

Supplement 5

Title: Factors influencing consultant knee surgeons' decision making in anterior cruciate ligament (ACL) injury management in athletes: an international Delphi study

Short title: Decision making among expert surgeons in ACL management: A Delphi Study

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R Code for Data Visualisation

Figure 1

```
library(tidyverse)

# Manually entered summary statistics
summary_df <- tribble(
  ~Question, ~Round, ~Median, ~IQR,
  "Q1", "R2", 4, 2,
  "Q1", "R3", 4, 3,
  "Q2", "R2", 4, 2,
  "Q2", "R3", 5, 1,
  "Q3", "R2", 2, 1,
  "Q3", "R3", 2, 1,
  "Q4", "R2", 3, 1,
  "Q4", "R3", 3, 1,
  "Q5", "R2", 1, 0,
  "Q5", "R3", 1, 0,
  "Q6", "R2", 2, 1,
  "Q6", "R3", 2, 0,
  "Q7", "R2", 2, 0,
  "Q7", "R3", 2, 0,
  "Q8", "R2", 4, 2,
  "Q8", "R3", 4, 1,
  "Q9", "R2", 4, 1,
  "Q9", "R3", 4, 0,
  "Q10", "R2", 3, 1,
  "Q10", "R3", 3, 1,
  "Q11", "R2", 3, 1,
  "Q11", "R3", 3, 1,
  "Q13", "R2", 2, 2,
  "Q13", "R3", 3, 2,
  "Q14", "R2", 3, 2,
  "Q14", "R3", 3, 2,
  "Q15", "R2", 3, 1,
  "Q15", "R3", 3, 1,
  "Q16", "R2", 5, 1,
  "Q16", "R3", 5, 1,
  "Q17", "R2", 5, 1,
  "Q17", "R3", 5, 0,
  "Q18", "R2", 3, 3,
  "Q18", "R3", 2, 2,
  "Q19", "R2", 1, 1,
  "Q19", "R3", 1, 0,
  "Q20", "R2", 5, 2,
  "Q20", "R3", 5, 1
) %>%
mutate(
  Q1 = pmax(1, Median - IQR / 2),
  Q3 = pmin(5, Median + IQR / 2)
)
```

```

# Add question text labels
question_labels <- c(
  "Q1" = "Q1 - That rehabilitation-only is a viable option for managing ACL injuries in an elite athlete?",
  "Q2" = "Q2 - That rehabilitation-only is a viable option for ACL injuries returning to cutting, twisting or pivoting sports (football, basketball, tennis, badminton etc)?",
  "Q3" = "Q3 - That a rehabilitation approach carries a greater risk of re-injury on return to play when compared with surgical management?",
  "Q4" = "Q4 - That surgery will be required eventually in athletes who have returned to competition following rehabilitation-only?",
  "Q5" = "Q5 - That the patient should have an active role in the decision-making process for management of their ACL injury?",
  "Q6" = "Q6 - That your decision for surgery may change if a period of successful rehabilitation is completed whilst the patient is on the waiting list?",
  "Q7" = "Q7 - That a more definitive return to play timeline is important when considering your choice of management and the overall impact on an athlete's career?",
  "Q8" = "Q8 - That the financial influence of the club/organisation/NGB is considered in your choice of management?",
  "Q9" = "Q9 - That a surgical approach would always be your first-choice management if there were no waiting times?",
  "Q10" = "Q10 - That the development of secondary complications (such as osteoarthritis) is impacted by a rehabilitation only approach?",
  "Q11" = "Q11 - That the development of secondary complications (such as osteoarthritis) is impacted by a surgical only approach?",
  "Q13" = "Q13 - That you would feel confident in referring a patient for a rehabilitation only approach?",
  "Q14" = "Q14 - That autologous BTB grafts are preferential in elite athletes?",
  "Q15" = "Q15 - That autologous hamstring grafts are preferential in elite athletes?",
  "Q16" = "Q16 - That allografts are preferential in elite athletes?",
  "Q17" = "Q17 - That synthetic grafts are preferential in elite athletes?",
  "Q18" = "Q18 - That a lateral extra-articular procedure should be included when operating on elite athletes?",
  "Q19" = "Q19 - That your lateral extra-articular procedure of choice would be a lateral extra-articular tenodesis?",
  "Q20" = "Q20 - That your lateral extra-articular procedure of choice would be an anterolateral ligament reconstruction?"
)

summary_df <- summary_df %>%
  mutate(
    QuestionText = factor(question_labels[Question], levels = rev(question_labels)),
    Round = factor(Round, levels = c("R2", "R3"))
  )

# Plot
ggplot(summary_df) +
  geom_errorbarh(
    aes(y = QuestionText, xmin = Q1, xmax = Q3, colour = Round),
    height = 0.3, size = 1, position = position_dodge(width = 0.6)
  ) +
  geom_point(
    aes(x = Median, y = QuestionText, colour = Round),
    position = position_dodge(width = 0.6),
    size = 6, shape = 18
  )

```

```

) +
scale_x_continuous(
  breaks = 1:5,
  limits = c(0.5, 5.5),
  labels = c("Strongly agree", "Agree", "Neither", "Disagree", "Strongly disagree")
) +
scale_colour_manual(values = c("R2" = "blue", "R3" = "purple"), name = "Round") +
labs(x = "Response", y = NULL, title = "") +
theme_minimal(base_family = "Times New Roman") +
theme(
  legend.position = "top",
  axis.text.y = element_text(size = 13),
  axis.text.x = element_text(size = 13),
  panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(),
  axis.ticks = element_line(color = "black"),
  axis.line = element_line(color = "black")
)

ggsave("/Users/nickdobbin/Desktop/LikertPlot.tiff", dpi = 300, width = 18, height = 10.27, units =
"in")

```

Figure 2

```

library(ggplot2)
library(tidyverse)
library(scales)
library(RColorBrewer)

# Define full question labels (same as you have)
question_labels <- c(
  "Q1" = "Q1 - That rehabilitation-only is a viable option for managing ACL injuries in an elite athlete?",
  "Q2" = "Q2 - That rehabilitation-only is a viable option for ACL injuries returning to cutting, twisting or pivoting sports (football, basketball, tennis, badminton etc)?",
  "Q3" = "Q3 - That a rehabilitation approach carries a greater risk of re-injury on return to play when compared with surgical management?",
  "Q4" = "Q4 - That surgery will be required eventually in athletes who have returned to competition following rehabilitation-only?",
  "Q5" = "Q5 - That the patient should have an active role in the decision-making process for management of their ACL injury?",
  "Q6" = "Q6 - That your decision for surgery may change if a period of successful rehabilitation is completed whilst the patient is on the waiting list?",
  "Q7" = "Q7 - That a more definitive return to play timeline is important when considering your choice of management and the overall impact on an athlete's career?",
  "Q8" = "Q8 - That the financial influence of the club/organisation/NGB is considered in your choice of management?",
  "Q9" = "Q9 - That a surgical approach would always be your first-choice management if there were no waiting times?",
  "Q10" = "Q10 - That the development of secondary complications (such as osteoarthritis) is impacted by a rehabilitation only approach?",
  "Q11" = "Q11 - That the development of secondary complications (such as osteoarthritis) is impacted by a surgical only approach?",

```

"Q13" = "Q13 - That you would feel confident in referring a patient for a rehabilitation only approach?",
 "Q14" = "Q14 - That autologous BTB grafts are preferential in elite athletes?",
 "Q15" = "Q15 - That autologous hamstring grafts are preferential in elite athletes?",
 "Q16" = "Q16 - That allografts are preferential in elite athletes?",
 "Q17" = "Q17 - That synthetic grafts are preferential in elite athletes?",
 "Q18" = "Q18 - That a lateral extra-articular procedure should be included when operating on elite athletes?",
 "Q19" = "Q19 - That your lateral extra-articular procedure of choice would be a lateral extra-articular tenodesis?",
 "Q20" = "Q20 - That your lateral extra-articular procedure of choice would be an anterolateral ligament reconstruction?"
)

Input data (same as yours)

```
df <- tribble(
  ~Question, ~Round, ~Disagree, ~Agree, ~Overall,
  "Q1", "R2", 68, 23, 35,
  "Q1", "R3", 68, 32, 35,
  "Q2", "R2", 68, 18, 35,
  "Q2", "R3", 77, 23, 52,
  "Q3", "R2", 5, 86, 48,
  "Q3", "R3", 0, 100, 61,
  "Q4", "R2", 23, 41, 35,
  "Q4", "R3", 18, 36, 43,
  "Q5", "R2", 0, 100, 83,
  "Q5", "R3", 0, 100, 91,
  "Q6", "R2", 5, 73, 48,
  "Q6", "R3", 9, 86, 74,
  "Q7", "R2", 0, 86, 65,
  "Q7", "R3", 0, 95, 83,
  "Q8", "R2", 73, 14, 43,
  "Q8", "R3", 91, 9, 61,
  "Q9", "R2", 50, 23, 39,
  "Q9", "R3", 82, 14, 74,
  "Q10", "R2", 23, 36, 39,
  "Q10", "R3", 23, 32, 43,
  "Q11", "R2", 32, 23, 43,
  "Q11", "R3", 14, 27, 57,
  "Q13", "R2", 32, 55, 43,
  "Q13", "R3", 27, 50, 43,
  "Q14", "R2", 32, 45, 35,
  "Q14", "R3", 36, 45, 39,
  "Q15", "R2", 36, 14, 48,
  "Q15", "R3", 45, 9, 43,
  "Q16", "R2", 91, 5, 61,
  "Q16", "R3", 95, 5, 70,
  "Q17", "R2", 100, 0, 70,
  "Q17", "R3", 100, 0, 83,
  "Q18", "R2", 32, 50, 26,
  "Q18", "R3", 18, 64, 39,
  "Q19", "R2", 0, 59, 35,
  "Q19", "R3", 0, 73, 57,
  "Q20", "R2", 50, 9, 39,
  "Q20", "R3", 64, 4, 4
```

```

)

# Pivot longer and create factor with full question text ordered by Q1 to Q20
df_long <- df %>%
  pivot_longer(cols = c(Disagree, Agree, Overall),
    names_to = "Type",
    values_to = "Percentage") %>%
  mutate(
    QuestionText = question_labels[Question],
    QuestionText = str_wrap(QuestionText, width = 75)
  ) %>%
  # Set levels in the order of question_labels (Q1 to Q20)
  mutate(
    QuestionText = factor(QuestionText, levels = str_wrap(question_labels[names(question_labels)],
width = 75))
  ) %>%
  mutate(
    Type = factor(Type,
      levels = c("Disagree", "Agree", "Overall"),
      labels = c("Strongly Disagree or Disagree",
        "Strongly Agree or Agree",
        "Overall Score"))
  )

# Plot using QuestionText as y-axis, reversed for top-down order
ggplot(df_long, aes(x = Round, y = fct_rev(QuestionText), fill = Percentage)) +
  geom_tile(color = "grey90") +
  facet_wrap(~Type, nrow = 1) +
  scale_fill_gradientn(
    colours = c(
      "#FFB3BA", "#FFD1A9", "#FFFFBA",
      "#B6FFB3", "#BAE1FF", "#D5BAFF", "#E8BAFF"
    ),
    limits = c(0, 100),
    name = "Percentage"
  ) +
  theme_classic() +
  theme(
    text = element_text(family = "Times New Roman", size = 11),
    strip.text = element_text(size = 11),
    strip.background = element_blank(),
    axis.text.x = element_text(angle = 0, hjust = 0.5),
    axis.text.y = element_text(size = 11),
    plot.title = element_text(face = "bold", hjust = 0.4),
    legend.position = "right",
    plot.margin = margin(10, 10, 10, 10)
  ) +
  labs(
    title = "",
    y = "Question"
  )

ggsave(filename = "~/Desktop/ACL_Agreement_Plot.tiff",
  dpi = 300,
  width = 12, # extra wide for big margin

```

```
height = 9,  
units = "in",  
device = "tiff")
```