



## Executive Summary

World Rugby have through many years of research formed a new legal entity to build, own and manage a Health Platform used for “past”, “present” and “future” players worldwide of Rugby with the goal to improve Player Welfare over participants’ lifetimes. Over the years, academic research has shown that there may be a connection between CTE (Chronic Traumatic Encephalopathy) and concussion

## Customer Challenges

Due to the risks ongoing concussion can pose, including CTE, the goal of the Brain Health Platform is to identify medium to high-risk participants using assessments to enable early and better treatment of cognitive decline.

“Virtual Brain Health Clinics” have been identified as scalable and will “establish a uniform integrated world-wide process that will support Brain Health in participants and underpin global research.”

## Governance

World Rugby Institutional Ethics and Science Committee provides ethical oversight of research being understand by and on behalf of World Rugby.

## High Compliance

The dataset must comply with associated EU standards, including GDPR, housing of Medical and Personal PII data, and data protection standards.

The application must comply with or match HIPAA security standards and GDPR, including MFA. Data for research will be housed separately in a data lake with the appropriate new anonymization method. This method was approved by the Data Protection Officer (DPO).

Legal requirements as a data processor require compliance on both sides. This includes the additional undertaking of insurance positions held by the vendor.

## Cloud Delivery

World Rugby uses AWS Ireland for all medical and statistic-related applications. Koan built the concussion management ecosystem SCRM and is the development and AWS partner for World Rugby.

## Brain Health Service



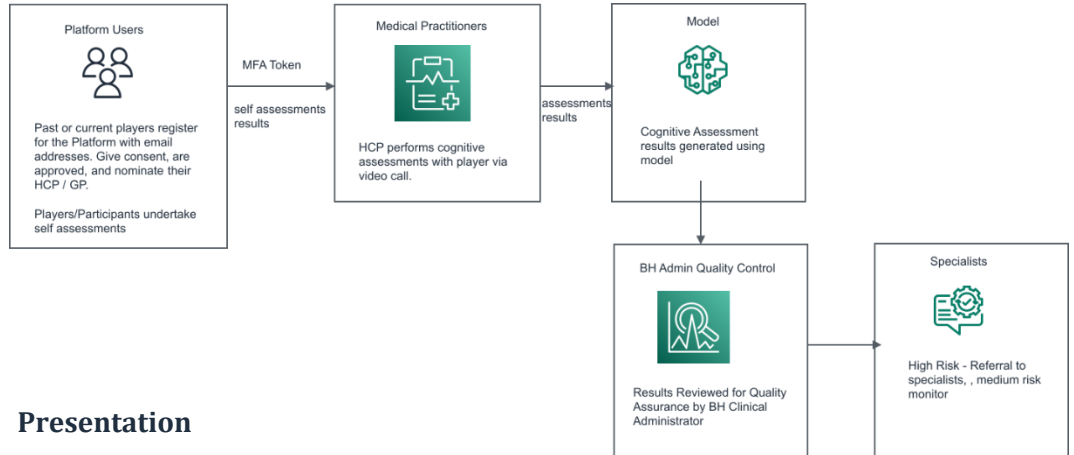
**The Brain Health Service is a wholly owned subsidiary of World Rugby, setup to manage the global delivery of the Brain Health Platform to “past”, “present” and “future” players of rugby.**

**The goal of the organization is to increase Player Welfare. Once successful other sports will be approached.**

## Scientific Research

The Brain Health Platform manages risks associated with neurological functions. The Platform identifies issues associated with concussions during a player's lifetime, associated with neurological functions. The platform contains algorithms which identify cognitive functions using "neuropsychology" assessments driven by 10 years of academic and data analysis, and consultation with experts, doctors and health care professionals.

## Workflow



## Presentation

These investigations will support assessment of modifiable risk factors and support specific recommendations that target improvement in brain health for the participant.

**WORLD RUGBY** Brain Health Service koandev English Deirdre Keating

Home / Assessment / Self assessment

### Sport participation

School age sport

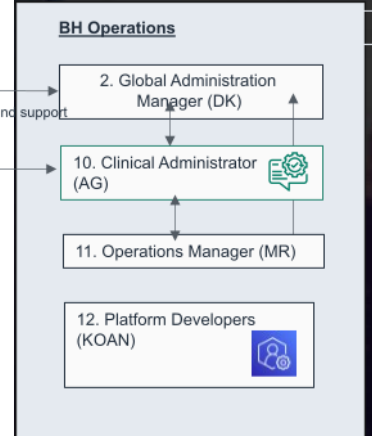
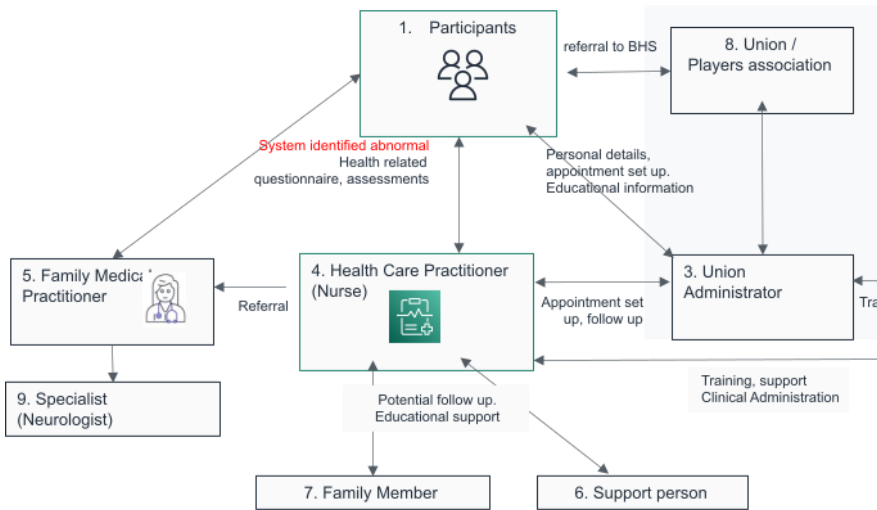
What sport did you play most at school? Basketball	How old were you when you started this sport? <input checked="" type="radio"/> <= 5 years old <input type="radio"/> 6-10 years old <input type="radio"/> 11-15 years old <input type="radio"/> > 15 years old	How many years did you play this sport while at school? <input type="radio"/> <= 5 years <input checked="" type="radio"/> 6-10 years <input type="radio"/> 11-15 years <input type="radio"/> 16-20 years <input type="radio"/> > 20 years	What was your number 2 sport at school? Athletics	How old were you when you started this sport? <input type="radio"/> <= 5 years old <input type="radio"/> 6-10 years old <input checked="" type="radio"/> 11-15 years old <input type="radio"/> > 15 years old	How many years did you play this sport while at school? <input type="radio"/> <= 5 years <input checked="" type="radio"/> 6-10 years <input type="radio"/> 11-15 years <input type="radio"/> 16-20 years <input type="radio"/> > 20 years
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General

What is your current level of sports participation? <input type="radio"/> Current professional or elite player (athlete) <input type="radio"/> Current non-professional recreational player (athlete) <input checked="" type="radio"/> Retired professional or elite player (athlete) <input type="radio"/> Retired non-professional recreational player (athlete) <input type="radio"/> No significant past sports history	What age did you start playing contact sport? <input type="radio"/> Never played contact sport <input checked="" type="radio"/> <= 5 years old <input type="radio"/> 6-10 years old <input type="radio"/> 11-15 years old <input type="radio"/> 16-20 years old <input type="radio"/> > 20 years old	How many years of contact sport have you played? <input type="radio"/> None <input type="radio"/> <= 5 years <input type="radio"/> 6-10 years <input checked="" type="radio"/> 11-15 years <input type="radio"/> 16-20 years <input type="radio"/> > 20 years	How often do you exercise each week? <input type="radio"/> < 1 hour / week <input checked="" type="radio"/> 1-3 hours / week <input type="radio"/> 3-5 hours / week <input type="radio"/> > 5 hours / week
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Professional / Elite amateur sport

## Interactions with Medical Practitioners



## Medical Professionals

The BH Platform supports many user roles, including participant, administrator, nurse, doctor (GP), and specialist. There is a process for managing medical records, assessment outcomes, and referrals between the roles. This enables the relevant medical practitioner to access the participant's case history and determine available actions.

## Digital Medical Records

The platform facilitates the management of medical records, assessment outcomes, and referrals between medical professionals.

This allows the relevant medical practitioner to access the participant's case history and determine the necessary next steps. Notifications are sent to assist in completing these workflows, ensuring efficient and effective healthcare management.

## Cognitive Models

The assessments include a wide range of current neurological examinations, (e.g. BC-PCI, IQ Code, Conor Davidson, Verbal Fluency, Normative Values), and a wide-ranging set of evaluations delivered in the virtual clinic.

The model collates all results to form an overall risk rating across all assessments. The Cognitive model determines the risk of cognitive impairment (low, medium, or high), high risk cases, cases with comorbidities requiring action; and recommended follow-up investigations for the Family General Practitioner.

## GDPR and HIPAA Compliance

Koan wrote the initial Data Protection Impact Assessment (DPIA) and worked through the process with World Rugby's Data Protection Officer (DPO). The service-based and data lake approach has passed a security audit working with Security Advisors.

## Platform Delivery

The platform has a public facing landing zone with a login form and a registration form. Rich content like video and basic educational material, downloadable handouts, description of the process. Global languages are support to enable effective communication

The platform has an Administration Portal front end built in Vue.js, Node.js Serverless API Backend, BH Database, and Datalike deployed into AWS Ireland accounts using "repeatable deployment mechanisms" Terraform and GitHub Actions CI/CD.

## Technical Outcomes

The application's administration front end and serverless API are built on [modern frameworks](#), RDS, and anonymized research datasets. The technical solution uses Multi-Factor Authentication (MFA) with Authorisation and user one-time codes using AWS Cognito and JWT.

The API is built on Lambda using NodeJS frameworks [Fastify](#) (OpenAPI, Zod, CORS) and Knex for data access. API Gateway is optimized for speed, and minimal latency, with compressed payloads The API [auto-generates the OpenAPI](#) spec by parsing annotations in source code and rendering docs. Redis is used for key-value caching and pub/sub for notification events (email and SMS).

The front end is built with Vue (Vue, Vite, Vuetify, and Cypress), and a built-in CMS is included to enable multilingual global users. Automated test coverage for the API and front end is high.

Terraform deployment for all infrastructure and GitHub actions to deploy code into lambdas.

## About Koan

Koan is a global cloud and software development consultancy based in Wellington, New Zealand. Koan has been building and deploying secure, compliant, enterprise applications for Global customers for 20 years. Koan is an AWS Advanced Tier Partner providing AWS Certified resources for DevSecOps AWS Migrations, Modernizations, Data Analytics.

