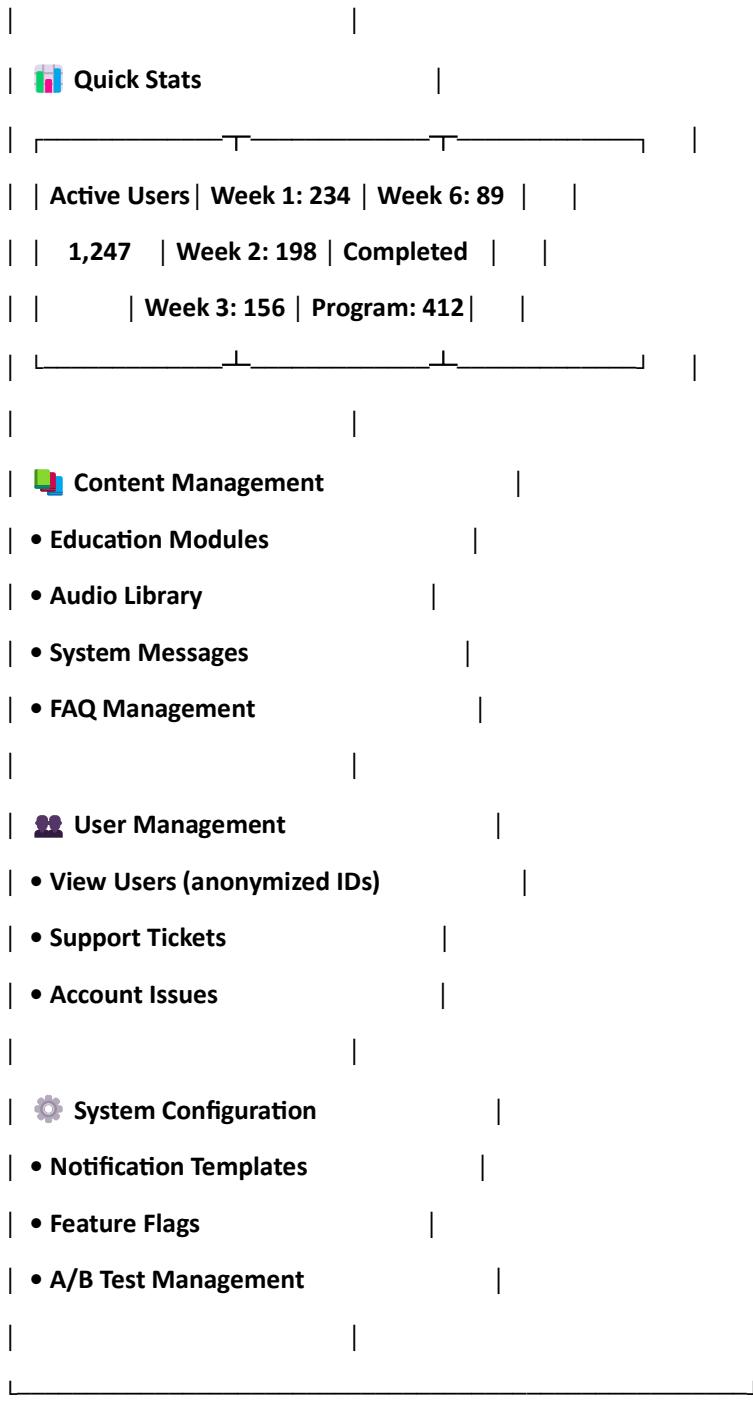
X. Content Management System (CMS) Requirements

A. Admin Dashboard

For managing psychoeducational content, audio library, and system messages without developer intervention.

Dashboard Overview





B. Education Module Editor

Module Structure:

```
{
  id: "week-1-sleep-drive",
  title: "Understanding Sleep Drive",
  week_unlocked: 1,
  module_type: "education",
  estimated_time_minutes: 5,
```

```
content_blocks: [
  {
    type: "video",
    url: "https://cdn.example.com/videos/sleep-drive.mp4",
    thumbnail: "...",
    duration_seconds: 90,
    transcript: "..."
  },
  {
    type: "text",
    content: "## Key Takeaways\n\n- Sleep drive builds...",
    markdown: true
  },
  {
    type: "interactive_quiz",
    questions: [...]
  },
  {
    type: "application",
    content: "This is why your fixed wake time matters.."
  }
],
```

```
published: true,
created_at: "2025-01-15T10:00:00Z",
updated_at: "2025-01-20T14:30:00Z"
}
```

Editor Interface:

The screenshot shows a user interface for editing a module. At the top, there's a header bar with the text "Edit Module: Understanding Sleep Drive". Below this, there's a main content area with a title field containing "Title: [Understanding Sleep Drive]". The interface has a clean, modern design with a white background and light gray borders for the input fields.

Week: [1 ▼]	Type: [Education ▼]
Est. Time: [5] minutes	
Content Blocks:	
<div style="border: 1px solid black; height: 10px;"></div>	
[Video Block]	
Upload: [Choose File]	
Transcript: [Edit]	
[Move Up] [Move Down] [Delete]	
<div style="border: 1px solid black; height: 10px;"></div>	
[+ Add Text Block]	
[+ Add Quiz Block]	
[+ Add Interactive Element]	
Status: <input type="radio"/> Draft <input checked="" type="radio"/> Published	
[Save Draft] [Preview] [Publish]	
<div style="border: 1px solid black; height: 10px;"></div>	

C. System Message Templates

For automated weekly reports, notifications, and adjustment messages.

Template Variables:

Available placeholders:

- {{user_first_name}}
- {{week_number}}
- {{avg_sleep_efficiency}}
- {{sleep_efficiency_change}}
- {{new_bedtime}}
- {{new_wake_time}}
- {{adjustment_direction}} (increase/maintain/decrease)

Example Template: Weekly Report Email

Subject: Your Week {{week_number}} Sleep Report

Hi {{user_first_name}},

Great work completing Week {{week_number}}! Here's your progress:

Sleep Efficiency: {{avg_sleep_efficiency}}%

Change from last week: {{sleep_efficiency_change}}

{{#if adjustment_direction == 'increase'}}

Your sleep is becoming very solid! We're adding 15 minutes
to your sleep window.

{{/if}}

{{#if adjustment_direction == 'maintain'}}

You're in the ideal range. Let's maintain your current
schedule to solidify these gains.

{{/if}}

Your schedule for next week:

Bedtime: {{new_bedtime}}

Wake time: {{new_wake_time}}

Keep up the excellent work!

[\[View Full Report in App\]](#)

XI. Analytics & Monitoring Strategy

A. Key Performance Indicators (KPIs)

Clinical Effectiveness Metrics

Primary Outcomes:

- Mean ISI score reduction (baseline to Week 6)

Target: ≥ 7 point reduction (clinically significant)

- % users achieving ISI < 10 (remission)

Target: > 50%

- Mean Sleep Efficiency improvement

Target: \geq 10 percentage point increase

Secondary Outcomes:

- Sleep onset latency reduction (minutes)
- Wake after sleep onset reduction (minutes)
- Total sleep time increase (minutes)
- Self-reported sleep quality improvement

Engagement Metrics

User Journey:

- Registration → Onboarding completion rate

Target: > 80%

- Onboarding → Week 1 start rate

Target: > 90%

- Weekly retention rate (Week 1 → Week 6)

Target: > 60%

- Program completion rate (all 6 weeks)

Target: > 50%

Daily Engagement:

- Daily diary entry rate

Target: > 85% of active users

- Average time to complete diary entry

Target: < 60 seconds

- Feature utilization rates:

- Can't Sleep helper usage

- Thought record creation

- Audio exercise plays

- Education module completion

Technical Performance Metrics

Reliability:

- Uptime: > 99.9%

- Error rate: < 0.1% of requests

- Mean time to resolution (MTTR): < 2 hours

Performance:

- API p95 response time: < 500ms
- Page load time p95: < 3 seconds
- Mobile app crash rate: < 0.5%

Security:

- Failed login attempts (monitoring for attacks)
 - Suspicious access patterns
 - Data breach attempts: 0
-

B. Analytics Implementation

Privacy-Respecting Analytics

// Use privacy-focused analytics (e.g., Plausible, Fathom)

// No personal identifiers, no cross-site tracking

// Event tracking structure

```
{  
  event: 'diary_entry_completed',  
  properties: {  
    week_number: 2,  
    time_to_complete_seconds: 47,  
    device_type: 'mobile',  
    // NO user_id, NO email, NO IP  
  }  
}
```

// Key events to track

- page_view
- diary_entry_started
- diary_entry_completed
- diary_entry_abandoned
- weekly_report_viewed
- sleep_window_adjusted

- education_module_started
 - education_module_completed
 - thought_record_created
 - audio_exercise_played
 - cant_sleep_helper_used
 - account_created
 - program_completed
-

C. Monitoring & Alerting

Application Monitoring (APM)

// Use tools like Sentry, DataDog, or New Relic

Critical Alerts (PagerDuty/SMS):

- API error rate > 5% for > 2 minutes
- Database connection failures
- Service downtime
- Security breach attempts
- Payment processing failures (if applicable)

Warning Alerts (Email/Slack):

- API response time p95 > 1 second
- Increased error rate in specific endpoint
- Unusual traffic patterns
- Low disk space on servers
- SSL certificate expiring in < 30 days

Daily Digests:

- New user signups
- Program completions
- Support tickets opened
- System performance summary

User Behavior Monitoring

// Cohort analysis

- Week-over-week retention by signup cohort

- Feature adoption by cohort
- Completion rates by demographic (if collected)

// Funnel analysis

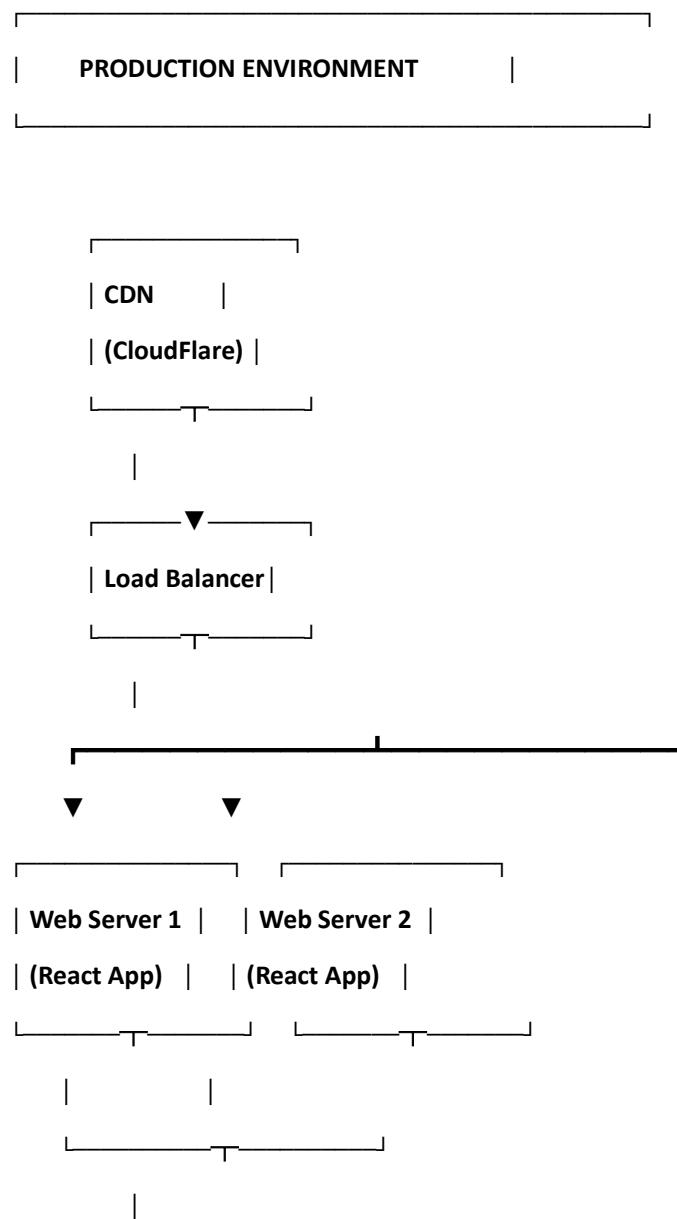
Registration → Safety Screen → ISI → Baseline Week → Program Start

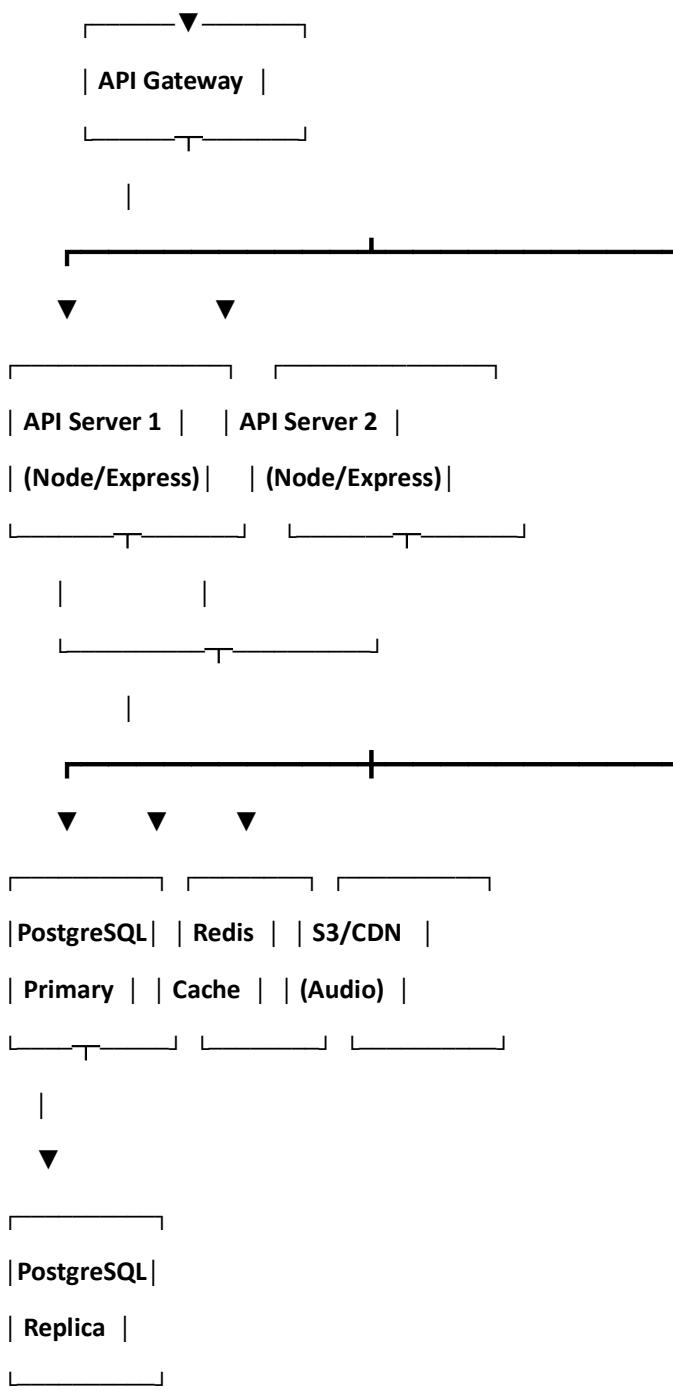
↓ ↓ ↓ ↓ ↓
95% 90% 85% 75% 70%

// Identify drop-off points for optimization

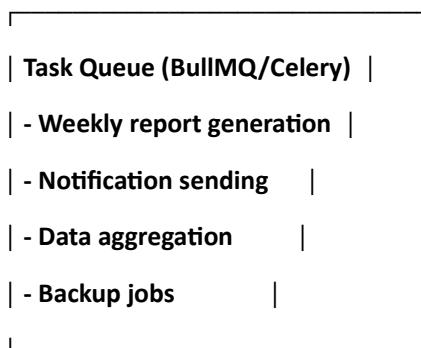
XII. Deployment & DevOps Strategy

A. Infrastructure Architecture





Background Jobs:



B. Deployment Pipeline (CI/CD)

```
# Example GitHub Actions workflow
```

```
name: Deploy to Production
```

```
on:
```

```
  push:
```

```
    branches: [main]
```

```
jobs:
```

```
  test:
```

```
    runs-on: ubuntu-latest
```

```
    steps:
```

```
      - uses: actions/checkout@v3
```

```
      - name: Install dependencies
```

```
        run: npm ci
```

```
      - name: Run unit tests
```

```
        run: npm test
```

```
      - name: Run integration tests
```

```
        run: npm run test:integration
```

```
      - name: Lint code
```

```
        run: npm run lint
```

```
      - name: Type check
```

```
        run: npm run type-check
```

```
build:
```

```
  needs: test
```

```
  runs-on: ubuntu-latest
```

steps:

- uses: actions/checkout@v3

- name: Build frontend

- run: |

- cd frontend

- npm ci

- npm run build

- name: Build backend

- run: |

- cd backend

- npm ci

- npm run build

- name: Upload artifacts

- uses: actions/upload-artifact@v3

- with:

- name: build-artifacts

- path: |

- frontend/dist

- backend/dist

deploy:

needs: build

runs-on: ubuntu-latest

steps:

- name: Download artifacts

- uses: actions/download-artifact@v3

- name: Deploy to staging

- run: |

- # Deploy to staging first

- ./scripts/deploy-staging.sh

```

- name: Run smoke tests
  run: npm run test:e2e:staging

- name: Deploy to production
  run: |
    # Blue-green deployment
    ./scripts/deploy-production.sh

- name: Health check
  run: curl -f https://api.cbt-platform.com/health

- name: Notify team
  uses: 8398a7/action-slack@v3
  with:
    status: ${{ job.status }}
    text: 'Deployment completed'

```

C. Environment Strategy

Development → Staging → Production

Development:

- Local Docker containers
- Seeded test data
- Hot reload enabled
- Verbose logging

Staging:

- Mirrors production architecture
- Anonymized production data (optional)
- E2E test environment
- Feature flag testing

Production:

- High availability setup
 - Auto-scaling configured
 - Comprehensive monitoring
 - Automated backups (hourly incremental, daily full)
-

D. Disaster Recovery Plan

Backup Strategy:

- Database:

- Continuous WAL archiving
- Daily full backups retained for 30 days
- Weekly backups retained for 1 year
- Geo-redundant storage

- User-uploaded content (audio, etc):

- Replicated across 3 regions
 - Versioning enabled
- Code:
- Git repository (already versioned)
 - Tagged releases

Recovery Time Objective (RTO): 4 hours

Recovery Point Objective (RPO): 1 hour

Incident Response:

1. Detect (monitoring alerts)
 2. Assess severity
 3. Notify team (PagerDuty)
 4. Implement fix or failover
 5. Validate recovery
 6. Post-mortem documentation
-

XIII. Go-to-Market & Launch Strategy

A. Pre-Launch Checklist (MVP Launch)

Technical Readiness:

✓ Core Features Complete:

- Sleep diary (with 7-day baseline)
- SRT algorithm & weekly adjustments
- SCT rules & "Can't Sleep" helper
- Dashboard with progress visualization
- Week 0-2 psychoeducation content
- User authentication & security

✓ Quality Assurance:

- All critical paths tested (E2E)
- Cross-browser testing (Chrome, Safari, Firefox, Edge)
- Mobile responsive on iOS & Android
- Accessibility audit passed (WCAG AA)
- Load testing completed (500 concurrent users)
- Security penetration test passed

✓ Legal & Compliance:

- Privacy policy published
- Terms of service published
- Disclaimers prominently displayed
- Cookie consent implemented
- GDPR compliance (if targeting EU)
- Data protection impact assessment

✓ Operations:

- Monitoring & alerting configured
- Support email/ticket system ready
- FAQ documentation complete
- Admin dashboard functional
- Backup & recovery tested

B. Launch Phases

Phase 1: Soft Launch (Weeks 1-4)

Goal: Validate product-market fit, identify critical issues

Target: 100-200 users

Acquisition:

- Personal networks
- Sleep-focused online communities (Reddit r/insomnia)
- Sleep clinic partnerships (referrals)

Focus:

- Monitor completion rates daily
- Weekly user interviews (5-10 users)
- Rapid bug fixes
- Content refinement based on feedback

Phase 2: Limited Public Launch (Weeks 5-12)

Goal: Scale to 1,000 users, optimize conversion

Target: 1,000 users

Acquisition:

- Google Ads (keywords: "CBT-I", "insomnia treatment")
- Facebook/Instagram ads (targeting sleep content engagement)
- Content marketing (blog posts, sleep tips)
- SEO optimization
- Partnership with sleep tracking apps

Focus:

- A/B testing on onboarding flow
- Optimize diary entry UX based on time data
- Build email nurture sequences
- Implement referral program

Phase 3: Full Public Launch (Month 4+)

Goal: Scale to 10,000+ users, establish market presence

Acquisition:

- Expanded paid advertising

- PR outreach (health tech publications)
- Partnerships with employers (wellness programs)
- Affiliate program with therapists
- App store presence (if mobile app developed)

Focus:

- Reduce user acquisition cost (CAC)
 - Increase lifetime value (LTV)
 - Build community features
 - Develop premium/coaching tier
-

C. Pricing Strategy (If Applicable)

Option 1: Freemium Model

Free Tier:

- 2-week trial of full program
- Limited to basic SRT & SCT
- No cognitive tools or audio library

Premium Tier (\$49-79 for 6-week program):

- Full CBT-I protocol
- Cognitive restructuring workbench
- Relaxation audio library
- Extended progress tracking
- Priority support
- Access to future updates

Option 2: One-Time Purchase

\$79-99 for lifetime access

- All features unlocked
- No recurring fees
- Positions as "digital workbook"
- Higher conversion potential than subscription

Option 3: Insurance/B2B2C

Partner with:

- Health insurance companies

- Employee assistance programs (EAPs)
- Corporate wellness programs

Pricing:

- \$30-50 per user (bulk rates)
- White-label options for enterprises
- Integration with existing benefits platforms

Recommendation for MVP: Start with direct-to-consumer one-time purchase. Simplest to implement, aligns with "completing a course" mental model, and easier to market than subscription for a 6-week program.

XIV. Future Enhancements Roadmap

Phase 1 Enhancements (Months 4-6 post-launch)

- Wearable integration (Fitbit, Apple Watch, Oura Ring)
 - Auto-populate diary with objective sleep data
 - Hybrid approach: wearable data + subjective ratings
- Social proof elements
 - Anonymous success stories
 - Aggregate statistics ("Join 10,000 people...")
- Enhanced reminder system
 - Smart timing based on user patterns
 - Gentle escalation for missed entries

- Progress milestones & gamification
 - Badges for consistency streaks
 - Celebration moments for improvements

Phase 2 Enhancements (Months 7-12)

- Mobile native apps (iOS & Android)
 - Better notifications
 - Offline-first architecture
 - Widget for quick diary entry
- Specialized programs

- CBT-I for shift workers
 - CBT-I for chronic pain patients
 - CBT-I for older adults
-
- Community features
 - Anonymous peer support forum
 - Weekly check-in groups
 - Success story sharing
-
- AI-powered personalization
 - Adaptive content based on user profile
 - Predictive insights (sleep pattern trends)
 - Personalized tip generation
- Phase 3 Enhancements (Year 2+)**
- Therapist dashboard (B2B product)
 - Clinicians can monitor patient progress
 - Hybrid model: digital + human support
 - Telehealth integration
-
- Research partnerships
 - Academic studies using anonymized data
 - Publication of effectiveness data
 - Continuous improvement based on research
-
- International expansion
 - Multi-language support
 - Cultural adaptation of content
 - Regional sleep research integration
-
- Adjacent conditions
 - CBT for anxiety (with sleep focus)
 - Stress management module
 - Circadian rhythm disorder protocols
-

XV. Success Criteria & Exit Conditions

Definition of Success (6 months post-launch)

Primary Success Metrics:

Clinical:

- ✓ Mean ISI reduction ≥ 7 points (clinically significant)
- ✓ $\geq 50\%$ of completers achieve remission (ISI < 10)
- ✓ Sleep efficiency improvement ≥ 10 percentage points

Engagement:

- ✓ $\geq 50\%$ program completion rate
- ✓ $\geq 85\%$ daily diary adherence (among active users)
- ✓ Net Promoter Score (NPS) ≥ 40

Business:

- ✓ 5,000+ registered users
- ✓ User acquisition cost $< \$30$
- ✓ Revenue (if paid) covers operational costs

Secondary Success Metrics:

- User testimonials & case studies collected
 - Media coverage in health tech publications
 - Partnership interest from clinics/employers
 - Low support burden ($< 5\%$ users need help)
 - Technical reliability ($> 99.5\%$ uptime)
-

Red Flags & Pivot Indicators

When to Pause & Reassess:

- ✗ < 30% program completion rate after 3 months
→ Indicates fundamental engagement problem

- ✗ No measurable ISI improvement in completers
→ Indicates protocol implementation issues

- ✗ Average diary entry time > 3 minutes

→ UX is too complex, needs simplification

✗ High support ticket volume (> 20% of users)

→ Product is confusing or broken

✗ User acquisition cost > \$100 with no path to reduction

→ Business model not viable

Potential Pivots:

If engagement is low but those who engage see results:

→ Focus on onboarding optimization & motivation design

If engagement is high but clinical results are poor:

→ Review CBT-I protocol implementation, consult sleep experts

If B2C adoption is slow but clinical results strong:

→ Pivot to B2B (sell to employers, clinics, insurers)

If sleep restriction is too challenging for users:

→ Consider "gentler" variant or more support touchpoints

XVI. Final Implementation Priorities

Must-Have for MVP (Don't Launch Without)

1. Sleep diary with accurate SE calculation
2. SRT algorithm with weekly auto-adjustment
3. Stimulus control guidance & "Can't Sleep" helper
4. Safety screening (contraindications)
5. ISI assessment (baseline & follow-up)
6. Basic progress visualization (SE trend graph)
7. User authentication & data security
8. Mobile-responsive design
9. Week 0-2 psychoeducation content
10. Privacy policy & legal disclaimers

Should-Have for Launch

1. Cognitive restructuring workbench

2. Relaxation audio library (3 tracks minimum)
3. Full 6-week psychoeducation curriculum
4. Email/push notifications (diary reminders)
5. Weekly progress reports (automated)
6. Data export functionality
7. Comprehensive FAQ

Nice-to-Have (Post-Launch)

1. Wearable device integration
 2. Native mobile apps
 3. Social proof elements
 4. Advanced analytics dashboard
 5. A/B testing infrastructure
 6. Multi-language support
-

XVII. Conclusion & Next Steps

This blueprint provides a comprehensive technical specification for building a minimalist, clinically-focused digital CBT-I platform. The architecture prioritizes:

1. Clinical Fidelity: Implementing evidence-based SRT and SCT protocols with precision
2. User Experience: Designing for fatigued users who need simplicity above all
3. Therapeutic Feedback Loop: Creating a self-reinforcing system where data drives motivation
4. Privacy & Security: Building trust through transparent, robust data protection
5. Scalability: Architecting for growth while maintaining quality

Immediate Next Steps:

Week 1-2: Project Setup

- Assemble development team (2 full-stack developers, 1 designer, 1 PM)
- Set up repositories, project management tools
- Create development, staging, production environments
- Design system foundations & component library

Week 3-4: Core Infrastructure

- Database schema implementation
- API endpoint scaffolding
- Authentication system
- Admin dashboard basics

Week 5-8: MVP Feature Development

- Sleep diary interface (highest priority)
- SRT calculation engine
- User dashboard
- Onboarding flow

Week 9-12: Testing & Refinement

- Internal testing
- Beta user recruitment
- Bug fixes & optimization
- Content creation (videos, audio)

Week 13-16: Launch Preparation

- Security audit
- Performance optimization
- Legal review
- Marketing site & launch plan

Week 17: Soft Launch

- Limited user access
- Intensive monitoring
- Rapid iteration

Success depends on maintaining focus: This is not a wellness app. This is not a sleep tracker. This is a targeted therapeutic intervention delivered digitally. Every feature decision must serve the primary goal: helping people break the perpetuating factors of insomnia through behavior change, supported by data-driven feedback and cognitive reframing.

XVIII. Technical Documentation Requirements

A. Developer Documentation

To ensure maintainability and enable team onboarding, comprehensive technical documentation must be created alongside development.

API Documentation

Tool: Swagger/OpenAPI 3.0

Required for each endpoint:

- Endpoint path and HTTP method
- Authentication requirements
- Request parameters (path, query, body)
- Request/response schemas with examples

- Possible error responses
- Rate limiting information
- Versioning strategy

Example:

```
/*
 * @api {post} /api/diary/entries Create Sleep Diary Entry
 * @apiVersion 1.0.0
 * @apiName CreateDiaryEntry
 * @apiGroup SleepDiary
 *
 * @apiHeader {String} Authorization Bearer JWT token
 *
 * @apiParam {Date} entry_date Date of the sleep record
 * @apiParam {Time} time_got_in_bed Time user got into bed
 * @apiParam {Time} time_tried_to_sleep Time user attempted sleep
 * @apiParam {Integer} sleep_onset_latency_minutes Minutes to fall asleep
 * @apiParam {Integer} number_of_awakenings Number of night awakenings
 * @apiParam {Integer} total_time_awake_minutes Total awake time
 * @apiParam {Time} final_wake_time Final morning awakening
 * @apiParam {Time} time_got_out_of_bed Time user left bed
 * @apiParam {Integer{1-5}} sleep_quality_rating Subjective quality
 *
 * @apiSuccess {Object} entry Created diary entry with calculations
 * @apiSuccess {Number} entry.sleep_efficiency_percent Calculated SE
 * @apiSuccess {Number} entry.total_sleep_time_minutes Calculated TST
 *
 * @apiError (400) ValidationError Invalid input parameters
 * @apiError (401) Unauthorized Missing or invalid token
 * @apiError (409) DuplicateEntry Entry already exists for date
 */


```

Code Documentation Standards

```
// Function documentation
/**
```

```

* Calculates sleep window adjustment based on weekly average SE
*
* Implements the core SRT protocol adjustment algorithm following
* clinical guidelines from Spielman et al. (1987) and Morin (2003).
*
* @param {number} weeklyAvgSE - Average sleep efficiency for the week (0-100)
* @param {number} currentPTIB - Current prescribed time in bed (minutes)
* @returns {Object} Adjustment details
* @returns {number} returns.newPTIB - New prescribed time in bed
* @returns {string} returns.adjustmentReason - 'increase' | 'maintain' | 'decrease'
* @returns {string} returns.message - User-facing explanation
* @returns {boolean} returns.changed - Whether window changed
*
* @example
* const adjustment = calculateSleepWindowAdjustment(87, 420);
* // returns { newPTIB: 420, adjustmentReason: 'maintain', ... }
*/
function calculateSleepWindowAdjustment(weeklyAvgSE, currentPTIB) {
    // Implementation
}

```

Architecture Decision Records (ADRs)

ADR 001: Use PostgreSQL for Primary Database

Status

Accepted

Context

We need a reliable, scalable database for storing user health data including sleep diary entries, assessments, and progress tracking.

Decision

Use PostgreSQL as the primary database.

Consequences

Positive

- ACID compliance ensures data integrity for health records
- Strong support for complex queries (weekly aggregations)
- JSON/JSONB support for flexible fields (notifications, analytics)
- Excellent backup and replication tools
- Wide developer familiarity

Negative

- Slightly more complex setup than NoSQL alternatives
- Requires schema migrations for changes

Alternatives Considered

- MongoDB: Rejected due to need for ACID compliance
 - MySQL: Rejected due to inferior JSON support
-

B. Clinical Documentation

Clinical Protocol Implementation Guide

Sleep Restriction Therapy (SRT) Implementation

Clinical Foundation

Based on Spielman et al. (1987) and refined by Morin & Espie (2003).

Implementation Details

Initial Sleep Window Calculation

1. User completes 7-day baseline sleep diary
2. Calculate average Total Sleep Time (TST) across 7 nights
3. Initial PTIB = average TST (minimum 5.5 hours/330 minutes)

Safety Floor Rationale

The 5.5-hour minimum is based on:

- Excessive sleep restriction can impair daytime functioning
- Safety concerns for driving, work performance

- Balance between therapeutic effect and tolerability
- Clinical guidelines from AASM (Schutte-Rodin et al., 2008)

Weekly Adjustment Protocol

[Insert Table 1 from Section III.A]

Deviation from Traditional Protocol

Traditional face-to-face CBT-I may use 5-hour minimum or more aggressive restriction. This digital adaptation prioritizes safety in an unsupervised setting.

Clinical Validation

- Algorithm reviewed by [Name], PhD, licensed clinical psychologist
- Based on protocols from [specify research studies]
- Aligned with AASM clinical guidelines (2008)

Contraindications Documentation

Safety Screening Rationale

Contraindications to Unsupervised SRT

Absolute Contraindications

1. **Untreated Sleep Apnea**

- Rationale: SRT may worsen apnea symptoms
- Action: Refer to sleep medicine physician

2. **Seizure Disorders**

- Rationale: Sleep deprivation can lower seizure threshold
- Action: Require physician clearance

3. **Bipolar Disorder**

- Rationale: Sleep restriction may trigger manic episodes
- Action: Require psychiatrist supervision

4. **High-Risk Occupations** (commercial driver, pilot, etc.)

- Rationale: Initial sleepiness poses safety risk
- Action: Require physician clearance, timing coordination

Relative Contraindications (Require Caution)

- Pregnancy: Consult OB-GYN
- Severe depression: Consider supervised treatment
- Substance use disorders: May interfere with adherence

Screening Implementation

All users complete mandatory screening before program access.

Positive responses trigger educational message and referral resources, but do not hard-block access (user autonomy preserved).

C. User Support Documentation

FAQ Database

Frequently Asked Questions

Getting Started

Q: How long does the program take?

A: The core program is 6 weeks, with daily sleep diary entries (1 minute) and weekly schedule adjustments. Most users spend 10-15 minutes per week on educational content.

Q: Do I need any special equipment?

A: No. Just a smartphone or computer to access the platform. Wearable sleep trackers are optional but not required.

Q: Is this covered by insurance?

A: Currently, this is a direct-pay program. We're working on insurance partnerships. You may be able to submit for reimbursement using [provide codes if applicable].

During the Program

Q: I'm feeling very tired during the day. Is this normal?

A: Yes, increased daytime sleepiness is common in the first 1-2 weeks as your body adjusts to the new schedule. This typically improves by Week 3. However, if you're concerned about safety (driving, work), please contact your doctor.

Q: Can I take naps during the program?

A: We recommend avoiding naps to build sleep drive. If absolutely necessary, limit to <30 minutes before 3 PM.

Q: What if I miss a diary entry?

A: Complete it as soon as you remember. If you miss multiple days, just resume—the program adapts to your available data.

Q: My sleep got worse in Week 2. Should I quit?

A: No! This is actually common. Your sleep often dips slightly before improving as your body adjusts. Most users see significant gains by Weeks 3-4. Stick with it!

Technical Issues

Q: The app won't load my diary entry.

A: Try these steps:

- 1. Refresh your browser**
- 2. Clear cache and cookies**
- 3. Try a different browser**
- 4. Contact support: support@cbti-platform.com**

Q: Can I use the program on multiple devices?

A: Yes! Your data syncs across all devices when you log in.

Q: Is my data secure?

A: Yes. We use bank-level encryption and never sell your data.

See our Privacy Policy for details.

Support Ticket Response Templates

Support Response Templates

Template: Excessive Daytime Sleepiness Concern

Subject: Re: Feeling too tired during the day

Hi [Name],

Thank you for reaching out. Increased daytime sleepiness is a normal and expected part of Sleep Restriction Therapy, especially in the first 2 weeks. Your body is adjusting to a new schedule.

However, your safety is our top priority. If you're experiencing:

- Difficulty staying awake while driving
- Impaired performance at work
- Feeling unsafe in any situation

Please:

1. Pause the program temporarily
2. Consult with your doctor
3. Share these details: [program info sheet for physicians]

For most users, sleepiness improves significantly by Week 3 as your sleep becomes more consolidated.

Would you like to continue with support, or would you prefer to pause your program?

Best regards,

[Support Team]

Template: Technical Issue - Diary Won't Submit

Subject: Re: Can't submit my sleep diary

Hi [Name],

Sorry you're experiencing this issue! Let's troubleshoot:

1. What browser/device are you using?
2. Do you see any error messages?
3. Which step of the diary form causes the problem?

In the meantime, try:

- Using Chrome or Safari (most compatible)
- Clearing your browser cache
- Trying on a different device

Your data is auto-saved as you type, so you won't lose progress.

I'm here to help get this resolved quickly!

Best,

[Support Team]

XIX. Legal & Compliance Considerations

A. Terms of Service Key Clauses

Sample Key Terms (Consult Legal Counsel)

1. Nature of Service

This platform provides educational content and tools based on

Cognitive Behavioral Therapy for Insomnia (CBT-I) principles.

It is NOT medical advice, diagnosis, or treatment.

2. User Responsibilities

- Consult healthcare provider before starting if you have any medical conditions
- Follow safety recommendations
- Use the program as intended
- Maintain confidentiality of your account

3. Assumption of Risk

You acknowledge that:

- Sleep Restriction Therapy may cause temporary sleepiness
- You will not engage in dangerous activities if impaired
- You understand the contraindications
- You will seek medical care if problems arise

4. Data Usage

- We collect only necessary data for the program
- We use data to improve services (anonymized)
- We do not sell personal information
- You can export or delete your data anytime

5. Limitation of Liability

To the maximum extent permitted by law, we are not liable for:

- Any health outcomes or lack thereof
- Indirect, consequential, or punitive damages
- Use of the program contrary to guidelines

6. Modifications

We may update these terms with notice. Continued use constitutes acceptance of new terms.

7. Governing Law

[Specify jurisdiction]

8. Dispute Resolution

[Specify arbitration or court process]

B. Informed Consent Process

Pre-Program Consent Flow

Step 1: Safety Screening



Step 2: Review Contraindications (if applicable)



Step 3: Educational Video (2 min)

"What to Expect from Sleep Restriction"

- Temporary sleepiness
- Time commitment
- When to seek help



Step 4: Consent Checkboxes:

- I understand this is not medical treatment
- I have reviewed the contraindications
- I understand sleep restriction may cause sleepiness
- I will not engage in dangerous activities if impaired
- I will consult my doctor if I have concerns
- I have read the Privacy Policy and Terms of Service



Step 5: Electronic Signature

[Full Name] [Date]

[✓ I agree to the Terms of Service]



Step 6: Confirmation Email

- Copy of consent
- Link to terms
- Support contact

C. Privacy Policy Requirements

GDPR Compliance (if serving EU users)

Privacy Policy Key Sections

What Data We Collect

- Account information (email, name, timezone)
- Sleep diary entries (times, quality ratings)
- Assessment scores (ISI)
- Content engagement (modules viewed, tools used)
- Technical data (device type, browser, anonymized IP)

Legal Basis for Processing

- Contractual necessity (provide the service)
- Legitimate interest (improve the service)
- Consent (marketing communications)

Your Rights (GDPR)

- Right to access your data
- Right to correction
- Right to deletion ("right to be forgotten")
- Right to data portability
- Right to restrict processing
- Right to object
- Right to withdraw consent

Data Retention

- Active account: Data retained while account active
- Deleted account: Data deleted within 30 days
- Backups: Removed within 90 days
- Anonymized analytics: Retained indefinitely

International Transfers

[If applicable] Data may be processed in [countries].

We use Standard Contractual Clauses for EU data protection.

Contact

Data Protection Officer: privacy@cbti-platform.com

CCPA Compliance (California users)

California Privacy Rights

Categories of Personal Information Collected

- Identifiers (email)
- Internet activity (usage data)
- Sensitive personal information (health data - sleep information)

Purpose of Collection

- Provide the CBT-I program
- Improve user experience
- Send program-related communications

Your California Rights

- Right to know what personal information is collected
- Right to delete personal information
- Right to opt-out of sale (we do NOT sell data)
- Right to non-discrimination for exercising rights

How to Exercise Rights

Email: privacy@cbti-platform.com

Phone: [Number]

Response time: 45 days maximum

XX. Maintenance & Long-Term Operations

A. Ongoing Maintenance Schedule

Daily Tasks (Automated)

- Health checks (every 5 minutes)
- Database backups (incremental)
- Error log monitoring
- User support ticket triage
- Weekly report generation (for users completing Week 7)

Weekly Tasks

- Review user feedback/support tickets

- Analyze engagement metrics
- Check for security vulnerabilities
- Content updates (if needed)
- Marketing performance review

Monthly Tasks

- Database optimization (VACUUM, index maintenance)
- Security patches and updates
- Cost analysis (infrastructure, marketing)
- User cohort analysis (retention, completion)
- Product roadmap review
- Team retrospective

Quarterly Tasks

- Comprehensive security audit
- Accessibility audit
- Full backup restoration test
- Clinical outcomes analysis
- Competitive analysis
- Strategic planning session

Annual Tasks

- HIPAA-aligned compliance review (if applicable)
 - Privacy policy review with legal counsel
 - Infrastructure architecture review
 - Major version updates
 - User research study (interviews, surveys)
 - Clinical validation study (if resources allow)
-

B. Content Update Strategy

Psychoeducation Content Lifecycle

Review Cycle: Every 6 months

Criteria for Updates:

- New research published
- User feedback indicates confusion
- Engagement metrics show drop-off

- Video/audio quality improvements available

Process:

1. Content manager flags outdated material
2. Clinical advisor reviews new research
3. Updated script written
4. New video/audio produced
5. A/B test with subset of users
6. Full rollout if performance equal or better
7. Archive old version for legacy users

Audio Library Expansion

Year 1: 3 core tracks (breathing, PMR, imagery)

Year 2: Add 3 advanced tracks

- Body scan meditation
- Autogenic training
- Mindfulness for sleep

Year 3: Personalization

- Multiple voice options
 - Variable lengths (5 min, 10 min, 15 min)
 - User favorites and playlists
-

C. Technical Debt Management

Debt Prevention Strategies

- Code reviews required for all PRs
- 80% test coverage minimum
- Documentation updated with code changes
- Refactoring sprints (20% of development time)
- "Boy Scout Rule": Leave code better than you found it

Technical Debt Register

Track in project management tool:

High Priority Debt:

- Items affecting user experience

- Security vulnerabilities
- Performance bottlenecks
- Breaking changes in dependencies

Medium Priority:

- Code duplication
- Outdated libraries (non-breaking)
- Missing tests
- Poor documentation

Low Priority:

- Code style inconsistencies
 - Minor optimizations
 - Nice-to-have refactoring
-

XXI. Team Structure & Roles

A. Core Team (MVP Phase)

Product Manager (1)

- Product strategy and roadmap
- User research and feedback integration
- Feature prioritization
- Stakeholder communication

Full-Stack Developers (2)

- Frontend (React/TypeScript)
- Backend (Node.js/Express, PostgreSQL)
- API development
- DevOps/deployment

UI/UX Designer (1)

- User interface design
- User experience optimization
- Design system maintenance
- Usability testing

Clinical Advisor (Part-time consultant)

- Protocol validation
- Content review
- Safety considerations
- Research integration

Marketing/Growth (1)

- Go-to-market strategy
- User acquisition
- Content marketing
- Analytics

Customer Support (0.5 FTE initially)

- Ticket response
- User onboarding assistance
- FAQ maintenance
- Bug reporting

B. Extended Team (Scale Phase)

Add as needed:

- QA Engineer (dedicated testing)
- DevOps Engineer (infrastructure optimization)
- Content Creator (video/audio production)
- Data Analyst (advanced analytics)
- Mobile Developers (native apps)
- Sales (B2B partnerships)

XXII. Budget Considerations

A. Development Phase Budget Estimate

Personnel (4 months development):

- Product Manager: \$30,000
- Developers (2): \$80,000
- Designer: \$25,000
- Clinical Advisor: \$10,000

- Total Personnel: \$145,000

Infrastructure & Tools:

- Cloud hosting (dev/staging): \$500

- Development tools: \$2,000

- Design tools: \$1,000

- Total Tools: \$3,500

Content Creation:

- Educational videos (6): \$6,000

- Audio recordings (3): \$3,000

- Total Content: \$9,000

Legal & Compliance:

- Terms of service: \$2,000

- Privacy policy: \$2,000

- Security audit: \$5,000

- Total Legal: \$9,000

Contingency (20%): \$33,000

TOTAL DEVELOPMENT: ~\$200,000

B. Ongoing Operations Budget (Monthly)

Infrastructure:

- Cloud hosting (production): \$1,500

- CDN & bandwidth: \$500

- Backup & monitoring: \$300

- Total Infrastructure: \$2,300

Personnel:

- Product Manager (PT): \$6,000

- Developer (PT): \$8,000

- Support: \$3,000

- Total Personnel: \$17,000

Marketing & Acquisition:

- Paid advertising: \$5,000
- Content marketing: \$2,000
- Total Marketing: \$7,000

Miscellaneous:

- Software licenses: \$500
- Professional services: \$1,000
- Total Misc: \$1,500

TOTAL MONTHLY: ~\$28,000

ANNUAL OPERATIONS: ~\$335,000

C. Break-Even Analysis (If Paid Product)

Assumptions:

- Price: \$79 per user
- Conversion rate: 5% of website visitors
- Monthly traffic: 10,000 visitors
- Monthly paying users: 500
- Monthly revenue: \$39,500

Monthly costs: \$28,000

Monthly profit: \$11,500

Break-even: ~710 paying users per month

OR ~14,200 website visitors at 5% conversion

Time to break-even from launch: 2-3 months

XXIII. Risk Assessment & Mitigation

A. Risk Register

Technical Risks

Risk: Database Failure

- Probability: Low

- **Impact: Critical**
- **Mitigation:**
 - **Automated backups every 6 hours**
 - **Replica database for failover**
 - **Regular restoration testing**
 - **RTO: 4 hours, RPO: 1 hour**

Risk: Security Breach

- **Probability: Medium**
- **Impact: Critical**
- **Mitigation:**
 - **Penetration testing quarterly**
 - **Encrypted data at rest and in transit**
 - **Rate limiting and DDoS protection**
 - **Incident response plan documented**
 - **Cyber insurance (consider)**

Risk: Performance Degradation at Scale

- **Probability: Medium**
- **Impact: High**
- **Mitigation:**
 - **Load testing before launch**
 - **Auto-scaling configured**
 - **Database query optimization**
 - **CDN for static assets**
 - **Monitoring with alerts**

Clinical Risks

Risk: User Experiences Adverse Event

- **Probability: Low**
- **Impact: Critical**
- **Mitigation:**
 - **Comprehensive safety screening**
 - **Clear disclaimers and warnings**
 - **Prominent "when to seek help" guidance**
 - **Support contact readily available**

- Clinical advisor on retainer
- Professional liability insurance

Risk: Protocol Implementation Error

- Probability: Low
- Impact: High
- Mitigation:
 - Clinical advisor review of algorithm
 - Extensive testing with various scenarios
 - Comparison against published protocols
 - User testing with feedback
 - Regular audit of calculations

Business Risks

Risk: Low User Adoption

- Probability: Medium
- Impact: High
- Mitigation:
 - Pre-launch user research
 - Beta testing with target audience
 - Multiple acquisition channels
 - Referral incentives
 - Content marketing strategy

Risk: Poor Retention/Completion

- Probability: Medium
- Impact: High
- Mitigation:
 - Simplify UX ruthlessly
 - Engagement features (streaks, milestones)
 - Supportive messaging
 - Email nurture campaigns
 - User feedback loops

Risk: Negative Reviews/Press

- Probability: Low
- Impact: Medium

- **Mitigation:**
 - Proactive support
 - Clear expectation-setting
 - Request feedback before public review
 - Crisis communication plan
 - Build positive testimonials library
-

Legal/Regulatory Risks

Risk: Regulatory Classification as Medical Device

- **Probability:** Low
- **Impact:** Critical
- **Mitigation:**
 - Legal opinion obtained pre-launch
 - Position as "wellness/education tool"
 - Avoid diagnostic or treatment claims
 - Monitor FDA guidance on digital health
 - Pivot strategy if classification changes

Risk: Privacy Breach/GDPR Violation

- **Probability:** Low
 - **Impact:** Critical
 - **Mitigation:**
 - Privacy by design principles
 - Regular privacy audits
 - DPO designated (if GDPR applies)
 - Incident response plan
 - Privacy insurance consideration
-

XXIV. Conclusion & Executive Summary

The Opportunity

Insomnia affects 10-30% of adults globally, yet access to gold-standard CBT-I treatment is limited by:

- Shortage of trained therapists (estimated 10,000+ needed in US alone)
- High cost (\$500-2,000 for in-person treatment)
- Geographic barriers
- Stigma around seeking treatment

Digital CBT-I (dCBT-I) has demonstrated effectiveness equivalent to face-to-face therapy in multiple RCTs, with effect sizes of 0.8-1.2 for insomnia severity reduction.

Our Approach

This blueprint outlines a Minimal Viable Therapy platform that:

1. Focuses ruthlessly on the highest-impact components (SRT, SCT)
2. Prioritizes simplicity as a clinical necessity for fatigued users
3. Leverages automation to create a powerful feedback loop
4. Ensures safety through screening and clear guidelines
5. Builds trust through transparency and data protection

Key Differentiators

- Clinical-first design: Not a sleep tracker or wellness app, but a therapeutic intervention
- Algorithmic precision: Automated weekly adjustments ensure protocol fidelity
- Ultra-simplified UX: <60 second diary entry, mobile-first, minimal cognitive load
- Evidence-based: Every feature maps to established CBT-I research
- Privacy-focused: Minimal data collection, no selling of user data

Success Roadmap

Months 1-4: Development & Testing

- Build core MVP features
- Beta test with 100 users
- Iterate based on feedback

Months 5-6: Soft Launch

- Target 500 users
- Validate clinical effectiveness
- Optimize conversion funnel

Months 7-12: Scale

- Reach 5,000+ users
- Establish market presence
- Develop partnerships (employers, clinics)
- Plan Phase 2 enhancements

Year 2+: Expand

- Native mobile apps
- International markets
- Adjacent conditions
- Research partnerships

Investment Required

Development Phase: ~\$200,000 **Annual Operations:** ~\$335,000 **Break-even:** 2-3 months post-launch (at \$79/user, 500 monthly users)

Impact Potential

At scale (10,000 annual users):

- Lives improved: 5,000-7,000 achieving insomnia remission
 - Healthcare savings: \$10-20M (reduced physician visits, medications)
 - Accessibility: Treatment available 24/7, any location
 - Research contribution: Real-world effectiveness data
-

Final Recommendation

Proceed with development. The combination of:

- Strong clinical evidence for CBT-I effectiveness
- Proven viability of digital delivery
- Large underserved market
- Clear technical implementation path
- Manageable risk profile

...makes this a high-impact, achievable project.

Critical success factors:

1. Maintain unwavering focus on core therapeutic loop
2. Design for the tired, frustrated user (simplicity > features)
3. Ensure clinical safety through screening and support
4. Build trust through transparency and data protection
5. Measure and optimize for clinical outcomes, not vanity metrics

This platform has the potential to make evidence-based insomnia treatment accessible to millions who currently have no effective options.

Appendices

Appendix A: Research References

[List key CBT-I studies, guidelines, and digital health research]

Appendix B: Glossary of Terms

[Define clinical and technical terms used throughout]

Appendix C: Sample User Personas

[Detailed profiles of target users]

Appendix D: Competitive Analysis

[Analysis of existing dCBT-I platforms]

Appendix E: Sample Contracts

[Vendor agreements, clinical advisor contract templates]

END OF BLUEPRINT

Document Version: 1.0

Last Updated: [Date]

Next Review: [Date + 3 months]

Owner: [Product Manager Name]

Status: Ready for Implementation