

Supplementary Table 1: Availability of Cardiac Rehabilitation Programs in Low- and Middle-Income Countries, Response Rate, and Unmet Need

Income Classification Country	Number of Responses	Number of Programs	Response Rate	Unmet CR Need*
Upper Middle-Income				
Albania	0	0	-	9,490
Algeria	1	1	100·0%	-
Argentina	3	23	13·0%	76,357
Azerbaijan	0	0	-	28,593
Belarus	1	5	20·0%	87,374
Belize	0	0	-	596
Bosnia and Herzegovina	1	1	100·0%	17,068
Botswana	0	0	-	3,569
Brazil	30	75	40·0%	523,662
Bulgaria	1	1	100·0%	52,871
China	83	216	37·5%	3,034,003
Colombia	48	50	96·0%	55,745
Costa Rica	6	6	100·0%	7,568
Cuba	8	8	100·0%	48,349
Dominica	0	0	-	209
Dominican Republic	1	2	50·0%	193,919
Ecuador	2	5	40·0%	26,096
Equatorial Guinea	0	0	-	1,105
Fiji	0	0	-	1,631
Gabon	0	0	-	2,272
Georgia	13	17	76·5%	6,288
Grenada	0	1	0·0%	-
Guyana	0	0	-	1,814
Iran	14	34	41·2%	219,007
Iraq	0	0	-	117,130
Jamaica	1	3	33·3%	7,846
Kazakhstan	1	1	100·0%	57,125
Lebanon	1	1	100·0%	27,333
Libya	0	0	-	20,254
Macedonia, FYR	1	1	100·0%	8,285
Malaysia	4	6	66·7%	84,724
Maldives	0	0	-	625
Marshall Islands	0	0	-	98
Mauritius	1	1	100·0%	107,880
Mexico	9	24	37·5%	155,348
Montenegro	0	1	0·0%	2,964
Nambia	0	0	-	3,412

Nauru	0	0	-	-
Panama	1	1	100.0%	4,959
Paraguay	3	3	100.0%	14,292
Peru	7	10	70.0%	47,467
Romania	2	3	66.7%	119,335
Russia	3	-	-	1,222,142
Saint Lucia	0	0	-	288
Saint Vincent and Grenadines	0	0	-	296
Samoa	0	0	-	299
Serbia	2	2	100.0%	37,125
South Africa	14	23	60.8%	107,880
Suriname	0	0	-	1,468
Thailand	0	5	0.0%	-
Tonga	0	0	-	168
Turkey	9	10	90.0%	334,117
Turkmenistan	0	0	-	9,388
Tuvalu	0	0	-	-
Venezuela	8	9	88.9%	44,108
<i>Program response rate in upper-MICs (30/33 countries with CR; 90.9% country response rate)</i>	279	549	50.3%	-
<i>Total Unmet Need in Upper-MICs</i>	-	-	-	6,933,942
Lower Middle-Income				
Angola	0	0	-	24,579
Armenia	0	0	-	11,125
Bangladesh	1	1	100.0%	409,010
Bhutan	0	0	-	1,319
Bolivia	0	0	-	19,423
Cambodia	0	0	-	22,764
Cameroon	0	0	-	25,761
Cape Verde	0	0	-	965
Congo	0	0	-	5,921
Cote d'Ivoire	0	0	-	31,106
Djibouti	0	0	-	1,407
Egypt	2	2	100.0%	369,288
El Salvador	0	2	0.0%	-
Federated States of Micronesia	0	0	-	147
Ghana	0	0	-	36,001
Guatemala	2	2	100.0%	13,551
Honduras	1	2	50.0%	10,899
India	18	23	78.3%	3,304,474

Indonesia	10	13	76.9%	65,376
Jordan	0	0	-	22,639
Kenya	1	3	33.3%	55,114
Kiribati	0	0	-	162
Kosovo	0	0	-	-
Kyrgyzstan	0	1	0.0%	-
Laos	0	0	-	10,390
Lesotho	0	0	-	2,997
Mauritania	0	0	-	5,612
Moldova	1	1	100.0%	20,976
Mongolia	1	1	100.0%	5,241
Morocco	1	1	100.0%	156,088
Myanmar	0	0	-	108,283
Nicaragua	0	0	-	7,341
Nigeria	1	1	100.0%	223,944
Pakistan	2	4	50.0%	616,146
Palestine	0	0	-	-
Papua New Guinea	0	0	-	11,091
Philippines	10	10	100.0%	211,507
Sao Tome and Principe	0	0	-	263
Solomon Islands	0	0	-	753
Sri Lanka	2	4	50.0%	66,507
Sudan	0	0	-	111,063
Swaziland	0	0	-	1,925
Syria	0	0	-	57,355
Tajikistan	0	0	-	13,029
Timor-Leste	0	0	-	1,695
Tunisia	1	1	100.0%	50,067
Ukraine	0	0	-	519,761
Uzbekistan	0	0	-	90,959
Vanuatu	0	0	-	399
Vietnam	0	0	-	238,156
Yemen	0	0	-	69,006
Zambia	0	0	-	18,951
<i>Program response rate in lower-MICs (15/17 countries with CR; 88.2% country response rate)</i>	54	72	75.0%	-
<i>Total Unmet Need in Lower-MICs</i>	-	-	-	7,050,536
Low Income				
Afghanistan	1	1	100.0%	88,906
Benin	0	1	0.0%	-

Burkina Faso	0	0	-	19,241
Burundi	0	0	-	13,432
Central African Republic	0	0	-	6,831
Chad	0	0	-	16,436
Comoros	0	0	-	1,034
Democratic Republic of the Congo	0	0	-	82,818
Eritrea	0	0	-	5,386
Ethiopia	0	0	-	138,477
Gambia	0	0	-	2,607
Guinea	0	0	-	16,645
Guinea-Bissau	0	0	-	2,797
Haiti	0	0	-	23,896
Liberia	0	0	-	6,669
Madagascar	0	0	-	32,640
Malawi	0	0	-	25,374
Mali	0	0	-	17,278
Mozambique	0	0	-	41,012
Nepal	1	1	100.0%	63,134
Niger	0	0	-	23,462
North Korea	0	0	-	48,117
Rwanda	0	0	-	11,947
Senegal	0	0	-	20,843
Sierra Leone	0	0	-	9,247
Somalia	0	0	-	15,179
South Sudan	0	0	-	17,290
Tanzania	0	1	0.0%	-
Togo	0	0	-	9,988
Uganda	0	1	0.0%	-
Zimbabwe	0	0	-	21,766
<i>Program response rate in LICs (2/5 countries with CR; 40.0% country response rate)</i>	2	5	40.0%	-
<i>Total Unmet Need in LICs</i>	-	-	-	782,452
<i>LMIC Program Response Rate (47/55 LMICs with CR; 85.5% country response rate)</i>	335	626	53.5%	-
<i>Total Unmet Need in all LMICs</i>	-	-	-	14,766,930

LMICs, low- and middle-income countries; CR, cardiac rehabilitation

-not applicable/missing

*number of annual incident ischemic heart disease cases estimated in Global Burden of Disease study³⁰ minus national annual CR capacity, to reflect total number more CR spots needed per year. See Turk-Adawi et al. for a listing of these values by country.²⁴

Supplementary Table 2. Accepted Cardiac Rehabilitation Indications by Country Income Classification and Funding Source, N=1082

	LMIC				HIC (n=747)	p*
	Private (n=103)	Public (n=115)	Hybrid (n=108)	Total† (n=326)‡		
<u>Cardiac</u>						
Myocardial Infarction/ Acute Coronary Syndrome	100 (97.1%)	78 (95.1%)	90 (90.68%)	268 (96.4%)	562 (97.9%)	0.52
PCI	94 (91.3%)	78 (95.1%)	91 (97.8%)	263 (94.6%)	554 (96.9%)	0.34
CABG	98 (95.1%)	78 (95.1%)	87 (93.5%)	263 (94.6%)	551 (96.3%)	0.83
Stable coronary artery disease, without a recent event or procedure	94 (91.3%)	72 (87.8%)	87 (93.5%)	253 (91.0%)	437 (76.4%)	0.06
Heart failure	88 (85.4%)	68 (82.9%)	87 (93.5%)	243 (87.4%)	511 (89.3%)	0.25
Valve procedure	80 (77.7%)	61 (74.4%)	71 (76.3%)	212 (76.3%)	522 (91.3%)	<0.01
Rhythm device	75 (72.8%)	60 (73.2%)	73 (78.5%)	208 (74.8%)	454 (79.4%)	0.16
Arrhythmias	76 (73.8%)	55 (67.1%)	75 (80.6%)	206 (74.1%)	358 (62.6%)	0.49
Cardiomyopathy	75 (72.8%)	56 (68.3%)	73 (78.5%)	204 (73.4%)	437 (76.4%)	0.27
Congenital heart disease	64 (62.1%)	46 (56.1%)	66 (71.0%)	176 (63.3%)	316 (55.2%)	0.39
Rheumatic heart disease	61 (59.2%)	53 (64.6%)	62 (66.7%)	176 (63.3%)	258 (45.1%)	<0.05
Ventricular assist devices	42 (40.8%)	38 (46.3%)	54 (58.1%)	134 (48.2%)	304 (53.1%)	0.24
Heart transplant	43 (41.7%)	28 (34.1%)	36 (38.7%)	107 (38.5%)	363 (63.5%)	<0.001
<u>Non-cardiac</u>						
High-risk / primary prevention	87 (84.5%) ‡	50 (61.0%) ‡	70 (75.3%)	207 (74.5%)‡	283 (49.5%)	<0.01
Diabetes	85 (82.5%)	52 (63.4%)	66 (71.0%)	203 (73.0%)	215 (37.6%)	<0.001
Intermittent claudication/ peripheral vascular disease	68 (66.0%)	44 (53.7%)	59 (63.4%)	171 (61.5%)	250 (43.7%)	0.06
Chronic lung disease	66	34	56	156	183	<0.01

	(64.1%)	(41.5%)	(60.2%)	(56.1%)	(32.0%)	
Stroke / transient ischemic attack	40 (38.8%)	32 (39.0%)	31 (33.3%)	103 (37.1%)	150 (26.2%)	0.24
Cancer	35 (34.0%)	13 (15.9%)	24 (25.8%)	72 (25.9%)	91 (15.9%)	0.18

*Generalized Linear Mixed Models were used to test for significant differences in LMICs versus HICs.

†p< 0.05 for Generalized Linear Mixed Models testing for significant differences by most common funding source;

‡For pairwise comparisons ‡=p<0.01

§respondents did not provide information on funding source for CR in 9/335 surveys

CABG=Coronary artery bypass graft; HIC=high-income country; LMIC= low- and middle-income country; PCI=percutaneous coronary intervention.

Note: Due to missing data, percentages are computed where the denominator is the number of valid responses from responding programs.

Supplementary Table 3: Healthcare Professionals on Cardiac Rehabilitation Staff by Country

Income Classification and Funding Source, N=1082

	LMIC				HIC (n=747)	p*
	Private (n=103)	Public (n=115)	Hybrid (n=108)	Total† (n=326)‡		
Cardiologist	91 (88.3%)	88 (92.6%)	87 (87.0%)	266 (89.3%)	453 (72.5%)	<0.001
Nurse	65 (65.0%)	79 (84.0%)	90 (90.0%)	234 (79.6%)	544 (91.7%)	<0.001
Physiotherapist	83 (81.4%)	73 (78.5%)	77 (76.2%)	233 (78.7%)	500 (79.9%)	0.60
Dietitian	82 (80.4%)	70 (75.3%)	67 (68.4%)	219 (74.7%)	520 (83.2%)	0.001
Administrative assistant / secretary	69 (68.3%)‡	56 (60.9%)	54 (55.1%)‡	179 (61.5%)†	417 (67.9%)	<0.05
Psychologist	50 (48.5%)	65 (69.9%)¶	53 (54.1%)	168 (57.1%)†	357 (58.0%)	0.69
Physiatrist / PM&R	42 (44.7%)	60 (63.2%)	51 (53.7%)	153 (53.9%)	235 (38.5%)	<0.001
Kinesiologist / Exercise specialist	61 (58.7%)	47 (50.5%)	45 (46.9%)	153 (52.2%)	310 (52.1%)	0.71
Other physician	43 (45.7%)	42 (46.7%)	32 (34.8%)	117 (42.4%)	215 (36.1%)	0.08
Sports medicine physician	42 (42.9%)	23 (25.3%)	38 (38.8%)	103 (36.1%)	80 (13.3%)	<0.001
Psychiatrist	33 (34.7%)	39 (42.9%)	27 (28.7%)	99 (35.4%)	107 (17.8%)	<0.001
Pharmacist	14 (14.6%)‡	41 (46.1%)‡	36 (37.9%)	91 (32.5%)††	275 (45.1%)	0.001
Social worker	16 (16.7%)‡	39 (42.4%)‡	25 (26.3%)	80 (28.3%)††	300 (48.8%)	<0.001
Community health worker	12 (12.8%)	24 (26.1%)	23 (24.5%)	59 (21.1%)	109 (18.0%)	0.28
Other	12 (21.8%)	18 (28.1%)	19 (25.7%)	49 (25.4%)	122 (39.0%)	0.001

Total # of program staff§	5.4 ± 2.5	6.3 ± 3.2	5.8 ± 2.8	5.8 ± 2.8	5.9 ± 2.8	0.58
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¶respondents did not provide information on funding source for CR in 9/335 surveys.

*Generalized Linear Mixed Models could not reliably be used to test for significant differences in LMICs versus HICs so Pearson's chi-square were computed.

† p< 0.05; †† p< 0.01; ††† p< 0.001 for Generalized Linear Mixed Models testing for significant differences by most common funding source;

For pairwise comparisons ‡: one symbol=p<0.05; two symbols=p<0.01; 3 symbols=p<0.001

¶¶Significantly different from all funding sources (p<0.01).

HIC=high-income country; LMIC= low- and middle-income country

§frequency and percent of personnel on team, with full-time personnel counted as 1 and part-time personnel counted as 0.50.

Note: Due to missing data, percentages are computed where the denominator is the number of valid responses from responding programs.

Supplementary Table 4: Cardiac Rehabilitation Elements Delivered by Country Income Classification and Funding Source, N=1082

n (%)	LMIC				HIC (n=747)	p*
	Private (n=103)	Public (n=115)	Hybrid (n=108)	Total† (n=326)‡		
<u>Core Components</u>						
Initial Assessment	105 (99.1%)	96 (100.0%)	101 (99.0%)	305 (99.0%)	634 (98.8%)	0.91
Management of CV Risk Factors	103 (97.2%)	94 (97.9%)	101 (99.0%)	298 (98.0%)	627 (98.4%)	0.75
Patient Education	87 (96.7%)	87 (91.6%)	93 (96.9%)	267 (95.0%)	591 (97.7%)	0.39
End of program re-assessment	99 (93.4%)	86 (91.5%)	87 (87.9%)	272 (91.0%)	584 (91.8%)	0.74
Prescription and/or titration of medications	88 (82.2%)	89 (92.7%)	95 (93.1%)	272 (89.2%)	476 (74.6%)	0.13

Supervised Exercise Training	92 (86.0%)	71 (75.5%)	79 (78.2%)	242 (80.1%)	530 (82.8%)	0.83
Communication of assessment results to patients' primary care provider	88 (82.2%)◇	58 (61.1%)◇	78 (77.2%)	224 (73.9%)†	562 (89.1%)	<0.01
Stress Management	73 (68.9%)	66 (70.2%)	73 (72.3%)	212 (70.4%)	556 (87.0%)	<0.01
Tobacco cessation interventions sessions/classes	50 (47.6%)¶	72 (75.0%)	67 (67.0%)	189 (62.8%)†††	500 (78.2%)	0.001
Return-to-work counselling	58 (55.8%)	62 (66.0%)	62 (62.0%)	182 (61.1%)	431 (68.2%)	<0.05
<u>Other Elements</u>						
Heart rate measurement training / exercise intensity monitoring	104 (98.1%)	93 (96.9%)	101 (99.0%)	298 (98.0%)	587 (92.3%)	0.13

Individual consult with a physician	98 (92.5%)	89 (94.7%)	95 (94.1%)	282 (93.7%)	412 (64.4%)	<0.05
Assessment of Comorbidities	95 (91.3%)	86 (90.5%)	88 (88.0%)	269 (90.0%)	605 (94.7%)	0.10
Resistance Training	102 (95.3%) $\diamond\diamond$	76 (80.9%) $\diamond\diamond$	92 (90.2%)	270 (89.1%) \dagger	585 (91.7%)	0.17
Nutrition Counseling	91 (85.0%)	85 (88.5%)	92 (90.2%)	268 (87.9%)	609 (95.2%)	<0.05
Exercise Prescription	98 (91.6%)	83 (87.4%)	85 (84.2%)	266 (87.8%)	566 (88.6%)	0.55
Physical Activity Counseling	96 (90.6%)	82 (86.3%)	86 (86.0%)	264 (87.7%)	582 (90.7%)	0.89
Exercise Stress Test	91 (85.8%)	83 (89.2%)	76 (76.8%)	250 (83.9%)	403 (63.5%)	<0.001
Follow-up post-program	87 (82.1%)	80 (84.2%)	75 (74.3%)	242 (80.1%)	418 (65.9%)	<0.01
Depression screening	79 (74.5%)	72 (75.0%)	83 (82.2%)	234 (77.2%)	579 (90.6%)	<0.01

Other Functional Capacity Test	82 (78.8%)	72 (76.6%)	72 (72.7%)	226 (76.1%)	506 (80.4%)	0.54
Psychological Counselling	67 (63.2%) \diamond	76 (80.0%) \diamond	78 (77.2%)	221 (73.2%) \dagger	528 (82.5%)	0.09
Electronic patient charting	58 (63.7%)	48 (58.5%)	70 (70.7%)	176 (64.7%)	294 (59.3%)	0.86
Individual consult with a nurse	42 (40.8%) $\diamond\diamond\diamond$	70 (74.5%) $\diamond\diamond\diamond$	65 (65.7%)	177 (59.8%) $\dagger\dagger$	536 (84.0%)	<0.001
Assessment of strength	66 (64.7%)	49 (52.1%)	57 (56.4%)	172 (57.9%)	273 (43.5%)	0.26
Alternative forms of exercise (e.g., yoga, dance)	44 (41.9%)	46 (48.9%)	50 (51.0%)	140 (47.1%)	213 (33.7%)	0.34
Women-only classes	17 (16.2%)	19 (20.4%)	18 (18.2%)	55 (18.3%)	55 (8.7%)	0.07
Other	20 (39.2%)	22 (33.8%)	24 (36.4%)	66 (36.3%)	46 (20.1%)	0.01
Total Elements (mean \pm SD)\S	18.2 \pm 4.2	18.2 \pm 4.9	18.3 \pm 4.5	18.2 \pm 4.5	18.9 \pm 3.8	0.18
Total core (/10)\S	6.7 \pm 2.6	6.7 \pm 2.5	7.0 \pm 2.4	7.3 \pm 1.8	7.9 \pm 1.7	<0.01

*Generalized Linear Mixed Models were used to test for significant differences in LMICs versus HICs.

\dagger $p < 0.05$; $\dagger\dagger$ $p < 0.01$; $\dagger\dagger\dagger$ $p < 0.001$ for Generalized Linear Mixed Models testing for significant differences by most common funding source;

\parallel respondents did not provide information on funding source for CR in 9/335 surveys

For pairwise comparisons \diamond : one symbol= $p < 0.05$; two symbols= $p < 0.01$; 3 symbols= $p < 0.001$

\P Significantly different from all funding sources ($p < 0.001$).

CV=cardiovascular; HIC= high-income country; LMIC= low- and middle-income country; SD= standard deviation

\S components offered in all models of CR counted as 1 and Components offered in some CR models counted as 0.50.

Note: Due to missing data, percentages are computed where the denominator is the number of valid responses from responding programs.