|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Table 1: Demographic data** | | | | | |
|  | | **Overall** | **Females** | **Males** | **Other** |  |
| **n (%)** | **n (%)** | **n (%)** |  | **P-value** |
| **Sex at birth** | | **236 (100)** | 113 (47.9) | 123 (52.1) |  | 0.515 |
| **Gender** | | **236 (100)** | 112 (47.5) | 123 (52.1) | 1 (0.4%) | < 0.001 f |
| **Age** | |  |  |  |  | 0.058 f |
| <30 | | **18 (7.6)** | 10 (8.8) | 8 (6.5) |  |  |
| 30-34 | | **183 (77.5)** | 93 (82.3) | 90 (73.2) |  |  |
| 35-40 | | **34 (14.4)** | 10 (8.8) | 24 (19.5) |  |  |
| >40 | | **1 (0.4)** | 0 (0) | 1 (0.08) |  |  |
| **Race/Ethnicity** | |  |  |  |  | 0.009 |
| East Asian | | **37 (15.7)** | 24 (21.2) | 13 (10.6) |  |  |
| South Asian | | **56 (23.7)** | 33 (29.2) | 23 (18.7) |  |  |
| Black/African American | | **11 (4.7)** | 5 (4.4) | 6 (4.9) |  |  |
| Hispanic | | **15 (6.4)** | 9 (8.0) | 6 (4.9) |  |  |
| White/Caucasian | | **104 (44.1)** | 36 (31.9) | 68 (55.3) |  |  |
| Other | | **13 (5.5)** | 6 (5.3) | 6 (5.7) |  |  |
| **Training Level** | |  |  |  |  | 0.045 |
| First year fellow | | **79 (33.6)** | 43 (38.1) | 36 (29.5) |  |  |
| Second year fellow | | **77 (32.8)** | 41 (36.3) | 36 (29.5) |  |  |
| Advanced fellow | | **14 (6.0)** | 29 (25.7) | 50 (41.0) |  |  |
| **Height** | |  |  |  |  | 0.001 f |
| <5' | | **1 (0.5)** | 2 (0.02) | 0 (0) |  |  |
| 5'-5'3 | | **40 (17.6)** | 38 (33.9) | 2 (1.6) |  |  |
| 5'4-5'6 | | **56 (24.6)** | 46 (41.1) | 10 (8.1) |  |  |
| 5'7-5'9 | | **66 (28.6)** | 25 (22.3) | 41 (33.3) |  |  |
| 5'10-6' | | **46 (17.6)** | 1 (0.9) | 44 (35.8) |  |  |
| 6'1-6'4 | | **24 (10.6)** | 0 (0) | 24 (19.5) |  |  |
| >6'4 | | **2 (0.5)** | 0 (0) | 2 (1.06) |  |  |
| **Glove size** | |  |  |  |  | 0.001 f |
| 5 | | **1 (0.9)** | 2 (1.8) | 0 (0) |  |  |
| 5.5 | | **7 (3.0)** | 7 (6.4) | 0 (0) |  |  |
| 6 | | **29 (12.6)** | 29 (26.4) | 0 (0) |  |  |
| 6.5 | | **61 (26.4)** | 55 (50.0) | 6 (5.0) |  |  |
| 7 | | **51 (22.1)** | 15 (29.4) | 36 (29.8) |  |  |
| 7.5 | | **62 (26.8)** | 2 (3.2) | 60 (49.6) |  |  |
| 8 | | **16 (6.9)** | 0 (0) | 16 (13.2) |  |  |
| 8.5 | | **3 (1.3)** | 0 (0) | 3 (2.5) |  |  |
| **Average endoscopy time weekly (hours)** | |  |  |  |  | 0.694 f |
| <10 | | **56 (23.8)** | 26 (23.2) | 30 (24.4) |  |  |
| 10-20 | | **110 (46.8)** | 55 (49.1) | 55 (44.7) |  |  |
| 21-30 | | **49 (20.9)** | 20 (17.9) | 29 (23.6) |  |  |
| 31-40 | | **13 (5.5)** | 8 (7.1) | 5 (4.1) |  |  |
| >40 | | **7 (3.0)** | 3 (2.7) | 4 (3.3) |  |  |
| **Preference for same gender teacher** | |  |  |  |  | 0.001 f |
| Yes | | **14 (5.9)** | 13 (11.5) | 1 (0.8) |  |  |
| No | | **222 (94.1)** | 100 (88.5) | 122 (99.2) |  |  |
| **Number of female endoscopy teachers** | |  |  |  |  | 0.397 f |
| None | | **4 (1.7)** | 2 (1.8) | 2 (1.6) |  |  |
| 1-2 | | **22 (9.3)** | 10 (8.8) | 12 (9.8) |  |  |
| 3-5 | | **90 (38.1)** | 49 (43.4) | 41 (33.3) |  |  |
| 6-10 | | **88 (37.3)** | 41 (36.3) | 47 (38.2) |  |  |
| >10 | | **32 (13.6)** | 11 (9.7) | 21 (17.1) |  |  |
| **Number of male endoscopy teachers** | |  |  |  |  | 0.640 f |
| None | | **0 (0)** | 0 (0) | 0 (0) |  |  |
| 1-2 | | **2 (0.9)** | 0 (0) | 2 (1.6) |  |  |
| 3-5 | | **19 (8.1)** | 8 (7.1) | 11 (9.0) |  |  |
| 6-10 | | **111 (47.2)** | 53 (46.9) | 58(47.5) |  |  |
| >10 | | **103 (43.8)** | 52 (46.0) | 51 (41.8) |  |  |
| **Sustained endoscopy-related injury?** | |  |  |  |  | 1.00 |
| Yes | | **32 (13.6)** | 15 (13.4) | 17 (13.8) |  |  |
| No | | **203 (86.4)** | 97 (86.6) | 106 (86.2) |  |  |
| **Transient pain immediately after session** | |  |  |  |  |  |
| No | | **21 (8.9)** | 8 (8.0) | 13 (10.6) |  | 0.643 |
| Yes, hand pain | | **186 (78.9)** | 93 (82.3) | 93 (75.6) |  | 0.273 |
| Neck/shoulder pain | | **96 (40.7)** | 62 (54.9) | 34 (27.6) |  | 0.001 |
| Back pain | | **90 (38.1)** | 46 (40.7) | 44 (35.8) |  | 0.518 |
| Leg pain | | **33 (14.0)** | 17 (15.0) | 16 (13.) |  | 0.793 |
| Foot pain | | **36 (15.3)** | 23 (20.4) | 13 (10.6) |  | 0.056 |
| **With pain, told just growing pains?**  (NA’s excluded) | |  |  |  |  | 0.264 |
| Yes | | **93 (42.9)** | 50 (47.2) | 43 (38.7) |  |  |
| No | | **124 (57.1)** | 56 (52.8) | 68 (61.3) |  |  |
| **Ergonomically difficult during pregnancy** (Pregnant Women only) | |  |  |  |  |  |
| Yes | | **14 (60.9)** | 14 (60.9) | 0 (0) |  |  |
| No | | **9 (39.1)** | 9 (39.1) | 0 (0) |  |  |
| **Ergonomic related injury during pregnancy** | |  |  |  |  |  |
| Yes | | **1 (4.5)** | 1 (4.5) | 0 (0) |  |  |
| No | | **21 (95.5)** | 21 (15.5) | 0 (0) |  |  |
|  | |  |  |  |  |  |
|  | |  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 2: Endoscopic suite environment** | | | | |
|  | **Overall** | **Females** | **Males** |  |
| **n (%)** | **n (%)** | **n (%)** | **P-value** |
| **Formal endoscopic ergonomic training** |  |  |  | 0.615 |
| Yes | **99 (41.9)** | 45 (39.8) | 54 (43.9) |  |
| No | **137 (58.1)** | 68 (60.2) | 69 (56.1) |  |
| **Informal endoscopic ergonomic training** |  |  |  | 1.00 |
| Yes | **209 (88.6)** | 100 (88.5) | 109 (88.6) |  |
| No | **27 (11.4)** | 13 (11.5) | 14 (11.4) |  |
| **Techniques discussed during training (Yes responses)** |  |  |  |  |
| Posture awareness | **206 (87.3)** | 95 (84.1) | 111 (90.2) | 0.220 |
| Adjustment of bed height | **230 (97.4)** | 110 (97.3) | 120 (97.6) | 1.00 f |
| Adjustment of bed angle/position in room | **164 (69.5)** | 74 (65.5) | 90 (73.2) | 0.255 |
| Adjustment of monitor height | **198 (83.9)** | 94 (83.2) | 104 (84.5) | 0.914 |
| Special maneuvers to reduce injuries | **119 (50.4)** | 62 (54.9) | 57 (46.3) | 0.239 |
| Building strength through exercise | **50 (21.2)** | 26 (23.0) | 24 (19.5) | 0.619 |
| Use of dial extenders | **60 (25.4)** | 32 (28.3) | 27 (21.9) | 0.328 |
| Use of pediatric colonoscope | **120 (50.8)** | 62 (54.9) | 58 (47.1) | 0.292 |
| **Budget allotment for ergonomic training/tools** |  |  |  | 0.486 f |
| Yes | **2 (0.8)** | 2 (2.0) | 0 (0) |  |
| No | **64 (27.1)** | 30 (26.5) | 34 (27.6) |  |
| I don't know | **170 (72.0)** | 81 (71.7) | 89 (72.4) |  |
| **Ergonomic feedback frequency from endoscopy teachers** |  |  |  | 0.547 f |
| Never | **6 (2.5)** | 2 (1.8) | 4 (3.3) |  |
| Rarely | **83 (35.2)** | 37 (32.7) | 46 (37.4) |  |
| Sometimes | **118 (50.0)** | 57 (50.4) | 61 (49.6) |  |
| Often | **29 (12.3)** | 17 (15.0) | 122 (9.8) |  |
| **Who is providing ergonomic feedback?** |  |  |  | 0.568 |
| Do not/rarely receive feedback | **37 (15.7)** | 15 (13.3) | 22 (17.9) |  |
| Mostly male teachers | **39 (16.5)** | 17 (15.0) | 22 (17.9) |  |
| Mostly female teachers | **36 (15.3)** | 20 (17.7) | 16 (13.0) |  |
| Both male and female equally | **124 (52.5)** | 61 (54.0) | 63 (51.2) |  |
| **Equipment ergonomically optimized for you?** |  |  |  | 0.002 |
| Yes | **71 (30.1)** | 24 (21.2) | 47 (38.2) |  |
| No | **86 (36.4)** | 53 (46.9) | 33 (26.8) |  |
| I don't know | **79 (33.5)** | 36 (31.9) | 43 (35.0) |  |
| **Gloze size available** |  |  |  | 0.001 f |
| Yes | **217 (91.9)** | 97 (85.8) | 120 (97.6) |  |
| No | **19 (8.1)** | 16 (14.2) | 3 (2.4) |  |
| **Dial extenders available** |  |  |  | 0.001 |
| Yes | **37 (18.5)** | 25 (22.1) | 18 (4.6) |  |
| No | **68 (34.0)** | 47 (41.6) | 28 (22.8) |  |
| I don't know | **95 (47.5)** | 41 (36.3) | 77 (62.6) |  |
| **Encouraged to use dial extenders** |  |  |  | 0.778 f |
| Yes | **20 (28.2)** | 15 (29.4) | 5 (25.0) |  |
| No | **51 (71.8)** | 36 (70.6) | 15 (75.0) |  |
| ~~I do not use dial extenders~~ | **~~135 (67.8)~~** | ~~53 (39.3)~~ | ~~82 (60.7)~~ | ~~<0.0001~~ |
| **Likely to use dial extender with female trainer** |  |  |  | 0.261 f |
| Not likely | **19 (51.4)** | 13 (44.8) | 6 (75.0) |  |
| Somewhat likely | **12 (32.4)** | 10 (34.5) | 2 (25.0) |  |
| Very likely | **6 (16.2)** | 6 (20.7) | 0 (0) |  |
| **Likely to use dial extender with male trainer** |  |  |  | 0.397 f |
| Not likely | **24 (64.9)** | 17( 58.6) | 7 (87.5) |  |
| Somewhat likely | **9 (24.3)** | 8 (27.6) | 1 (12.5) |  |
| Very likely | **4 (10.8)** | 4 (13.8) | 0 (0) |  |
| **Pediatric colonoscope available** |  |  |  | 0.162 f |
| Yes | **229 (97.4)** | 107 (95.5) | 122 (99.2) |  |
| No | **2 (0.9)** | 2 (1.8) | 0 (0) |  |
| I don’t know | **4 (1.7)** | 3 (2.7) | 1 (0.8) |  |
| **Well-fitting lead aprons available** |  |  |  | 0.001 |
| Yes | 133 (56.4) | 48 (42.5) | 85 (69.1) |  |
| No | 39 (16.5) | 26 (23.0) | 13 (10.6) |  |
| Don’t Know | 64 (27.1) | 39 (34.5) | 25 (20.3) |  |
| **Lead apron availability** (yes answers) |  |  |  |  |
| Lightweight and one piece | **46 (19.5)** | 14 (12.4) | 32 (26.0) | 0.013 |
| Light weight and two-piece | **53 (22.5)** | 19 (16.8) | 34 (27.6) | 0.066 |
| Standard weight and one-piece | **98 (41.5)** | 47 (41.6) | 51 (41.5) | 1.00 |
| Standard weight and two-piece | **122 (51.7)** | 59 (52.2) | 63 (51.2) | 0.982 |
| Double lead apron (“maternity lead”) | **13 (5.5)** | 6 (5.3) | 7 (5.7) | 1.00 f |
| Thyroid shield | **118 (50.0)** | 52 (46.0) | 66 (53.7) | 0.297 |
| Maternal dosimeter | **8 (3.4)** | 4 (3.5) | 4 (3.2) | 1.000 f |
| Fetal dosimeter | **5 (2.1)** | 3 (2.6) | 2 (1.6) | 0.672 f |
| **Use of formal ergonomic timeout** |  |  |  | 0.791 f |
| Yes | **15 (6.4)** | 8 (7.1) | 7 (5.7) |  |
| No | **219 (93.6)** | 104 (92.9) | 115 (94.3) |  |
| **Use of informal ergonomic timeout** |  |  |  | 0.165 |
| Yes | **170 (72.3)** | 87 (77.0) | 83 (68.0) |  |
| No | **65 (27.7)** | 26 (23.0) | 39 (32.0) |  |
| **Monitors easily adjustable** |  |  |  | 0.215 |
| Yes | **168 (71.5)** | 76 (67.3) | 92 (75.4) |  |
| No | **67 (28.5)** | 37 (32.7) | 30 (24.6) |  |
| **Teachers train with consideration of your physical size** |  |  |  | 0.068 |
| Yes | **118 (50.4)** | 49 (43.8) | 69 (56.6) |  |
| No | **116 (49.6)** | 63 (56.2) | 53 (43.4) |  |
| **Gender of teacher who train with consideration of physical size** |  |  |  | 0.070 f |
| Male | **16 (6.8)** | 8 (7.1) | 8 (6.6) |  |
| Female | **33 (14.1)** | 23 (20.5) | 10 (8.2) |  |
| Both equally | **127 (54.3)** | 55 (49.1) | 72 (59.0) |  |
| I have not had female endoscopy teachers | **5 (2.1)** | 3 (2.7) | 2 (1.6) |  |
| I am not sure | **53 (22.6)** | 23 (20.5) | 30 (24.6) |  |
| **Received tactile instrumentation instruction from Males** |  |  |  | 0.035 |
| Yes, often | **36 (18.1)** | 21 (18.6) | 25 (20.5) |  |
| Yes, rarely | **55 (27.6)** | 40 (35.4) | 25 (20.5) |  |
| No | **108 (54.3)** | 52 (46.0) | 72 (59.0) |  |
| **Received tactile instrumentation instruction from Females** |  |  |  | 0.603 |
| Yes, often | **42 (17.9)** | 21 (18.8) | 21 (17.2) |  |
| Yes, rarely | **61 (26.1)** | 32 (28.6) | 29 (23.8) |  |
| No | **131 (56.0)** | 59 (52.7) | 72 (59.0) |  |
| **Confident asking nurses for help** |  |  |  | 0.212 |
| Yes | **209 (88.9)** | 97 (85.8) | 112 (91.8) |  |
| No | **26 (11.1)** | 16 (14.2) | 10 (8.2) |  |
| **Confident asking techs/medical assistants for help** (includes only respondents with techs) |  |  |  | 0.140 f |
| Yes | **210 (92.2)** | 98 (89.1) | 112 (94.9) |  |
| No | **18 (7.8)** | 12 (10.9) | 6 (5.1) |  |
| **Frequency asking nurses for help** |  |  |  | 0.777 |
| Once | **103 (44.2)** | 51 (45.5) | 52 (43.0) |  |
| Twice | **54 (23.2)** | 27 (24.1) | 27 (22.3) |  |
| More than twice | **76 (32.6)** | 34 (30.4) | 42 (34.7) |  |
| **Frequency male attendings ask nurses for help** |  |  |  | 0.166 |
| Once | **112 (48.9)** | 49 (45.4) | 63 (52.1) |  |
| Twice | **44 (19.2)** | 18 (16.7) | 26 (21.5) |  |
| More than twice | **73 (31.9)** | 41 (38.0) | 32 (26.5) |  |
| **Frequency female attendings ask nurses for help** |  |  |  | 0.661 |
| Once | **93 (40.6)** | 42 (38.9) | 51 (42.1) |  |
| Twice | **57 (24.9)** | 25 (23.1) | 32 (26.4) |  |
| More than twice | **73 (31.9)** | 37 (34.3) | 36 (29.8) |  |
| Not applicable | **6 (2.6)** | 4 (3.7) | 2 (1.7) |  |
| **Feel recognized/respected as physician by endoscopy staff** |  |  |  | 0.141 f |
| Yes | **216 (92.3)** | 101 (89.4) | 115 (95.0) |  |
| No | **18 (7.7)** | 12 (10.6) | 6 (5.0) |  |
| **Feel recognized/respected as physician by anesthesia** |  |  |  | 0.002 |
| Yes | **188 (80.3)** | 81 (71.7) | 107 (88.4) |  |
| No | **46 (19.7)** | 32 (28.3) | 14 (11.6) |  |
| **Feel recognized/respected as physician by GI attendings** |  |  |  | 0.059 f |
| Yes | **227 (97.0)** | 107 (94.7) | 120 (99.2) |  |
| No | **7 (3.0)** | 6 (5.3) | 1 (0.8) |  |
| **Referred to by first name without permission** |  |  |  | 0.124 |
| Yes | **65 (27.9)** | 37 (33.0) | 28 (23.1) |  |
| No | **168 (72.1)** | 75 (67.0) | 93 (76.9) |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 3: Future desires for the endoscopy suite** | | | | |
|  | **Overall** | **Females** | **Males** |  |
| **n (%)** | **n (%)** | **n (%)** | **P-value** |
| **Mandatory ergonomic training** |  |  |  | 0.371 f |
| Yes | **228 (97.4)** | 112 (99.1) | 116 (95.9) |  |
| No | **2 (0.9)** | 0 (0) | 2 (1.7)) |  |
| I don't know | **4 (1.7)** | 1 (0.9) | 3 (2.5) |  |
| **Budget for ergonomic optimization/tools** |  |  |  | 0.054 f |
| Yes | **215 (92.3)** | 109 (96.5) | 106 (88.3) |  |
| No | **3 (1.3)** | 0 (0) | 3 (2.5) |  |
| I don't know | **15 (6.4)** | 4 (3.5) | 11 (9.2) |  |
| **Increased availability of dial extenders** |  |  |  | 0.001 |
| Yes | **87 (37.2)** | 64 (56.6) | 23 (19.0) |  |
| No | **38 (16.2)** | 9 (8.0) | 29 (24.0) |  |
| I don't know | **109 (46.6)** | 40 (35.4) | 69 (57.0) |  |
| **Increased availability of pediatric colonoscope** |  |  |  | 0.039 |
| Yes | **74 (31.6)** | 44 (38.9) | 30 (25.0) |  |
| No | **91 (39.1)** | 36 (31.9) | 55 (45.8) |  |
| I don't know | **68 (29.2)** | 33 (29.2) | 35 (29.2) |  |
| **Increased availability of well-fitting lead aprons** |  |  |  | 0.004 |
| Yes | **78 (38.6)** | 55 (49.1) | 39 (32.2) |  |
| No | **28 (14.2)** | 10 (8.9) | 27 (22.3) |  |
| I don't know | **91 (41.2)** | 45 (45.9) | 46 (46.5) |  |
| **Teachers should receive formal ergonomic training to teach fellows** |  |  |  | 0.459 f |
| Yes | **208 (88.9)** | 103 (91.2) | 105 (86.8) |  |
| No | **5 (2.1)** | 1 (0.9) | 4 (3.3) |  |
| I don't know | **21 (9.0)** | 9 (8.0) | 12 (9.9) |  |

**Table 4: Ergonomic Knowledge**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Overall** | **Females** | **Males** |  |
|  | **n (%)** | **n (%)** | **n (%)** | **P-value** |
| **Importance of ergonomics in relation to ERI** |  |  |  |  |
| A. Equipment design and environment can be tailored |  |  |  |  |
| B. Equipment should not be adjusted prior to procedure start |  |  |  |  |
| C. Equipment design and environment can prevent ERI |  |  |  |  |
| D. A & C | **187 (79.2)** | 92 (81.4) | 95 (77.2) | 0.529 |
| E. All of the above |  |  |  |  |
| **Mitigation strategies to reduce risk of muscle strain** |  |  |  |  |
| A. Microbreaks |  |  |  |  |
| B. Sitting when possible |  |  |  |  |
| C. Minimizing procedure time |  |  |  |  |
| D. Stretching |  |  |  |  |
| E. All of the above | **191 (80.9)** | 94 (83.2) | 97 (78.9) | 0.497 |
| F. I'm not sure |  |  |  |  |
| **Bed position in relation to elbow** |  |  |  |  |
| 10 cm below elbow height | **152 (64.4)** | 80 (70.8) | 72 (58.5) | 0.067 |
| 10 cm above elbow height |  |  |  |  |
| 15 cm below elbow height |  |  |  |  |
| 15 cm above elbow height |  |  |  |  |
| I'm not sure |  |  |  |  |
| **Endoscopy trained best positioned** |  |  |  |  |
| Head of bed, right of trainee, same side |  |  |  |  |
| Head of bed, right of trainee, opposite side |  |  |  |  |
| Foot of bed, same side of trainee | **87 (36.9)** | 43 (38.0) | 44 (35.8) | 0.820 |
| Foot of bed, opposite side of trainee |  |  |  |  |
| **When to explore disability insurance** |  |  |  |  |
| During training | **186 (78.8)** | 87 (77.0) | 99 (80.5) | 0.619 |
| Early career |  |  |  |  |
| Mid-career |  |  |  |  |
| Never |  |  |  |  |
| I am not sure |  |  |  |  |

**Additional analyses:**

-correlation between hand size and sustaining endoscopy-related injury (by sex and independent of sex)

-Transient hand pain by hand size and sex

-All other transient pain metrics by height band and sex

-subgroup analyses by training year of endoscopy-related injury (n=32)

-association between height and ergonomic difficulty and ergonomic-related injury during pregnancy (n=14)

-subgroup analysis by training year, height, hand size of Equipment ergonomically optimized for you

-Teachers train with consideration of your physical size by height and by hand size

-Subgroup analysis of Referred to by first name without permission and training year

-Subgroup analysis of Referred to by first name without permission and height

-Ergonomically optimized Yes v no/I don’t know) and knowledge quiz score correlation